TECHNICAL SPECIFICATIONS

FOR:

Fort Utah Park

CONSTRUCTION DOCUMENT SET

May 29, 2026

G.BROWN:DESIGN INC
SITE AND LANDSCAPE ARCHITECTS

610 East South Temple, Ste 50
Salt Lake City, Utah 84102
p. 801.575.6066 f. 801.575.6166
www.gbrowndesign.com

NOTE: Contractor shall reference the latest APWA Manual of Standard Specifications for all specification sections denoted with (APWA) following the section name. The Contractor is responsible for obtaining the most current version of the reference specification and standard drawings and details. Plan set shall supersede any specifications if they are noted. APWA Standard Plans and Specifications are available for purchase in hard copy or electronic format at the following web address: http://utah.apwa.net/

SECTION 000000 - CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

TABLE OF CONTENTS

SECTION 010000 - GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Sections, shall apply to all work stated in this and subsequent sections.

B. Separation of the specifications into divisions and sections is for convenience only and is not intended to establish limits of work.

C. The Specifications (divisions/sections) and Drawings are complementary, and what is called for by anyone shall be as binding as if called for by all. Anything not expressly set forth in either, but which is reasonably implied, shall be furnished and performed the same as if it were both shown and mentioned. It is the intention of the documents to include all labor and materials, equipment, and transportation necessary to complete the work shown or indicated by the drawings or called for in the specifications, in accordance with the best practices prevailing for the work of the various kinds. Materials or work described in words or those which are implied and having a well-known trade or technical meaning, shall be held to refer to such recognized standards.

1.2 Definitions

A. City Representative shall be the:

Provo City
1417 S 350 E Provo, UT 84606
Contact: **John Bunderson**, Parks Project Manager
Ph: (801) 852-6643 email: jbunderson@provo.gov

1. The person designated by Provo City to act on its behalf shall have authority to transmit instructions, receive information, interpret and define policy and decisions, with respect to materials, equipment, elements, and systems pertinent to proper execution of the work, and hereafter be known as the Project Manager. Any deviation from the specifications and requirements of the contract must be authorized by the City Representative. In the event the Contractor deviates without approval from the City Representative, such deviation will be at the risk of the Contractor, and any cost related thereto will be borne by the Contractor

B. A/E Design Representative shall be:

Jessica Henrie
G Brown Design, Inc.
678 East Vine Street, #10
Murray, UT 84107
(801) 575-6066

1. The above representative or person designated by that company to act on its behalf and shall have the authority to transmit instructions, receive information, interpret and define decisions to ensure compliance with contract requirements insofar as the work is concerned, and advise the City Representative of any contract issues. The Technical/Design Representative cannot authorize deviations from the specifications and requirements of this contract. In the event the Contractor deviates without approval from the City Representative, such deviation will be at the risk of the Contractor, and any cost related thereto will be borne by the Contractor.

1.3 Procedures

A. This Contractor shall provide all items, materials, operations, and methods, including all labor, equipment, and incidentals necessary for the successful completion of the project.
B. This Contractor shall be duly licensed for the work involved and shall secure all building permits and certificates, and obtain all inspections as might be required for the proper prosecution of the work.
C. This Contractor shall visit the site prior to submitting a bid to adequately determine the scope, intent, and requirements of the project and its satisfactory completion.

1.4 Quality Assurance

A. A Pre-Construction conference will be held before the start of any work, with the Contractor and authorized representatives of the City, to review the drawings, specifications, and applicable requirements pertaining to the work and to establish a mutual understanding of procedures and precautions related to the proper prosecution of the work.
   1. This conference will be managed by:
      PROVO CITY

B. The apparent low-bidding contractor shall submit, using the City Sub-Contractor Form, a written list of all subcontractors they propose to use in the work as required in the contract documents, or if not stipulated therein, within 24 hours of request.
   1. The City reserves the right to reject any or all sub-contractors who have previously performed unsatisfactorily for the City or who do not meet the requirements specified in other sections of these specifications.

1.5 Notice to Proceed

A. The City will issue the Contractor a "Notice to Proceed" for the contracted work after the pre-construction conference and when all requirements of the City with respect to contract administration have been satisfied. The notice to proceed date will be that date agreed upon by the City and the Contractor as to when the work on the site will actually begin.

   The Contractor shall then be charged in time for each successive calendar day from that date until the work is complete.
   1. Any work done prior to the Notice to Proceed shall be at the Contractor's risk.

B. The City will issue the Contractor a “Stop Work Order” should winter weather prohibit completion of the contracted work this year. The City will issue the Contractor a “Resume Work Order” for the remaining work to be completed next year, when the weather allows the work to proceed.
   1. Any work done after the “Stop Work Order” is issued and before the “Resume Work Order” is issued shall be at the Contractor’s risk.

1.6 Liquidated Damages

A Should the Contractor fail to complete the work within the time stated in the Agreement (from the date of Notice to Proceed) or within such additional time as may have been allowed by extension, there shall be deducted from any monies due, or that may become due, the Contractor shall pay the amount stipulated in the Contract.

1.7 Payment Procedures

A. Application for Payment shall be consistent with previous applications and payments as certified by the Project Manager and paid for by the City.
B. Payment Application Forms:
   1. Submit one Application for Payment provided by the City. Each application must be signed by the Contractor.
   2. Use AIA Document G703 continuation Sheets or other Schedule of Values form approved by the City in conjunction with the Applications for Payment form.

C. Application Preparation: Complete every entry on the form. Notarize and execute by a person authorized to sign legal documents on behalf of the Contractor. The Project Manager will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders issued before the last day of the construction period covered by the application
D. Submit an updated progress schedule with each Application for Payment.
E. When Project Manager requires substantiating information, submit data.
F. Schedule of Values Form: Use AIA Form G703 - Application and Certificate for Payment Continuation Sheet and AIA G723 – Project Application Summary, or EJCDC Form 1910-8-E, or Contractor's standard form, or electronic media printout following one of the above standard forms. Follow the outline presented in the Bid Form. For each item, provide a column (or row) for listing each of the following:
   1. Item number.
   2. Description of work.
   3. Scheduled values.
   4. Previous applications.
   5. Work in the plan and stored materials under this application.
   6. Authorized Change Orders.
   7. Total completed and stored to date of application.
   8. Percentage of completion.
   9. Balance to finish.
   10. Retainage.
   11. Overhead and profit.
G. Submission Schedule: Submit a Schedule of Values form for review and approval within 10 Days after the Effective Date of the Construction Contract.
H. Revisions: Revise the schedule of values to list approved Change Orders, with each Application for Payment.

1.8 Submittals

A. Submittal Procedure
   1. Review submittals prior to transmittal. Determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
   2. Coordinate submittals with the requirements of Work and of Contract Documents.
   3. Sign or initial each sheet of shop drawings and product data, and each sample label to certify compliance with the requirements of Contract Documents. Notify A/E Design Representative in writing at the time of submittal of any deviations from the requirements of Contract Documents.
   4. Do not fabricate products or begin work that requires submittals until the return of the submittal with the Project Manager's acceptance.
   5. Transmit submittals to the Project Manager under the transmittal form. Submit the number of copies that the Project Manager requires, plus the number of copies required by the Project Manager.
   6. Comply with submittal sequences shown in the progress schedule.
   7. When required by Laws and Regulations, affix the licensed professional's stamp to submittal documents.
   8. Identify pertinent Drawing sheet and detail number, and Specification section number.
   9. Identify deviations from Contract Documents.
   10. Identify the date when Project Manager must complete review of submittal.
   11. Provide space for Contractor and Project Manager review stamps.
   12. After Project Manager's review of submittal, revise and resubmit as required, identifying changes made since previous submittal.

13. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

B. Shop Drawings
1. Present drawings in a clear and thorough manner. Title each drawing with Project name and number. Identify each element of drawings by reference to sheet number and detail or equipment schedule.
2. Identify field dimensions. Show relation to adjacent or critical features or work or products.
3. Provide sheet size adequate for Project Manager's review.

C. Product Data
1. Submit only pages which are pertinent. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions, And required clearances.
2. Modify product data by deleting information that is not applicable to the Work or by marking each copy to identify pertinent data.
3. Supplement standard information, if necessary, to provide additional information applicable to the Work.
4. Provide manufacturer's preparation, assembly and installation instructions.

D. Samples
1. Submit 1 of each sample required by Contract Documents. Samples shall show the quality, type, range of color, finish and texture of the material.

E. Certificates
1. Submit certificates, in duplicate, in accordance with requirements of each Specification section.

F. Submittal Completeness
1. Contractor shall ensure that each Submittal is complete, coordinated, and clearly indicates the specific products, materials, or systems proposed for use on the Project.
2. Product Data submittals shall have relevant materials, models, finishes, or performance data **clearly highlighted, marked, or otherwise indicated** to identify the item(s) being proposed.
3. Submittals that are incomplete, contain unmarked catalog pages, or do not clearly identify proposed products shall be **returned without review**.
4. Review by the Project Manager does not relieve the Contractor of responsibility for providing complete and accurate information in conformance with the Contract Documents.
5. The Contractor shall bear all costs and schedule delays resulting from the return of incomplete or uncoordinated submittals.

PART 2 - PRODUCTS

2.1 Products

A. Materials used by the Contractor or any Sub-contractor shall be new, unless noted otherwise, and shall be of specified quality and furnished in sufficient quantity to facilitate proper and speedy execution of the work. Materials must be delivered to the site in original packaging with labels and trademarks intact.

2.2 Substitutions

A. The Contractor may submit for approval materials, fixtures, or equipment other than

those specified. To obtain said approval, the Contractor must provide complete product data, the test results that might be required, and any other information necessary to substantiate that the material or system is equal to or better than specified. Unless approval of requests is provided in writing, all materials used shall be as specified.

1. The City shall be the final authority in deciding the approval of any request for substitution or deviation from the plans and specifications.
2. Any proposed product substitutions shall be in accordance with the General Conditions; shall meet or exceed the specified warranty; shall be equivalent in specific features and qualities such as performance, weight, size, durability, visual effect; shall be compatible with the rest of the work; and shall not require any changes or revisions to the Construction Documents.

B. Any material or equipment found installed on the site which is not that specified, or approved prior to bidding, shall be immediately removed and the specified item(s) installed at no additional cost to the City.

PART 3 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

3.1 Temporary Utilities

A. The Contractor shall provide service required for construction operations.

3.2 Barriers and Enclosures

A. Provide to prevent public entry to work areas and to protect existing trees and plants. Provide as required to protect existing facilities, improvements and adjacent properties from damage from construction operations. Repair damage at no cost to the City.

B. Provide barriers around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

C. Provide protection against weather - rain, winds, storms, frost or heat so as to maintain all work free from injury or damage. New work shall be covered if necessary.

3.3 Security

A. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

3.4 Temporary Controls

A. Surface Water, Erosion, and Sediment Control

1. Surface water shall be controlled so that the construction area is not allowed to become wet from runoff from adjacent areas. Surface water shall be directed away from these areas but not directed toward adjacent property, buildings, or any improvement that may be damaged by water. Surface water shall not be allowed to enter sanitary sewers.
2. Maintain excavations free of water. Provide and operate pumping equipment as needed.
3. Prevent erosion and sedimentation.
4. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
5. Provide and maintain public access road around the work area.

B. Construction Cleaning:

1. All public and private areas used as haul roads shall be continuously maintained and cleaned of all construction caused debris such as mud, sand, gravel, soils, pavement fragments, sod, etc. Care shall be taken to prevent spillage on haul routes. Any such spillage shall be removed immediately and the area cleaned.
2. Public roads shall be maintained in accordance with applicable ordinances and regulations.
3. Throughout all phases of construction, including suspension of work, and until

final acceptance of the project, the Contractor shall keep the work site clean and shall remove daily all refuse, dirt, damaged materials, unusable materials, and all other trash or debris that he has created from his construction activities.

4. Materials and equipment shall be removed from the site as soon as they are no longer necessary; and upon completion of the work and before final inspection, the entire work site shall be cleared of equipment, unused materials, and rubbish so as to present a satisfactory, clean and neat appearance. All cleanup costs shall be included in the Contractor's bid.

C. Dust Control:

1. Dust control measures shall be implemented by application of water to all work areas, storage areas, haul and access roads, or other areas affected by construction.
2. All work shall be in compliance with the Federal, State, and local air pollution standards, and not cause a hazard or nuisance to personnel and the public in the vicinity of the work.
3. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.
4. Execute work by methods to minimize the raising of dust from construction operations.

3.5 Traffic Regulation

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the City's operations.
B. Monitor the parking of construction personnel's vehicles. Construction personnel will be restricted to parking in designated areas only.
C. Prevent parking on or adjacent to access roads or in non-designated areas.
D. Consult with authorities, establish public thoroughfares to be used for haul routes and site access.
E. Confine construction traffic to haul routes and designated construction limits.

PART 4 - METHODS

4.1 Installations

A. The Contractor shall comply with all applicable safety ordinances, including required O.S.H.A. standards.
B. Contractor shall be responsible for all cutting, fitting, and/or patching as may be required to complete the work or to make its several parts fit together properly. During the course of construction, every care shall be taken to prevent damage to existing buildings and landscape elements not a part of the contract. Any damaged areas shall be restored to a "like new" condition at no additional cost to the City.

4.2 Permits

A. The Contractor will be responsible for securing all permits that may be required to complete the work in accordance with the General Conditions.

4.3 Field Engineering

A. The Contractor shall be fully responsible for all field engineering required for the proper layout, staking, and execution of the Work. The Contractor shall establish all grades, lines, and levels required for the completion of the Work in accordance with the Drawings and Specifications.
B. All layout shall be performed using a total station survey instrument operated by qualified personnel under the supervision of a licensed Professional Land Surveyor.
1. Use of GPS or GNSS positioning systems for layout of hardscape, structures, walls, or other precision work is not permitted.
2. GPS may only be used for rough grading or general earthwork layout with prior written approval from the Project Manager.

C. The City may provide reference control data on the Drawings or in electronic format for convenience only. The Contractor shall verify the accuracy, adequacy, and elevation of all provided control points, benchmarks, and reference data prior to beginning any layout or construction. Any discrepancies discovered shall be reported immediately to the Project Manager.

D. The Contractor shall locate, protect, and maintain all existing property corners, survey monuments, and benchmarks within or adjacent to the Project limits. The Contractor shall be responsible for any disturbance or damage to such monuments. If corners or monuments are disturbed or destroyed, the Contractor shall retain the services of a licensed Professional Land Surveyor to reestablish and record replacement monuments at no additional cost to the City.

E. The Contractor shall maintain all layout stakes and references until no longer required for the Work. Replacement of disturbed or missing stakes shall be at the Contractor's expense.

4.4 Coordination

A. Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the project any unfit person or anyone unskilled in the work assigned to him.

B. The Contractor and Sub-contractor(s) shall coordinate their work with adjacent work of others and cooperate their efforts so as to facilitate the progress of the project. Each contractor shall afford the other contractor every reasonable opportunity for the installation and/or storage of their materials.

4.5 Utilities

A. The locations of existing underground utilities depicted on the drawings are shown in an approximate way only. The Contractor shall determine the exact location of all existing utilities, whether or not shown on the drawings, before commencing work. He agrees to be fully responsible for any and all damages which might be occasioned by his failure to exactly locate and preserve any and all underground utilities. If damaged or removed, the existing utility shall be restored or replaced by Contractor in as nearly the original condition and location as is reasonably possible, at no cost to the Owner and/or the City.

B. The Contractor shall notify all utility companies, including Blue Stake, whether identified on the site or not, of any required connections to, or modifications or abandonment of, existing lines and/or equipment during the execution of the work. The Contractor shall properly and timely notify each utility company involved so as to properly schedule the work and coordinate necessary inspections and acceptance.

1. All such work shall be done in compliance with each utility company's requirements and standards.

4.6 Clean-up

A. Contractor shall at all times keep premises free from accumulations of waste materials or rubbish; shall immediately remove any demolition debris; and shall, at the completion of the work, leave the area clean and habitable with no additional maintenance work required by the City upon acceptance.

4.7 Record Documents

A. Contractor shall maintain one (1) copy of all drawings, specifications, addenda, field orders, approved shop drawings and change orders as "Record Documents".

1. These documents shall be maintained in good condition and marked during construction so as to record all changes and modifications to the work and to document exact dimensions (from permanent features of the site), along with grades and elevations of all exterior and interior underground work, including conduit, piping, valves, and drains.
2. At Substantial Completion of the project, documentation of changes, red-lines, and as-builts will be submitted to A/E Representative and Project Manager for

review and approval.

4.7 Substantial Completion

A. Substantial Completion: The point in time when the Work is sufficiently complete, in accordance with the Contract Documents, that the City can occupy or use the Work for its intended purpose. Substantial Completion shall be issued in writing by the Project Manager to the Contractor.

B. Substantial Completion procedures:

1. Before requesting substantial completion of the work from the Project Manager, Contractor shall have received approval on all building permit required inspections, as administered by the local governing municipality. The Contractor shall also supply proof of payment for all utility costs incurred during construction.
2. Contractor shall have received written acceptance of Turf Establishment from the Project Manager.
3. The Contractor shall request in writing his intent to have the City review and accept the project as substantially complete.
4. This request must be submitted to the Project Manager at least five (5) calendar days prior to the requested observation date in order to give those involved time to schedule attendance.
   a. **If the work is found not substantially complete, or if the list of incomplete items is more than a few, the Contractor shall be charged for the time of those in attendance at this meeting. These monies shall be deducted from the amount due the contractor at the end of the project.**

4.8 Close-Out Documents and Final Payment

A. Submit the following Close-out Documents:

1. Final Application for Payment
2. One year warranty letter
3. Lien Waiver
4. Record documents
5. Provide Operations & Maintenance manuals and instruct City's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Submit demonstration and training videotapes.
7. Irrigation invoices, GPS locations of irrigation, etc. as required by specification section 328400.

4.9 One Year Warranty Period and Final Project Acceptance

A. The Contractor warrants to the City that materials, equipment, and systems furnished under the Contract will be new and of good quality, that the work will be free from defects in quality and workmanship, and that the work will conform to the requirements of the Contract Documents. If, within one year after the date of the **Notice of Substantial Completion,** any of the work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Project Manager. The Contractor's warranty excludes remedies for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

1. At the conclusion of the one-year warranty period, a final project acceptance inspection will be performed by the City.
2. Any items needing repair or replacement will then be performed by the Contractor without additional charge or cost to the City.
3. Once all work is complete, City will release all bonds.

END OF SECTION 010000

SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 Description of Work

The work for this project shall consist of, but not be limited to, preparing the site and furnishing all labor, materials, and equipment to complete the following improvements with quality workmanship, in a timely manner, and in compliance with project plans and specifications:

Construction Time Schedule:

Project to Begin (N.T.P.):	**TBD**
Fort Utah Park Substantial Completion Date:	**TBD**

1. Review and accept existing site conditions.
2. Obtaining all required permits and approvals for construction work required by the Drawings and Specifications, and coordinating with Provo City for payment of associated permit fees. The Contractor shall be responsible for completing all required applications, documentation, and scheduling of inspections to ensure that all permits are obtained and maintained in good standing throughout construction.
3. Protect all adjacent properties from water and erosion damage during construction.
4. Protect existing walks and other site amenities as much as possible during construction. Repair or replace any items damaged during construction.
5. Contractor shall provide all survey, engineering, and construction staking necessary to complete the project in accordance with Section 010000 – Field Engineering. All staking shall be performed under the supervision of a licensed Professional Land Surveyor.
6. Perform site clearing and demolition as required in the construction documents.
7. Contractor shall be responsible for removing and disposing of existing vegetation and other materials that are required to be removed in order to properly execute this contract. All material shall be legally disposed of off-site.
8. Perform grading and earthwork as required in the construction documents.
9. Furnish and install electrical utility components as required in the construction documents.
10. Furnish and install all drainage as required in the construction documents.
11. Furnish and install concrete walks as required in the construction documents.
12. Furnish and install the freestanding seat walls as required in the construction documents.
13. Furnish and install concrete curb and gutter and curb walls as required in the construction documents.
14. Coordinate delivery and installation of site furnishings and improvements as required in the construction documents.
15. Furnish and install signage as required in the construction documents.
16. Coordinate delivery and install all materials for shade structures and trellises.
17. Furnish and install all irrigation system components as required in the construction documents.
18. Furnish and install all trees, plants, sod, seed, and native seed as required in the construction documents.
19. The Contractor shall be responsible for providing landscape and irrigation maintenance for the entire park, including areas surrounding the Senior Center, during construction and for the one-year establishment period following Substantial Completion, in accordance with Division 32 – Exterior Improvements, including all applicable phases of work.
20. Furnish and install topsoil and planting soil mixes as required in the construction documents.
21. Provide the owner with As-Built Drawings as required in the construction documents.
22. Maintain and establish all trees, plants, sod, and seeded areas for a period specified in the construction documents. Follow specified maintenance practices during the establishment period.
23. Provide warranty on all items for one (1) year following the date of Substantial Completion.

24. The Contractor shall furnish and install all other items, materials, equipment, and work necessary to provide a complete and fully functional project as shown on the Drawings and described in the Specifications, whether or not each item is specifically mentioned herein.

1.2 Minimum Licensing Requirements:

Minimum Licensing requirements shall include Utah State licensed E100 - General Engineering Contractor or B100 General Building Contractor; Utah State licensed S330 - Landscape Contractor; S260 General Concrete Contractor, and any other classes of licenses to complete the work, as shown by the plans and specifications.

1.3 Responsibility

It is intended that the General Contractor herein after referred to as the Contractor, shall be responsible for the overall management of the construction work. This includes any work done by their employees directly or through sub-contractors. The Contractor shall properly coordinate all work done, expediting the work of various trades, as necessary, so that different elements are built and installed in proper sequence. They must function properly and, as intended, at the completion of the project.

The Contractor shall visit the site prior to submitting a bid to adequately determine the scope, intent, and requirements of the project and its satisfactory completion.

1.4 Coordination

The Contractor shall see to it that orders for manufactured items called for by the various specifications, are ordered by the various trades and are delivered at the proper time.

END OF SECTION 011100

SECTION 014000 - QUALITY CONTROL

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

A. General Quality Control
B. Workmanship
C. Manufacturer’s Instructions
D. Manufacturer’s Certificates
E. Manufacturer’s Field Services
F. Testing Laboratory Services

1.2 RELATED DOCUMENTS

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

1.3 QUALITY CONTROL – GENERAL

A. The Contractor shall be fully responsible for implementing and maintaining a quality control program to ensure that all materials, products, and workmanship conform to the requirements of the Contract Documents. Supervision and inspection by the City or Landscape Architect shall not relieve the Contractor of this responsibility.

1.4 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.5 MANUFACTURERS' INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from the Engineer before proceeding.

1.6 MANUFACTURERS' CERTIFICATES

A. When required by the individual Specifications Section, submit the manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

1.7 MANUFACTURERS' FIELD SERVICES

A. When specified in respective Specification Sections, require supplier to provide qualified personnel to observe field conditions, quality of workmanship, as applicable, and to make appropriate recommendations.

B. Representative shall submit written report to Engineer listing observations and recommendations.

1.8 TESTING LABORATORY SERVICES

A. **Quality Control testing (for compaction density testing, concrete testing, asphalt testing, etc.) required under the Contract Documents shall be included as part of the Contractor's bid and listed as part of the Quality Control line item on the Contractor's Schedule of Values form submitted with all payment requests.** City and Landscape Architect shall be copied on all test results. The City, at its own expense, may perform additional quality assurance testing to verify compliance of the work with project specifications.

B. Services will be performed in accordance with the requirements of the local jurisdiction having authority and with specified standards.

C. Reports will be submitted to Owner in duplicate, giving observations and results of tests, indicating compliance or non-compliance with specified standards and with Contract Documents.

D. Contractor shall cooperate with Testing Laboratory personnel; furnish tools, samples of materials, mix design, equipment, storage, and assistance as requested.

PART 2 PRODUCTS
Not Used.

PART 3 EXECUTIONS
Not Used.

END OF SECTION 014000

SECTION 015600 - TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment, and services required for protecting existing trees, shrubs, and other vegetation to remain as indicated on the Drawings and specified herein.

B. The Contractor shall be fully responsible for the protection and preservation of all existing trees, shrubs, and vegetation to remain, and for implementing all measures required by this Section, whether or not each tree or plant is specifically identified on the Drawings.

C. Work includes, but is not limited to, the following:

1. Preconstruction coordination and installation of protective fencing and barriers.
2. Protection of tree root zones, trunks, and canopies during construction.
3. Pruning, root pruning, and other preparatory work as required by a Certified Arborist.
4. Maintenance of protection measures throughout the duration of construction.
5. Replacement of trees or vegetation damaged during construction, and implementation of required corrective actions

1.2 REFERENCES

A. The following standards shall apply to the work of this Section.

1. International Society of Arboriculture, Savoy, IL 61874 (ISA): Guide for Plant Appraisal

1.3 SUBMITTALS

A. Proposed methods, materials, and schedule for tree and plant protection shall be submitted for approval.

B. Proposed methods, materials, and schedule for root pruning and tree fertilization shall be submitted for approval.

C. Certifications: Submit appropriate evidence of certification of all arborists to be employed on the Project.

D. Licenses: Submit appropriate evidence of licensing of all chemical applicators to be employed on the Project.

E. MSDS: Submit Material Safety Data Sheets (MSDS) of all chemicals to be applied on the Project.

At least 30 days prior to ordering materials, the Contractor shall submit to the Owner's Representative, representative samples, certifications, manufacturer's product data and certified test results for materials as specified below. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Owner's Representative. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Owner's Representative reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

1.4 QUALITY ASSURANCE

A. Work of root pruning, fertilizing, spraying, and similar activities shall be undertaken only by certified Arborists and chemical applicators, as pertinent to the work being performed.

1. Application of chemicals shall be performed by licensed chemical applicators.
2. Arborist shall be a professional Certified Arborist with a minimum five years experience, who has successfully completed a certification program.

1.5 LIABILITY FOR DAMAGES

A. The Contractor shall be liable for all damage and/or disturbance to existing trees and shrubs not otherwise designated for removal. For bidding and general work guidelines prior to on-site tree protection conference, the Contractor shall assume all trees within the Limit of Work shall be saved unless specifically designated to be removed on the Plans. Actual charges for damage to plants shall be in accordance with the schedules defined herein, with assessed charges to be deducted from sums payable under the Construction Contract.

1. Damage which, in the Owner's Representative's opinion, can be remedied by corrective maintenance shall be repaired immediately.
2. Trees or shrubs which are damaged irreparably shall, at the Owner's Representative's discretion, be replaced by the Contractor with new trees or shrubs of the same size and type.
3. In the event that replacement of damaged trees is not feasible as determined by the Owner's Representative, the full replacement costs will be assessed to the Contractor's account at values based upon the square inches of cross sectional area of trunk (measured at 4 ft. above grade), in accordance with the Trunk Formula Method described in the ISA Guide described herein, and the following table:

$75.00/square inch for trees less than or equal to 6 inch diameter
$50.00/square inch for trees greater than 6 inch and less than 18 inch diameter
$40.00/square inch for trees greater than or equal to 18 inch diameter

B. Damaged trees or shrubs which require removal and/or replacement shall be removed according to the Specification requirements for removals, including refilling and repair of ground surface, with such costs to be borne by the Contractor in addition to assessed charges described herein.

The Contractor shall be liable for all damage and/or disturbance to existing adjacent lands beyond the Limit of Work. Actual damage to these areas, caused by the Contractor, shall be repaired to the satisfaction of the Owner's Representative, at no additional cost to the Owner. Repairs may include pruning or removing damaged vegetation in accordance with current horticultural practices, replacement of damaged vegetation, restoration of the ground plane to its original condition, and any other work required to restore the area to its original condition as depicted in the site photographs taken at the beginning of construction. The project will not be accepted until all repair work is complete.

1.6 DAMAGE PENALTIES

A. A fine of $1,000 will be levied against the Contractor for each incident of construction inside tree protection areas.

B. Visible damage to the tree trunks or to tree roots within the protected areas will cause the Owner to withhold from the Contractor an amount in accordance with and as described under Paragraph titled, Liability for Damages, in this Section, for a period of two years. After that period the impact of the damage will be assessed by the Owner's Representative and Owner, If in the opinion of the Owner's Representative or Owner, the tree is in fair to good health the damage fine will be refunded; if the tree is in poor condition or lost the fine will not be refunded.

1.7 ON-SITE PRECONSTRUCTION CONFERENCE

A. Before the start of any work on the site, preceding the arrival of equipment, materials or vehicles to the site, and prior to the commencement of any clearing on the site, the Contractor shall arrange a preconstruction conference on the site with the Owner's Representative and the Owner's Representative to identify trees and shrubs that are to be protected or removed. Do no clearing without a clear understanding of existing conditions to be preserved. In addition to the responsibilities and penalties described in this Part of the Specification, the Contractor shall be held responsible for any and all clearing, damage or destruction to plant material that results from the Contractor's failure to schedule and attend the preconstruction conference on site. In the event of said clearing, damage or destruction the Contractor will be assessed the full penalties described in this Section.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCING

A. Tree protection fencing shall be equal to the following:

1. New high density polyethylene laminar netting. Mesh dimensions shall be 3-3/4 in. x 2 in. with 1/2 in. strands. Fabric color shall be safety orange.
2. Stakes for fencing shall be 6 ft. long wood or metal drive stakes, commonly used to support fencing. Attachment shall be by staples to wood or wiring to metal.
3. Unless otherwise indicated, height of fencing shall be 6 ft.

B. Tree protection fence is not to be substituted for construction security fencing.

2.2 BOXING

A. Existing trees indicated to remain and which may, in the Owner's Representative's opinion, be damaged by the Contractor's equipment and operations shall be protected by boxing.

B. Boxing shall be 4 in. x 4 in. with two 2 in. x 4 in. rails. Box shall be approximately 8 ft. x 8 ft. in size centered on the tree trunk, to a height of approximately 6 ft.

2.3 FERTILIZERS

A. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. Liquid fertilizer for subsurface hydraulic injection to correct soil nutrient deficiencies shall be a product meeting the requirements of ANSI 300 and as modified by this paragraph. Liquid fertilizer shall include a slow release form of nitrogen (50% of N to be water insoluble), phosphorus and potassium; shall be chloride free; shall have a low salt content; and shall have a wetting agent to aid with dispersion. Fertilizer shall contain required micro-nutrients established by soil test analysis.

PART 3 - EXECUTION

3.1 IDENTIFICATION OF TREES AND SHRUBS TO REMAIN

A. Before any clearing is done, the Contractor shall arrange a conference on the site with the Owner's Representative to identify trees and shrubs that are to be protected or removed. Do no clearing without a clear understanding of existing conditions to be preserved.

B. The Contractor shall be responsible for the protection of all existing trees and plants designated to remain for the length of the construction period, including liability for all damages as specified herein. The placement of protection devices additional to those specified shall, however, be at the Contractor's discretion and with no additional cost to the Owner.

3.2 PROTECTION OF EXISTING TREES AND SHRUBS

A. Trees to remain within work area shall have tree protection fencing, posts, and bracing erected.

1. Protection shall be maintained throughout the duration of the Project. Fencing does not relieve the Contractor of other protection responsibilities.
2. Repair or replace trees indicated to remain which are damaged by construction operations, in a manner acceptable to Owner's Representative. Employ licensed arborist to repair damage to trees.
3. Such trees which are injured due to the Contractor's operations to such a degree that, in the opinion of the Owner's Representative, their usefulness or appearance are significantly impaired, shall be replaced with equivalent items at the Contractor's expense.

B. Materials and equipment shall not be stored or operated under the branches of existing trees which are to remain, except as actually required to construct the proposed work in those areas.

C. Suitable barricades, fences, or other barriers shall be provided at the drip line to protect existing trees from damage during construction.

D. Existing trees indicated to remain and which may, in the Owner's Representative's opinion, be damaged by the Contractor's equipment and operations shall be protected by the following method:

1. Boxing of Tree with Wood: Boxing shall be 4 in. x 4 in. posts with two 2 in. x 4 in. rails. Box shall be approximately 8 ft. x 8 ft. in size centered on the tree trunk, to a height of approximately 6 ft.

E. Water trees and other vegetation to remain within Limits of Contract work as required to maintain their health during course of construction operations. Hand water plant material if necessary.

3.3 TREE CUTTING, PRUNING AND REMOVAL

A. Pruning shall be performed in accordance with current horticultural practices.

B. Tree removal shall be performed in accordance with the requirements of current horticultural practices.

C. Trees and plants designated to be saved shall be protected during pruning operations and all subsequent construction. The Contractor shall provide the handwork necessary to complete pruning operations without damage to adjacent trees in accordance with current horticultural practices, of this Contract. The Contractor shall provide the means necessary to prevent scrapes and scars to trunks and branches, and such damage shall require the Contractor to be assessed as previously specified above, or to replace damaged material to the satisfaction of the Owner's Representative.

3.4 ROOT PRUNING

A. Where construction will be in close proximity to existing trees designated to remain, roots shall be pruned prior to trenching and tunneling operations. Root pruning shall be performed as early as possible before trenching or tunneling operations. Proximity shall be as determined in the field by the Owner's Representative.

B. Root pruning is the physical cutting of tree roots to minimize root damage and promote healing. Root prune using a sharpened spade for all roots smaller than one inch diameter. Root prune using an ax or chainsaw for all roots greater than one inch diameter. Any method which tears roots or disturbs the soil beyond the grading limit is unacceptable. Don't use a backhoe bucket or any other excavating machine to root prune.

C. Backfill root pruning trench with existing soil mixed with peat moss to a mixture of approximately 75% loam and 25% humus by volume. Tamp soil in six-inch lifts. Each lift shall be compacted to a point at which a foot print makes only a 1/16 inch impression.

D. Apply mulch to a depth of 4 inches at minimum 10 ft. to 15 ft. radius around tree to reduce compaction and increase moisture retention.

3.5 FERTILIZING

A. Fertilization of designated trees shall be by soil injection of liquid fertilizer. The fertilizer shall be mixed with water and injected into the soil under pressure using a hydraulic sprayer and a feeding needle.

B. Sprayer pressure shall be set to 100-200 psi.

C. Injection points shall be spaced 3 feet on center beneath the dripline of the tree. Place the first band of injections approximately 1/4 the distance from the trunk to the edge of the dripline. Successive bands shall be spaced 3 feet apart out to one to three feet beyond the edge of the dripline.

D. The feeding needle shall be inserted twelve to eighteen inches into the soil. Rotate the feeding needle by 90 degrees during the injection process to ensure distribution of the fertilizer in all directions.

E. The liquid fertilizer shall be a suspension grade fertilizer design to be mixed and applied in water using a high volume hydraulic sprayer.

F. Mixing and application rates shall be in accordance with the soil test report recommendations to an approved area under the dripline. Strong mechanical agitation shall be applied to maintain suspension. Use a 3 foot by 3 foot injection spacing.

G. Fertilizing of all trees shall occur at the completion of the Work. But under no circumstances shall fertilization be delayed more than one planting season. Should construction be delayed for any reason, the Contractor shall be required to fertilize all designated trees disturbed up to the time of the construction delay.

3.6 REMOVAL OF TREE AND SHRUB PROTECTION MATERIAL

A. Contractor shall remove and discard in a legal manner all tree protection material, excavated soil, pruned vegetation and all debris and trash from the site at the completion of the Contract.

END OF SECTION 015600

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Project Record Documents.
   3. Final cleaning.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, and similar final record information.
   6. Submit test records.
   7. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
   8. Complete final cleaning requirements
   9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, the OAR will either proceed with inspection or notify Contractor of unfulfilled requirements. The OAR will prepare the Notice of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before notice will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

C. All work must be sufficiently complete to permit full use and operation for its intended purpose. The Landscape Architect and City will not consider Substantial Completion requests until all major systems are functional and all safety and accessibility requirements are met.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
   2. Submit copy of the OAR's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Instruct Owner's personnel in operation, adjustment, and maintenance of, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, OAR will either proceed with inspection or notify Contractor of unfulfilled requirements. OAR will inform the Contractor that a final Payment Application can be submitted after the inspection or will notify Contractor of construction that must be completed or corrected before payment application can be submitted.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

C. Submit written certification stating that all punch list items have been completed and that the Project is clean, fully operational, and ready for final acceptance.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit **three** copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of areas in sequential order,
   2. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Landscape Architect
      d. Name of Contractor.
      e. Page number.

1.6 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
   1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
      b. Accurately record information in an understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings and Product Data, where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings**,** and Record Specifications, where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 – EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or for a portion of Project:
1. Clean the Project site, yard, and all areas disturbed by construction activities—including landscape development areas—of rubbish, waste material, litter, and other foreign substances.
2. Sweep all paved areas broom-clean. Power wash all hardscape surfaces, including, but not limited to, concrete walkways, plazas, curbs, seat walls, and boulder retaining walls, to remove construction dust, mud, and other foreign materials. Remove petrochemical spills, stains, tire marks, and other foreign deposits. Do not use cleaning methods that will etch, discolor, or otherwise damage finished surfaces.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface free of debris and construction waste.
4. Flush and clean all drainage structures, valve boxes, utility boxes, and adjacent landscape edging to ensure they are free of debris and sediment.
5. Remove all tools, construction equipment, machinery, temporary facilities, and surplus material from the Project site.
6. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

DIVISION 02 – EXISTING CONDITIONS

TABLE OF CONTENTS

SITE DEMOLITION AND CLEARING – SECTION 024112

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work: This work shall consist of clearing, grubbing, removing, and disposing of trees noted, woody plant material, and debris as well as stripping of topsoil within the contract line specified by the plans and specifications. This work shall also include the preservation from injury or defacement of all trees, vegetation, and objects other than those designated for clearing.

B. This work includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants, and grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass as indicated on demolition plan.
3. Clearing and Grubbing
4. Stripping and Stockpiling topsoil.
5. Removing above- and below-grade site improvements.

1.2 RELATED DOCUMENTS:

A. Related Sections include the following:

1. Section 312000 Earthwork
2. Section 329119 Fine Grading and Soil Preparation
3. Section 312500 Erosion and Sediment Control

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; free of subsoil and weeds, roots, toxic materials, or other non-soil 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.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to remain, cleared materials shall become Contractor’s property and shall be removed from project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.6 JOB CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing improvements indicated to remain in place. Protect improvements on adjoining properties and on Owner's property.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises where indicated.

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

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

PART 2 – PRODUCTS

2.1 CONSTRUCTION FENCE

A. Construction fence shall be 4’ tall Orange Plastic Mesh Barrier Fencing and 6’ tall Chain Link Barrier Fencing as required to ensure safe construction site.

2.2 METAL T POSTS

A. Fence posts for mesh construction fencing shall be a 6’ tall metal T Post.

PART 3 – EXECUTION

3.1 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. Install construction fencing in areas indicated on the drawings and in accordance with the General Conditions

1. Posts for Construction Fencing shall be spaced as required to support the fence.

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

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

3.2 EROSION AND SEDIMENTATION CONTROL

A. Provide 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 Specification Section 312500 “Erosion and Sediment Control” and the requirements of authorities having jurisdiction. Erosion and sedimentation control measures shall comply with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever, is more stringent.

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

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

3.3 UTILITIES

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

1. Notify Owner’s Authorized Representative not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions with Owner’s Authorized Representative’s written permission.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, stumps, roots, shrubs, concrete, asphalt, culverts, and other objectionable materials to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or 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 zones.
5. Remove tree branches and dispose of off-site.

B. The contract limit line will establish clearing lines between which the ground shall be cleared of all materials as indicated above. No debris may be buried on the site.

C. The Contractor shall dispose of all trees, stumps, roots, brush, concrete, asphalt, etc., from the premises in a manner satisfactory to the Owner’s Authorized Representative.

D. The Contractor shall thoroughly moisten all graded surfaces to lay the dust to rest before proceeding with other operations of the contract. He shall also make certain that the ground surface drains properly so as to avoid un-necessary puddling and standing water.

E. Water truck shall be used to maintain reasonable dust control during clearing, grubbing, and grading operations.

F. Clearing, grubbing, grading, and earth moving operations shall not continue during windy periods.

G. During clearing and grubbing operations, the Contractor shall take care not to strip any topsoil except as specified.

H. If any utility lines not shown on the plans are discovered during the clearing and grubbing operations, the Owner's Authorized Representative shall be notified immediately.

I. Fill depression 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.

3.5 SITE IMPROVEMENTS

A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction. Refer to project plans for improvements to be abandoned in place. Store and protect any improvements indicated for reuse in the project.

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

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

3.6 DISPOSAL

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

1. The Contractor shall remove all debris and surplus materials from the premises weekly to prevent large accumulations and the potential of unhealthy conditions. Burning on- site will not be permitted.

END OF SECTION 311100

DIVISION 05 – Metals

TABLE OF CONTENTS

SECTION 057210 – EXTERIOR METAL RAILINGS

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. Metal exterior railings and barriers

B. Related Sections include the following:

1. Division 31 – Earthwork for excavation, filling, rough grading, backfill materials, protection of existing trees and plantings, and site clearing.

2. Division 32 – Concrete

1.3 DEFINITIONS

A. Railings: Guardrails, barriers, handrails, and similar devices used for protection of occupants at retaining walls, pedestrian guidance and supports, and visual separation.

1.4 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 60 percent of minimum yield strength.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails & Barriers:
   a. Uniform load of 50 lbf/ft (0.73kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculations on surface temperature of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (range): 120 deg F (67 deg C), ambient: 180 deg F (100 deg C),

material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Welded connections.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

E. Mill Certificates: Signed by manufacturers of metal products certifying that products furnished comply with requirements. Mill certificates should come directly from the Mill to Owner’s Authorized Representative for verification.

F. Welding certificates.

G. Qualification Data: For professional engineer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Product Options: Details provided in drawings indicates size and the style of railings

1. Do not modify intended aesthetic effects, as judged solely by Owner’s Authorized Representative, except with Project Manager's approval. If modifications are proposed, submit comprehensive explanatory data to Project Manager for review.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.6, "Structural Welding Code."

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup for each type of railing to be provided (guardrail, handrail, etc…)
2. Build mockups that show weld quality, bends, and tube thickness of each tube diameter.
3. Each mockup must include at least one seamless butt joint, one tee joint, and one corner joint or bend.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor botls, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails, unless otherwise indicated.
1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
3. Provide formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.
4. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

2.2 METAL TUBING AND PIPE

A. Tubing & Pipe: size and type indicated in drawings and details.

2.3 FASTENERS

A. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

B. Provide concealed fasteners for attaching railings to other work, unless otherwise indicated.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners, unless otherwise indicated.

C. Anchors: Provide cast-in-place chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. All field connections shall be welded.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate exposed connections to be weather tight. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Provide continuous weld at all connections and fittings.

1. Use materials and methods that minimize distortion and maintain strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Form changes in direction as follows:

1. By bending or by inserting prefabricated elbow fittings.

I. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of hollow railing members with prefabricated end fittings.

K. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment. All protection shall be removed and disposed by the contractor prior to completion of project.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 POWDER COAT FINISH

A. Provide powder coat finish meeting AAMA 2605 standard specification for “High Performance Exterior Finish.”

B. COLOR: to be RED to match or compliment play equipment. Submit color samples for approval.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 PREPARATION

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Unless intended for field welded connection, do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5mm in 3 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 6 inches (152 mm) deep and 3 inch (76 mm) diameter for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions connected to posts and to metal supporting members as follows:

1. For railings, weld flanges to posts and bolt to metal-supporting surfaces.

C. Install removable railing sections, where indicated, in slip-fit steel sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with steel sleeves concealed within railing ends and anchored to wall construction with anchors and bolts, unless otherwise detailed.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure steel wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Payment for these services will be made by Owner.

B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.

C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and will comply with specified requirements.

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

3.8 CLEANING

A. Clean steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.9 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057210

DIVISION 22 – Plumbing

TABLE OF CONTENTS

DIVISION 26 – Electrical

TABLE OF CONTENTS

SECTION 260001 – ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. Architectural, Structural, Mechanical and other applicable documents also apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. The contract documents indicate the extent of electrical work. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system as described in divisions 26, 27, and 28.

1.3 RELATED SECTIONS:

A. Other Divisions relating to electrical work apply to the work of this section. See other applicable Divisions including, but not necessarily limited to:

1. Division 1 – General and Supplementary Conditions
2. Division 2 – Existing Conditions
3. Division 3 – Concrete
4. Division 5 – Metals
5. Division 6 – Wood, Plastics, and Composites
6. Division 7 – Thermal and Moisture Protection
7. Division 8 – Openings
8. Division 9 – Finishes

1.4 INTERPRETATIONS OF DRAWINGS AND SPECIFICATIONS:

A. Prior to bidding the job, submit requests for clarification in writing to the Architect/Engineer prior to issuance of the final addendum.

B. After signing the contract, provide all materials, labor, and equipment to meet the intent, purpose, and function of the contract documents.

C. The following terms used in Division 26, 27, and 28 documents are defined as follows:

1. "Provide" - Means furnish, install, and connect, unless otherwise indicated.
2. "Furnish" - Means purchase new and deliver in operating order to project site.
3. "Install" - Means to physically install the items in-place.
4. "Connect" - Means make final electrical connections for a complete operating piece of equipment. This includes providing conduit, wire, terminations, etc. as applicable.
5. "Or Equivalent" - Means to provide equivalent equipment. Such equipment must be approved by the Engineer prior to bidding.

1.5 EXAMINATION OF SITE:

A. Visit the site and verify existing field conditions prior to submitting bid.

B. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.6 QUALITY ASSURANCE:

A. Perform work in accordance with all governing codes, rules, and regulations including the following minimum codes (latest editions or as otherwise accepted by the Authorities Having Jurisdiction):

1. National Electric Code (NEC)
2. International Building Code (IBC)
3. International Fire Code (IFC)
4. International Mechanical Code (IMC)
5. International Plumbing Code (IPC)
6. American Disability Act (ADA)
7. National Electrical Safety Code (NESC)
8. Local Codes and Ordinances

B. Comply with all standards where applicable for equipment and materials including the following minimum standards:

1. Underwriter's Laboratories (UL)
2. American Society for testing Materials (ASTM)
3. Certified Ballast Manufacturers (CBM)
4. Insulated Cable Engineers Association (ICEA)
5. National Electrical Manufacturer's Institute (NEMA)
6. American National Standards Institute (ANSI)
7. Electrical Testing Laboratories (ETL)
8. National Fire Protection Association (NFPA)
9. Institute of Electrical and Electronics Engineers (IEEE)
10. American Institute of Electrical Engineer's Electrical Power
11. Systems and Grounding in Commercial Construction
12. Illuminating Engineers Society (IES)

C. Provide new electrical equipment conforming to all requirements as set forth in the above standards. Provide UL labeled equipment where such label is applicable.

D. Comply with all state and local codes and ordinances. When conflicts occur among codes, standards, drawings, and/or specifications, the most stringent requirements shall govern.

E. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Provide a certificate of approval to the owner's representative from the inspection authority at completion of the work.

F. Provide only first-class workmanship from competent workers, conforming to the best electrical construction practices.

G. The contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.7 SUBMITTALS:

A. The contractor shall submit complete shop drawings and other required submittals. Incomplete submittals will be returned to the contractor unreviewed. No time extensions or cost increases will be allowed for delays caused by the return of incomplete submittals.

B. Shop Drawings: After the contract is awarded, but prior to manufacture or installation of any equipment, submit eight (8) complete sets of shop drawings. Partially complete sets of shop drawings are not acceptable. Submit all shop drawings in one complete submittal package. Prior to submitting shop drawings, review and certify that they are in compliance with the contract documents; Sign all approved shop drawings. Allow a minimum of two weeks for architect/engineer to review shop drawings. Refer to architectural general provision section for additional requirements.

C. Provide equipment catalog “cut sheets”, brochures and/or drawings which clearly describe the proposed equipment. Include plans, elevations, sections, isometrics, and detailed engineering and dimensional information as applicable including equipment room layouts. Electrical room layouts are required to show all electrical equipment locations for all projects that include electrical rooms. Do not submit catalog sheets which describe several different items in addition to those items to be used, unless all relevant information is clearly identified. Bind each information set in three ring binder or binders of sufficient size or sizes to enclose all information. Organize all information by section. Provide separate tabbed covers for each section of Divisions 26, 27, and 28, indicating section number for each section requiring submittals.

D. Include on front cover of binder or binders the name and location of the project, architect, electrical engineer, general contractor, electrical contractor, subcontractors, supplier/vendor, order number, volume, date, and any other applicable information. Certify that shop drawings are submitted in accordance with the contract documents with a written statement indicating compliance. Submittals will be reviewed and comments produced two times maximum. Additional reviews will be billed at current rates.

1.8 OPERATION AND MAINTENANCE MANUALS:

A. Submit four (4) complete sets of operating instruction and maintenance manuals for all equipment and materials provided under Divisions 26, 27, and 28.

B. Provide manufacturer's recommended operating and maintenance instructions, cleaning and servicing requirements, serial and model number of each piece of equipment, complete list of replacement parts, performance curves and data, wiring diagrams, warranties, and vendor's name, address, and phone numbers. Do not submit information which describes several different items in addition to those items to be used, unless all relevant information is clearly identified. Assemble all data in completely indexed volume or volumes. Engrave the job title, and name, address, and phone numbers of the contractor on the front cover and on the spine. Incomplete O&M manuals will be returned to the contractor for corrections / additions.

1.9 RECORD DRAWINGS:

A. Maintain on a daily basis a complete set of "Red-Lined Drawings", reflecting an accurate record of all work including addendums, revisions, and changes. Indicate precise dimensioned locations of all concealed work and equipment, including concealed or embedded conduit, junction boxes, etc. Record all "Red-Lined Drawing" information on a set of full sized prints of the contract drawings.

B. Certify the "Red Lined Drawings" for correctness. Indicate on each drawing the name of the

general and electrical contractors with signatures of each representative responsible for the work.

C. The electrical engineering design firm will create record (as-built) drawings from the certified red-lined drawings; however, the general and electrical contractors retain the responsibility for the accuracy of the record drawings.

1.10 WARRANTY:

A. Ensure that the electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes and is free from electrical defects. Without additional charge, replace or repair, to satisfaction of the owner's representative, except from ordinary wear and tear, any part of the installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance or as otherwise indicated in individual sections, but in no case less than one year. Warranty incandescent and fluorescent lamps only for a period of two months from the date of substantial completion.

B. Provide complete warranty information for each item including beginning of warranty period, duration of warranty, names, addresses, and telephone numbers and procedures for filling a claim and obtaining warranty services. Written warranties and guarantees are to be submitted separately as:

1. Originals bound in a binder clearly identified with the title, “WARRANTIES AND GUARANTEES,” the project name, the project number, and the Contractor’s business name.
2. Electronic documents in *.pdf format.

PART 2 – PRODUCTS

2.1 GENERAL:

A. All materials shall be new and shall bear the manufacturer's name, trade name, and the approved testing laboratory such as the UL label in every case where a standard has been established for that particular material. Used materials are acceptable only if specifically indicated on drawings.

2.2 SUBSTITUTION OF MATERIALS:

A. Provide only specified products or products approved by addendum. Substitutions will be considered if two copies of the proposal is received at the architect's/engineer's office eight (8) working days prior to the bid day. Include in the proposal the specified and proposed catalog numbers of the equipment under consideration and a catalog cut sheet(s) with pictorial and descriptive information. Certify that the equipment proposed is equal to that specified, that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents.

B. It is the responsibility of the contractor to make all substituted equipment comply with the intent of the contract documents and bear all cost associated with conflicts arising form the use of substituted equipment.

C. Provide samples if so required by the architect or engineer before or after bid day.

2.3 SPARE PARTS:

A. Provide spare parts as specified in Divisions 26, 27, and 28 sections. Deliver all spare parts to owner's representative prior to substantial completion.

PART 3 – EXECUTION

3.1 GENERAL:

A. Workmanship: Provide only first class workmanship from competent workers. Defective materials or workmanship will not be allowed on the project. Provide competent supervision for the work to be accomplished. Keep same foreman on the job, unless a change is authorized by the engineer.

B. Coordination: Prior to construction, layout electrical work and coordinate work with other trades. Sequence, coordinate, and integrate installation of materials and equipment for efficient flow of the work. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components. Coordinate with all utilities including power, communication, and data installations.

C. Provide cutting, drilling, channeling, etc. only as necessary for proper completion of the work. Do not cut structural members unless authorization is issued in writing by the architect/engineer.

D. Repairs: Repair damage to building, grounds, or utilities as a result of work under this contract at no additional cost to the owner.

E. Dimensioning: Electrical drawings indicate locations for electrical equipment only in their approximate location, unless specifically dimensioned. Do not scale electrical drawings for dimensional information. Refer to architectural drawings and shop drawings where applicable for locations of all electrical equipment. Field verify all dimension on the job site.

F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

G. Standards: Provide electrical installation in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

H. All workmen doing work of any nature on State of Utah projects must at all times carry their electrician's license with them and show it upon request. The acceptable ratio of apprentice to journeyman electricians on the job is 1:1.

3.2 REQUESTS FOR INFORMATION:

A. When it is clearly apparent that information is not adequately described in the construction documents or when a coordination problem exists, submit a request for information (RFI) through proper contractual channels. The electrical engineering design firm will provide a response through its contractual channel. Although verbal direction may be given to expedite changes, responses are not considered part of the contract documents until a change order has

been issued and signed by the Owner or his designated representative. The Contractor shall bear all costs associated with proceeding on any change order that has not been approved by the Owner or his designated representative.

B. Any damages caused by construction delays due to frivolous RFI's, will be born solely by the Contractor.

3.3 SAFETY PRECAUTIONS:

A. Provide all necessary guards or construction barriers and take all necessary precautions to insure the safety of life and property.

3.4 CLEAN:

A. Clean up all equipment, conduit, fittings, wire, packing cartons, plastic, and other debris that is a direct result of the installation of the work of this division, both during the execution, and at the conclusion, of the project. Keep the site clean and safe during the progress of the work. Clean fixtures, interior and exterior of all equipment, and raceways prior to final acceptance. Vacuum interior of all electrical panels and equipment. Correct any damaged equipment. Touch-up or repaint if necessary.

3.5 TEMPORARY POWER:

A. Make arrangements with the proper institution authority for all temporary electricity.

B. Provide temporary power, complete with metering and wiring for lighting and power outlets for construction tools and equipment. Report the initial meter reading to the owner/institution, or otherwise as may be directed.

C. Service shall be provided with a main disconnect and all 20 ampere receptacles protected by 20 amp GFI, single-pole breakers. No attempt is made herein to specify construction power requirements for equipment in detail. Provide all electrical equipment and wiring as required.

D. As soon as permanent power and metering is available, the temporary power supply shall be disconnected and removed from the project site.

E. All temporary wiring shall meet the requirements of NEC Article 305 and the State Industrial Commission.

3.6 POWER OUTAGES:

A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the owner. Any electrical service interruption will be coordinated at least 7 days in advance of the power shut-off. Include all costs for overtime work in bid. Coordinate all outages and proceed only after receiving authorization from the owner's representative. Keep all outages to an absolute minimum.

3.7 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. Lost or damaged materials will be replaced at no additional cost to owner. Do not store materials and apparatus in any public thoroughfare or in any area on the site where such storage would constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.8 EXCAVATING FOR ELECTRICAL WORK:

A. Verification: Prior to excavating, locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling. Observe all State and Local codes prior to excavating. Do not disturb walls, footings, and other structural members in any way.

B. Protection: Provide barricades, warning signs, and illumination to protect persons from injury at excavations. Provide temporary coverings and heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.

C. Coordination: Do not excavate for electrical work until the work is ready to proceed without delay.

D. Excavated Materials: Temporarily store excavated materials near excavation in manner which will not interfere with or damage excavation or other work. Dispose of and remove excavated materials which are either in excess of quantity needed for backfilling or do not comply with the requirements for backfill material.

E. Burial Depths: Burial depths must comply with NEC Section 300-5 (or State of Utah requirements, whichever is more stringent), unless noted otherwise on drawings.

F. Excavation Permits: Obtain all shut-down and excavation permits as may be required for proper completion of the work.

3.9 BACKFILL MATERIALS:

A. For buried conduits or cables (other than below slab-on-grade, or concrete-encased), provide 2" thickness of well-graded sand on all sides of conduits or cables.

B. For trench backfill to within 6" of final grade, provide soil material suitable for compacting to required densities.

C. For top 6" of excavation, provide top soil.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment:

1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
2. Paved Areas, other than roadways: 90 percent for cohesive soils, 95 percent for cohesionless soils.

E. Where subsidence is observable at electrical work excavations during project warranty period, remove surface, add backfill material, compact, and replace surface treatment. Restore surface to original condition.

3.10 LABELING:

A. Engraved black plastic laminated, with white-core labels, 1/16" thick, shall be permanently attached on both the interior and exterior the following electrical equipment:

1. Branch panels

2. Switchgear
3. Disconnect switches
4. Motor starter and controls junction boxes (power and auxiliary)
5. Push buttons
6. Thermal switches
7. Time switches
8. Motor control centers
9. Transformer
10. Similar equipment.
11. Lighting contactors and associated switches
12. Junction boxes larger than 4x4x1/2.

B. The labels shall have 1/4" high, engraved letters, such as EF-1, AC-1, Panel A, etc.

3.11 CONCRETE BASES:

A. Concrete bases: Refer to Section 260551 – Exterior Area Lighting.

3.12 TESTS:

A. Notify engineer prior to all testing specified herein at least three business days prior to testing. Engineer shall observe all tests to insure the proper operation of the electrical system.

3.13 PROJECT FINALIZATION AND START-UP:

A. Upon completion of the work, have each factory representative and/or subcontractor assist in start-up and testing of their respective systems.

B. Have each representative give personal instructions on operating and maintenance of their equipment to the owner's maintenance and/or operation personnel.

C. Have representatives certify each system with a written statement indicating that they have performed start-up and final check out of their respective systems.

3.14 FINAL REVIEW:

A. Have the project foreman accompany their reviewing parties and remove coverplates, panel covers, access panels, etc. as requested, to allow review of the entire electrical system.

END OF SECTION 260001

SECTION 260070 – ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connections for equipment include all final electrical connections for all equipment having electrical requirements including, but not necessarily limited to the following:

1. Equipment specified under all divisions of the contract. Refer to other divisions for specific electrical requirements.
2. Owner-furnished equipment
3. Kitchen Equipment

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. SHOP DRAWINGS: Not required.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide all materials for electrical connections including, but not necessarily limited to the following:

1. Raceways
2. Fittings
3. Conductors
4. Wiring devices
5. Pressure connectors
6. Lugs (CU-AL)
7. Electrical insulating tape
8. Heat-shrinkable tubing
9. Cable ties
10. Wire nuts
11. Other items and accessories as required.

B. Crimp on or slip-on type splicing materials designed to be used without wire stripping are not acceptable.

C. Power Distribution Blocks: Provide Square D Type LB or Equivalent.

D. Refer to other Division 26, 27, and 28 Sections for specification of electrical materials as applicable.

PART 3 – EXECUTION

3.1 GENERAL:

A. Make electrical connections in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONNECTIONS:

A. Permanently Installed Fixed Equipment:

1. Install conductors in flexible conduit from junction box to equipment control panel or connection point.
2. Where such installations are subject to moisture, install in liquid-tight flexible conduit.

B. Movable equipment:

1. Provide wiring devices, cord caps, and multi-conductor cables as required.

C. Other methods as required by the NEC and/or as required by special equipment or field conditions.

D. Power Distribution Blocks: Unless noted otherwise on drawings, provide power distribution blocks only for tapping of feeders and branch circuits. Locate in junction box or gutter in NEMA ratings to suit application.

3.3 MANUFACTURER'S INSTRUCTIONS:

A. Obtain manufacturer's instruction and wiring diagram regarding electrical connections of each piece of equipment and provide connections in accordance therewith.

3.4 VERIFICATION OF LOAD CHARACTERISTICS:

A. Verify electrical load characteristics of all equipment prior to rough-in. Review respective shop drawings of all other Divisions and Owner's equipment manuals. Report any variances from electrical characteristics noted in the contract documents to the Architect/Engineer prior to rough-in.

B. Value of rough-in work, electrical equipment, etc. installed and/or purchased by the contractor not meeting equipment requirements shall be credited back to the owner.

END OF SECTION 260070

SECTION 260072 – ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

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. Hangers and supports for electrical equipment and systems.
2. Seismic restraints for electrical equipment and systems.
3. Construction requirements for concrete bases.

1.3 DEFINITIONS:

A. IBC: International Building Code.

B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS:

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:
   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
   c. Preapproval and Evaluation Documentation: By an agency acceptable to

authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.5 QUALITY ASSURANCE:

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS:

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Available Manufacturers:
   a. Cooper B-Line; a division of Cooper Industries.
   b. ERICO International Corporation.
   c. Allied Support Systems; Power-Strut Unit.
   d. GS Metals Corp.
   e. Michigan Hanger Co., Inc.; O-Strut Div.
   f. National Pipe Hanger Corp.
   g. Thomas & Betts Corporation.
   h. Unistrut; Tyco International, Ltd.
   i. Wesanco, Inc.
2. Finishes:

a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.

3. Channel Dimensions: Selected for structural loading and applicable seismic forces.

C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Verify suitability of fasteners in subparagraph below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers:
      1) Hilti, Inc.
      2) ITW Construction Products.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co. Inc.
3. In the following subparagraph, use stainless steel anchors in corrosive environments.
4. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers:
      1) Cooper B-Line; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc
      3) Hilti, Inc.
      4) ITW Construction Products.
      5) MKT Fastening, LLC.
      6) Powers Fasteners.
5. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
6. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
7. Toggle Bolts: All-steel springhead type.
8. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS:

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Available Manufacturers:
   a. Amber/Booth Company, Inc.
   b. Loos & Co., Inc.
   c. Mason Industries, Inc.
2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES:

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 – EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for raceways as within 12 inches of coupling, fitting, and box, at each 90 degrees bend, minimum of two supports per ten foot run. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps, or as otherwise required by an agency acceptable to authorities having jurisdiction.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION:

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, as permitted in NFPA 70.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Do not drill or core cut holes for anchors or use powder-activated fasteners in post-tension slabs, joists, and beams.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS:

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES:

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete

base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.

3.5 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS:

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 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: Test pullout resistance of seismic anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Record test results.

END OF SECTION 260072

SECTION 260110 – CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conduit raceways.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the followings:

1. Rigid Metal Conduit
2. PVC Externally Coated Rigid Steel Conduit
3. Intermediate Metal Conduit
4. Electrical Metallic Tubing
5. Flexible Metal Conduit

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 260001 – Electrical General Provisions as applicable. Provide conduit raceway installation in accordance with recommendations of the American Iron and Steel Institute "Design Manual on Steel Electrical Raceways", latest edition.

B. Manufacturers: Firms regularly engaged in the manufacture of raceway of types and sizes required, whose products have been in satisfactory service for not less than three (3) years.

C. Shop Drawings: Not required.

PART 2 – PRODUCTS

2.1 CONDUITS:

A. Rigid Metal Conduit (RMC): Provide zinc-coated, hot-dipped galvanized, rigid metallic conduit in accordance with Federal Specification WW-C-0581 and ANSI C80.1.

B. PVC Externally Coated Rigid Metal Conduit: Provide hot-dipped galvanized, rigid metallic conduit externally coated with Polyvinyl Chloride (PVC) in accordance with ANSI C80.1 and NEMA Std. Pub. No. RN 1.

C. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in accordance with Federal Specification WW-C-581.

D. Electric Metallic Tubing (EMT): Provide electric metal tubing in accordance with Federal

Specification WW-C-563 and ANSI C80.3.

E. Flexible Metal Conduit: Provide zinc-coated, flexible metal conduit in accordance with Federal Specification WW-C-566.

2.2 FITTINGS:

A. Rigid Metal Conduit, Intermediate Metal Conduit, and PVC Externally Coated Rigid Metal Conduit: Provide fully-threaded, malleable steel fittings, rain-tight and concrete-tight as applicable. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

B. Electric Metallic Tubing: Provide insulated throat, non-indenter, set screw, malleable steel fittings. Screws must have a full set. Provide concrete-tight compression-type fittings in suspended slabs. All EMT fittings shall be fabricated from steel. Die-cast fittings or fittings made from pot metal shall not be allowed. Indenter type fittings are not acceptable. Install OZ Type B bushings on conduits 1" and larger.

C. Flexible Metal Conduit: Provide flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 1, and Style A. Commercial "greenfield" not less than 1/2" diameter or as otherwise specified on drawings is acceptable.

D. Expansion Fittings: OZ Type AX, or equivalent to suit application.

E. Sealing Bushings: Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ Type CSB internal sealing bushings.

F. Cable Supports: Provide OZ cable supports for vertical risers, type as required by application.

2.3 SIZES:

A. Provide conduits in sizes as indicated in contract documents or as otherwise specified herein, but not less than 3/4".

PART 3 – EXECUTION

3.1 GENERAL:

A. Install raceway and accessories in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 LOCATIONS:

A. Rigid Metal Conduit and Fittings: Use for conduit bends greater than 22 degrees where buried below grade or slab on grade. Install RMC where raceway passes vertically through slab-on-grade. Where raceways penetrate building, manholes, or vault walls and floors below grade, provide RMC for a minimum distance of 10' on the exterior side of the floor or wall. Use RMC for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.

B. Intermediate Metal Conduit and Fittings: Use for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC

requirements.

C. Electric Metal Tubing and Fittings: Use for above-grade feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Install in suspended slabs subject to local code requirements and fire rating considerations.

D. Flexible Metal Conduit and Fittings: Use as whips for lighting fixtures, fixed equipment where not exposed to weather of moisture, other devices where required by NEC, and as requested by the Engineer. Maximum length not to exceed 6', unless specifically approved by the Electrical Engineer.

3.3 METHODS:

A. Maintain a minimum of 12" clearance between steam or hot water lines or other hot surfaces. Where such clearance is impractical, insulate conduit with approved materials.

B. Install conduits parallel with or at right angles to lines of the structure. Route conduits symmetrically where possible.

C. Field bends and offsets shall be made without flattening, kinking, rippling or destroying the smooth internal bore or surface of the conduit and to not less than NEC minimum radius. Conduit that shows signs of rippling or kinking shall not be installed. Conduits installed with wrinkles or kinks or otherwise in an unworkmanlike manner shall be replaced at no additional cost to owner.

D. Precaution shall be exercised to prevent accumulation of water, dirt or concrete in the conduits during the execution of the project. Conduits in which water or foreign matter has been permitted to accumulate shall be thoroughly cleaned or the conduits runs replaced where such accumulation cannot be removed by methods approved the engineer.

E. Any conduit which pierces airtight spaces or plenums shall be sealed to prevent air leakage with mastic acceptable to the Architect.

3.4 BURIED CONDUITS:

A. Comply with all burial depths as defined in NEC Section 300-5. Bury all conduits at least 24" below grade, unless specifically indicated otherwise on drawings. Provide magnetic 6" wide “Yellow Warning" ribbon 12" directly above conduit and 6" below finished grade measured from the top of the conduit or duct bank. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single marker.

B. Slope all conduits toward manholes or pull boxes for proper drainage. Use weep holes. Gravel drainage pockets are not permitted.

C. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.

D. Under Concrete Slab on Grade: Horizontal conduit must be installed a minimum of 2” below the bottom of the concrete slab. Conduits should not be installed in concrete slabs.

E. Concrete Encasement: Where concrete-encasement is indicated on drawings, provide ductbank construction using red 3000 psi at 28 day strength concrete. Provide minimum 4" cover on all sides of exterior conduits. Provide conduit spacers where applicable. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.

F. Where conduits are extended for future use, cap and clearly mark.

3.5 ELECTRICAL CONTINUITY:

A. Provide electrically continuous conduit systems throughout.

3.6 FIELD CUTS AND THREADS:

A. Cut all conduits square. Remove all sharp or rough edges and ream all burrs, inside and outside. Provide clean sharp threads on RMC and IMC.

B. Engage at least five full threads on all RMC and IMC fittings. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of RMC or IMC. Apply coat of red lead, zinc chromate or special compound recommended by manufacture to conduit where conduit protective coating is damaged.

3.7 SUSPENDED SLABS:

A. When conduit is installed in the suspended slab, it shall be limited to conduits having a diameter of 1" (25 mm) or less, or less than 1/3 the concrete cover, and no crossovers occur, and conduit spaced at least 18" (450 mm) apart with a 3/4" (20 mm) cover.

3.8 CONDUIT ENDS:

A. Cap all spare conduits. Cap or plug conduit ends during construction to prevent entrance of foreign material.

3.9 SPARE CONDUITS:

A. Provide five (5) 3/4" empty conduits from panel stubbed into accessible ceiling space and five (5) 3/4" conduits into accessible floor space. When floor is not accessible, provide six (6) 3/4" empty conduits from panel stubbed into accessible ceiling space. Cap and label all conduits.

B. Install a 200 lb. polypropylene pull cord in each empty conduit run.

3.10 HAZARDOUS LOCATIONS:

A. Install RMC and IMC in all hazardous locations as defined by the NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with all NEC requirements and/or as shown on the drawings. Provide inspection fittings with hazardous location rated drains to prevent water from accumulating in conduit runs.

3.11 CLEANING:

A. Pull mandrel and swab through all conduits before installing conductors.

END OF SECTION 260110

SECTION 260120 – CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conductors and cables.

1.2 DESCRIPTION OF WORK:

A. This section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors.

C. Applications for conductors and cables required for project include:

1. Feeders.
2. Branch Circuits.

1.3 SUBMITTALS:

A. Product Data: For each type of conductor and/or cable indicated.

B. Field Quality-Control Test Reports: From Contractor. Refer to Section 260001 – General Electrical Provisions.

1.4 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Manufacturers: In other Part 2 articles where subparagraph titles below introduce lists, provide products by the manufacturer specified, subject to compliance with requirements.

B. Ambient Conditions: Conductors used for branch circuits in areas where the ambient conditions exceed 30 degree C. shall be provided with insulation approved for that temperature.

C. Wire Sizes: As indicated on electrical drawings or as specified herein, but in no case less than No. 12 AWG.

2.2 COPPER CONDUCTORS:

A. Manufacturers:

1. Cerro Wire & Cable Company.
2. General Cable Technologies Corporation.
3. Encore Wire Corporation.
4. Southwire Incorporated.

B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.

C. References and Ratings:

1. ICEA S-95-658 / NEMA WC70.
2. ASTM.
3. UL Standard 83.
4. UL Standard 1063 (MTW).
5. Federal Specification J-C-30B.
6. NEC.

D. Conductor Material: Copper.

E. Stranding: Solid conductor for No. 12 AWG, stranded for No. 10 AWG and larger.

F. Conductor Insulation Types: Thermoplastic-insulated, Type THHN / THWN-2.

2.3 ALUMINUM CONDUCTORS:

A. Not allowed.

2.4 MC FLEXIBLE METAL CLAD COPPER CABLES:

A. Not allowed.

2.5 CONNECTORS AND SPLICES:

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. Splices for wire sizes #10 and smaller shall be screw-on type similar to scotch or ideal wing nut connectors. Crimp-on splices designed to be used without wire stripping are not acceptable.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install conductors, cables, and accessories as indicated, in compliance with manufacturer's written instruction, applicable requirements of NEC, NECA's "Standards of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONDUCTOR AND CABLE APPLICATIONS:

A. Feeders: As indicated on the electrical drawings.

B. Branch Circuits:

1. Exposed, including in crawlspaces: Copper conductors in raceway.
2. Concealed in ceilings, walls, and partitions: Copper conductors in raceways.
3. Concealed in concrete and below slabs-on-grade: Copper conductors in raceway.

C. Cord Drops, Reels, and Portable Appliance Connections: Flexible cord.

D. Class 1 Control Circuits: Copper conductors in raceway.

3.3 INSTALLATION:

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. When raceway is not required, install concealed cables parallel and perpendicular to surfaces of structural members, and follow surface contours where possible.

E. Support cables according to other applicable specification sections.

F. Seal around cables penetrating fire-rated elements to comply with applicable fire stop specification sections.

G. Color Coding: Color code secondary service, feeder, and branch circuit conductors. Colors shall remain consistent throughout the project and shall match existing coding system where applicable.

1. Conductor sizes No. 6 AWG and smaller: Colored insulation.
2. Conductors sizes No. 4 AWG and larger: 2 inch (51 mm) band of Colored adhesive marking tape applied at all terminations, junction boxes, and pull boxes.
3. Branch circuit switched-legs and travelers: Colored insulation (in colors other than those indicated below).
4. Color-code 120/208V system conductors:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

d. Neutral A: White with Black stripe.
e. Neutral B: White with Red stripe.
f. Neutral C: White with Blue stripe.
g. Neutral (Shared when allowed): White
h. Ground: Green.
i. Isolated Ground: Green with yellow tracer.

3.4 HOMERUN CIRCUITS:

A. Homerun circuits may be combined in common conduits at the option of the contractor in compliance with the following:

1. Three-Phase Installations: Not more than three single-phase circuits in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a, b, or c).
2. Single-Phase Installations: Not more than two single-phase circuits in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a or b).

3.5 NEUTRAL CONDUCTORS:

A. LINE-TO-NEUTRAL BRANCH CIRCUITS: Provide a dedicated neutral for each line-to-neutral branch circuit. Size the neutral conductor the same as the phase conductor. In each outlet or junction box containing multiple neutral conductors, tag each neutral to identify which circuit it serves.

3.6 VOLTAGE DROP:

A. Provide branch circuit conductors in sizes such that voltage drop for branch circuits do not exceed 3 percent at the farthest outlet. Provide service, feeder, and branch circuit conductors so that the voltage drop on the entire electrical system does not exceed 5 percent at the farthest outlet. This shall be strictly followed regardless of the conductor sizes indicated on the electrical drawings. Increase conductor sizes (and conduits where necessary to comply with NEC conduit fill requirements) as necessary to accommodate this requirement. Calculations shall be based on the following:

1. Lighting Branch Circuits: Connected load plus 25% spare.
2. Appliance and Equipment Branch Circuits: Nameplate or NEC required load.
3. 120V Convenience Outlet Branch Circuits: 12 amps minimum, but in no case less than NEC loading requirements. Use the following schedule:

Distance (feet)	Wire Size (AWG)
0-80	#12
81-125	#10
126-200	#8
201-320	#6

4. Use the NEC method to calculate voltage drop.

3.7 CONNECTIONS:

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent

or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack. Use pig tails when wiring outlets.

3.8 FIELD QUALITY CONTROL:

A. Testing: Perform the following field quality-control testing:

1. Visual and Mechanical Inspection:
   a. Inspect cables for physical damage and proper connection in accordance with the electrical construction documents.
   b. Test cable mechanical connections to manufacturer's recommended values with a calibrated torque wrench.
   c. Check cable color coding for compliance with electrical specifications.
2. Electrical Tests:
   a. Perform insulation resistance test on each conductors for feeders 100 amps and greater with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
   b. Perform continuity test to insure proper cable connection.
3. Test Values:
   a. Minimum insulation resistance values shall not be less than two megaohms.

B. Test Reports: Prepare a written report and submit to the Electrical Engineer at the completion of the project. The report shall include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260120

SECTION 260135 – ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical boxes and fittings.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical boxes and fittings work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Pull Boxes
4. Conduit Bodies
5. Bushings
6. Locknuts
7. Knockout Closures
8. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

A. Standards: Refer to Section 260001 – Electrical General Provisions as applicable.

B. Manufacturers: Firms regularly engaged in the manufacturer of boxes and fittings required, whose products have been in satisfactory service for not less than three years.

C. Shop Drawings: Submit shop drawings on floor boxes only where required.

PART 2 – PRODUCTS

2.1 INTERIOR OUTLET BOXES:

A. General: Provide one piece, galvanized or cadmium-plated, flat-rolled, sheet steel interior outlet boxes of types, shapes, and sizes to suit respective location and installation. Construct with stamped knockouts on back and sides and with threaded screw holes. Provide corrosion-resistant screws for securing boxes, covers, and wiring devices. Size all junction boxes in accordance with NEC Table 314.16(A), with a minimum box size of 4" x 4" x 1-1/2". Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16". Gangable boxes shall not be used.

B. Switch, Telephone, and Receptacle Outlets: Provide outlet boxes not less than 4" square, with

adapting tile or plaster covers where necessary to set flush with finished surfaces. Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Gang boxes shall be used where more than one switch or device is located at one point. Sectional Boxes are not acceptable. In masonry walls where tile or plaster ring cannot be used, install a single-gang 3-1/2" deep box minimum, unless otherwise noted. Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16".

C. Lighting Outlets:

1. Lay-in Grid: Outlets for recessed fixtures in acoustical tile ceilings shall be located to center on a single tile or at the intersection of four tiles.
2. Surface-mounted: Provide 4" square octagonal outlet boxes for surface-mounted, ceiling fixture outlets. Mount each box independently of the conduit on standard 3/8" stud or approved box hangar where applicable. Include backing and supports as required to carry 200 lbs. Where three or more raceway entrances are made, use a minimum box depth of 2-1/8".

2.2 WEATHERPROOF OUTLET BOXES:

A. Provide corrosion-resistant, cast-metal weatherproof outlet boxes, of types, shapes, and sizes, with threaded conduit ends, cast metal coverplates with spring-hinged waterproof caps, face plate gaskets, and corrosion-resistant fasteners.

2.3 JUNCTION AND PULL BOXES:

A. Provide code-gauge sheet steel junction and pull boxes, with removable screw-on covers and welded seams, of types, shapes, and sizes to suit each respective location and installation. Size all junction and pull boxes in accordance with NEC 314.28. Provide stainless steel nuts, bolts, screws, and washer.

2.4 CONDUIT BODIES:

A. Provide galvanized, cast-metal conduit bodies of type, shapes, and sizes to suit respective locations and installation. Construct with threaded conduit entrance ends and removable covers. Provide corrosion-resistant screws.

B. Aluminum boxes and fitting shall not be permitted.

2.5 CONDUIT CONNECTIONS:

A. Box connectors 3/4" and larger shall be insulated, throat-type or equal type plastic bushings. Provide double locknuts and insulating plastic bushings for RMC and IMC terminating at panels and boxes.

B. Where RMC penetrates building, manholes, or vault walls and floors below grade, provide sealing bushings with external membrane clamps as applicable. Provide segmented internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway. Where RMC terminates in manhole, vault, or pull box, provide insulated grounding bushings. Also see Section 260135 – Electrical Boxes and Fittings.

C. Install OZ type "B" connectors for all conduits 1" and larger.

D. Provide cable supports in all vertical risers in accordance with NEC 300-19.

2.6 EXPANSION FITTINGS:

A. Provide expansion joint fittings in all conduit runs crossing structural expansion joints, whether above-grade, in slab-on-grade, or in suspended slabs. Provide OZ type "AX" or approved equivalent, size to the raceway.

2.7 ACCESSORIES:

A. Provide all accessories including, but not necessarily limited to, bushings, knockout closures, locknuts, offset connectors, etc. of types, shapes, and sizes to suit respective locations and installation. Construct of corrosion-resistant steel.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install electrical boxes and fittings in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 METHODS:

A. Where outlet boxes are subject to weather or moisture, install weatherproof outlet boxes.

B. Remove knockouts only for entering conduits. Provide knockout closures to cap unused knockout holes where blanks are mistakenly removed.

C. Do not use condulets in place of elbows or junction boxes. Condulets in sizes 2" or larger shall not be used, unless specifically approved by the electrical engineer.

D. Install boxes and conduit bodies in readily accessible locations. Install recessed boxes with faces of boxes or rings flush with finished surfaces. Seal all openings between outlet box and adjacent surfaces with plaster, grout, or similar suitable material.

E. For stud construction, install boxes with rigid supports using metal bar hangers, or 2" X 4", 1" X 6" wood bridging between studs with screws. Welding or nailing boxes directly to metal joist and studs is not acceptable. Boxes set opposite in common wall shall have at least 10" of conduit between them. Securely fasten outlet boxes to structural surfaces to which attached.

F. For concrete or masonry construction, solidly embed electrical boxes in concrete and masonry. Provide box supports as required to keep outlet boxes flush with finished surfaces.

G. Coordinate location of all outlet boxes with millwork, back splashes, tackboards, etc.

H. Install junction boxes or condulets in conduit runs as required at 100 foot maximum intervals on long runs. This shall apply to concrete junction boxes in grade and junction boxes within the building.

I. Provide electrical connections for installed boxes.

3.3 IDENTIFICATION:

A. Mark circuit number on exterior side of junction boxes located in ceilings such that circuits numbers are readily identifiable. For outlet boxes in wall, mark circuit numbers on interior sides of outlet boxes.

B. Identification labels shall be as follows:

Normal Power	Black with White letters
Emergency Power	Red with White Letters
UPS	Orange with White Letters

END OF SECTION 260135

SECTION 260140 – WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to wiring devices.

1.2 DESCRIPTION OF WORK:

A. Extent of wiring device work is indicated by drawings and schedules.

B. Types of electrical wiring devices in this section include the following:

1. Toggle Switches
2. Receptacles

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. SHOP DRAWINGS:

1. Submit manufacturer's data on all electrical wiring devices.
2. Where occupancy sensors are required, provide scaled drawing showing manufacturer’s recommended locations.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA standards Pub No. WD 1. nylon construction, 20 amp rating minimum.

B. Provide wiring devices in colors selected by Architect/Engineer. Provide red receptacle outlets and toggle switches where devices are circuited to emergency power. Provide orange receptacle outlets where devices are circuited to UPS power.

2.2 TOGGLE SWITCHES:

A. Provide toggle switches from one of the following manufacturers (Fed-Spec):

Manufacturer	1-Pole	3-Way	4-Way	W/Pilot
Hubbell	HBL1221	1223	1224	1221-PL

Pass & Seymour	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	1221	1222	1223	1221-PLR
Cooper	2221	2223	2224	2221-PL
Bryant	4901	4903	4904	4901-PL

B. Abbreviations are defined as follows:

1. 1-Pole - Single-Pole Toggle Switch
2. 3-Way - Three-Way Toggle Switch
3. 4-Way - Four-Way Toggle Switch
4. W/Pilo - Single-Pole Toggle Switch with Pilot Light

C. Must be back and side wired, and have color-coded covers, Brass terminal screws, back wire ground clamp, and self-grounding clip.

2.3 RECEPTACLES:

A. Provide duplex receptacles from one of the following manufacturers:

Manufacturer	CO	GFCI	IG
Hubbell	5362	GF5362	5362IG
Pass & Seymour	5362	2091-S	IG6300
Leviton	5362	8899	5362-IG
Cooper	5362	VGF20	IG5362
Bryant	5362	GFR53FT	5362IG

B. Abbreviations are defined as follows:

1. CO- Convenience Outlet Duplex Receptacle
2. GFCI- Ground Fault Circuit Interrupter duplex Receptacle
3. IG- Isolated Ground Duplex Receptacle

C. Must have one-piece Brass back strap and back wire grounding clamp (Does not apply to GCFI or isolated ground).

2.4 COVERPLATES:

A. Wall Plates: Provide coverplates for all wiring devices. In all finished areas, provide nylon or high impact resistant thermoplastic coverplates in colors as selected by Architect. Provide pre-marked coverplates for special purpose outlet indicating voltage, amperages, and phase. Provide raised stamped, galvanized, steel plates in all unfinished areas. Provide weather-proof coverplates for outlets exposed to weather and moisture.

B. Weather-Protecting Device Enclosure: Where required for compliance with NEC 410-67 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted into the wring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

1. Intermatic WP1020 or WP1030
2. Hubbell WP826MP
3. Pass & Seymore

PART 3 – EXECUTION

3.1 GENERAL:

A. Install wiring devices and accessories in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to insure that products fulfill requirements.

3.2 METHODS:

A. Install wiring devices only in electrical boxes which are clean and free from excess building materials, dirt, and debris. Do not install wiring devices until painting work is completed.

B. Replace receptacles and/or coverplates which are damaged, stained, or burned.

3.3 GFCI RECEPTACLES:

A. Provide separate neutral conductor from panel to each GFCI receptacle circuits.

B. Install GFCI receptacles for all receptacles installed in restrooms, outdoors, or within six feet of any sink. All receptacles in kitchens shall be GCFI protected.

C. Do not wire standard receptacles on the load side of GFCI receptacle - Install GFCI receptacles.

3.4 GROUNDING:

A. Provide electrical continuous, tight, grounding connections for wiring devices.

3.5 TESTING:

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

3.6 IDENTIFICATION:

A. All devices shall be identified on the coverplate with panelboard name and circuit number.

B. In each outlet, tag each wire to identify the circuit it serves.

C. Identification labels shall be as follows:

Normal Power	Black with White letters

END OF SECTION 260140

SECTION 260452 – GROUNDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to grounding.

1.2 DESCRIPTION OF WORK:

A. Extent of grounding work is indicated by drawings and schedules and is specified herein.

B. Ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, equipment, and separately derived systems in accordance with the NEC and all other applicable codes to provide a permanent, continuous, low impedance, grounding system.

C. Provide grounding system such that the resistance from the service entrance ground bus, through the grounding electrode to earth is not greater than 5 ohms.

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.

B. TESTING: Submit results of ground resistance testing as specified in this section. Include name of testing agency with report. Include test results in operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide grounding equipment and accessories of types, sizes, ratings, and electrical characteristics indicated or as otherwise required to provide a complete system.

2.2 GROUNDING CONDUCTORS:

A. Unless noted otherwise, provide grounding conductors with stranding and insulation types to match phase conductors. Provide conductors with green insulation if possible; otherwise wrap with green tape. Size ground conductors as indicated on drawings. Do not size ground conductors smaller than that allowable by NEC.

2.3 GROUND RODS:

A. Provide copper clad, steel, 3/4" diameter by 10' long, ground rods (Weaver, Cadweld, or equivalent).

2.4 TEST WELLS:

A. Provide precast concrete box 9-1/2" W. x 16" L. x 18" D. with light duty concrete cover for non-traffic areas or rated steel plate for traffic areas. Provide covers with lifting holes. Engrave cover with "Ground Rod".

2.5 CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND):

A. Provide a bare copper conductor encased along the bottom of concrete foundation or footing that is in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. Size UFER ground conductor in accordance with the NEC. Extend conductor through a horizontal length of 30' minimum and encase with not less than 2 nor more than 5 inches of concrete separating it from surrounding soils.

2.6 INSULATED GROUNDING BUSHINGS:

A. Provide plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners (OZ Gedney BLG or equivalent).

2.7 CONNECTION TO PIPES:

A. Provide heavy duty, cast bronze, ground clamp systems with silicon bronze bolts and nuts (OZ Gedney G Series - B or equivalent).

2.8 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES:

A. Provide exothermic welds. (Cadweld or equivalent)

2.9 BONDING JUMPERS:

A. Provide bonding jumpers with hot dip galvanized malleable or ductile iron clamps, hot dip galvanized steel U-bolts, and tinned copper braids (OZ Gedney BJ Series or equivalent).

2.10 GROUND BUS:

A. Provide 1/4" x 4", copper ground bus complete with insulators and brackets in lengths and at mounting heights as indicated on drawings. Furnish complete with drilled holes and lugs to accommodate grounding conductors.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install grounding systems in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CLEANING:

A. Thoroughly clean all metal contact surfaces prior to installation of clamp-on connectors.

3.3 SEPARATELY DERIVED SYSTEMS:

A. Ground each separately derived system in accordance with NEC Section 250-16 unless otherwise indicated on drawings.

3.4 SERVICE ENTRANCE GROUNDING:

A. Connect the following items using NEC sized copper grounding conductors (in NEC sized, conduits if concealment is required) to lugs on the service ground bus:

1. Conductor from the UFER ground.
2. Conductor from two ground rods driven exterior to building at not less than 10' apart.
3. Conductor from main incoming cold water piping system.
4. Conductor from building structural steel.
5. Conductor from separately derived systems.
6. Conductor from insulated ground bushings on service entrance conduits.
7. Additional ground rods as required to achieve resistance value specified.
8. Additional items indicated on drawings.

3.5 EQUIPMENT BONDING AND GROUNDING:

A. Provide an NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:

1. Non-metallic conduits and ducts.
2. Distribution feeders.
3. Motor and equipment branch circuits.
4. Device and lighting branch circuits.
5. Full length of all multi-outlet assemblies and other surface wireways.

3.6 ADDITIONAL GROUNDING INSTALLATION REQUIREMENTS:

A. Provide grounding bushings on all service conduit and conduits installed in concentric/eccentric knock-outs or reducing washer at panelboards, cabinets, and gutters.

B. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system. Connection to water piping system shall be made electrically continuous by connecting to the street side of the water main valve and/or installing additional bonding jumpers across the meter, valves or service unions that might be disconnected.

C. Provide bonding wire in all flexible conduits.

D. Isolated Ground Circuits: Circuits used for isolated ground outlets shall be run in separate raceways or shall have a separate green insulated ground conductor installed and tagged for identification at all outlet and junction boxes.

3.7 TEST WELLS:

A. All ground rods shall be driven external to building and shall be located in ground well boxes. Locate in landscaped areas where possible.

3.8 TESTING:

A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified under this Section.

Use independent testing agency for all testing.

END OF SECTION 260452

SECTION 260551 – EXTERIOR AREA LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to exterior area lighting.

1.2 DESCRIPTION OF WORK:

A. Extent of exterior area lighting work is indicated by drawings and schedules and is specified herein.

1.3 QUALITY ASSURANCE:

A. STANDARDS: Refer to Section 260001 - Electrical General Provisions and other sections as applicable.

B. SHOP DRAWINGS: Submit manufacturer's data on exterior area lighting items including but not necessarily limited to poles, brackets, light fixtures, fuse, fuseblocks, etc. Submit dimensioned drawings of all pole and lighting fixtures. Include information with interior and exterior building lighting fixtures.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide exterior lighting fixtures of types as indicated on drawings or as approved by addenda.

2.2 LIGHT FIXTURES:

A. Refer to Section 260510 - Interior and Exterior Building Lighting for requirements for exterior light fixtures, lamps, ballasts, etc.

2.3 POLES:

A. Provide poles and all accessories including but not necessarily limited to anchor bolts, templates for anchor bolt pattern, brackets, bolts, etc. Provide handhole and cover at base of each pole. Provide poles which have been primed and painted at the factory. Provide poles, anchor bolts, etc. in sizes as recommended by manufacturer to withstand windloadings.

2.4 CONCRETE BASES:

A. Provide 3000 psi class concrete, forms, steel reinforcement, tie wires, etc. as required. See drawings for details.

2.5 GROUND RODS:

A. See Section 260452 – Grounding for ground rod requirements.

2.6 FUSEHOLDER, FUSES, AND BREAK-A-WAY RECEPTACLES:

A. Provide fuseholders with break-a-way receptacles equivalent to Bussmann Tron Waterproof Fuseholders and Break-A-Way Receptacles in the base for all phase conductors and materials. Neutral fuse holder will use a shorting fuse insert. Provide Bussmann KTK-R fuses in ratings to suit respective applications and sized in accordance with all manufacturer's recommendations.

PART 3 – EXECUTION

3.1 GENERAL:

A. Install exterior area lighting in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 INSTALLATION METHODS:

A. Set all poles plumb. Use belt slings or ropes to raise and set poles to protect finish. Repair nicks and scratches to match original surface.

B. Locate fuseholder at handhole. Provide fuse blanks in all neutral conductors.

C. Grounding: Provide one ground rod for each light pole. Connect ground rod to pole by means of an NEC-sized grounding conductor and all additional grounding as required.

3.3 CONCRETE BASES:

A. Provide concrete bases for light poles in accordance with details on drawings. Grout and hand-rub all concrete to a uniform smooth finish.

3.4 SPARE PARTS:

A. FUSES: Provide three spare fuses for each type and size used.

3.5 WIRING METHODS:

A. No common neutral multi-wire circuits will be used to feed area lighting. Provide dedicated neutral wire for each circuit indicated.

END OF SECTION 260551

DIVISION 31 – Earth Work

TABLE OF CONTENTS

SECTION 312000 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. Provide all equipment and materials, and do all work necessary to complete the earthwork which includes, but is not necessarily limited to the following:

1. Unclassified excavation.
2. Common trench excavation for piping and structures.
3. Rock excavation.
4. Fill materials, fill and compaction.
5. Trench backfill.
6. Drainage and dewatering as necessary to perform work in the dry.
7. Rough grading.
8. Removal of surplus or unsuitable excavated materials.
9. Dust control.
10. Preparation of subgrade for slabs, pavements, and landscaping.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 312500 - Erosion and Sediment Control

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Associated General Contractors of America, Inc. (AGC): Manual of Accident Prevention in Construction
2. American Society for Testing and Materials (ASTM):
   a. C 33 Concrete Aggregates
   b. C 136 Sieve Analysis of Fine and Coarse Aggregates
   c. D 422 Particle-Size Analysis of Soils
   d. D 448 Classifications for Sizes of Aggregate for Road and Bridge Construction
   e. D 698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)
   f. D 1556 Density of Soil In-Place by the Sand Cone Method
   g. Compaction Standard: Modified Proctor Density ASTM D1557
   h. D 2167 Density and Unit Weight of Soil In-Place by the Rubber Balloon Method

i. D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)
j. D 2922 Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)
k. D 2937 Density of Soil In-Place by the Drive-Cylinder Method
l. D 2940 Specification for Graded Aggregate Material For bases or Sub-bases for Highways or Airports
m. D 3017 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
n. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
o. D 4491 Test Methods for Water Permeability of Geotextiles by Permittivity
p. D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
q. D 4751 Test Method for Determining the Apparent Opening Size of a Geotextile
r. D 4759 Practice for Determining the Specification Conformance of Geosynthetics

3. American Association of State Highway and Transportation Officials (AASHTO)
4. American Public Works Association (APWA) Manual of Standard Specifications and Standard Plans, 2007 Edition.

1.5 SUBMITTALS

A. Soil Samples: A 70 lb. (31.85 kg) sample of each off-site material proposed for use, and of any on-site material when so requested by the Owner's Authorized Representative or testing laboratory, shall be submitted for approval.

1. Samples shall be delivered to the office of the Landscape Architect or testing laboratory, as directed.
2. Samples required in connection with compaction tests will be taken by and transported to the testing laboratory by the Contractor.

B. Product Data: Submit product data for the following:

1. Filter fabric.

C. Material Samples: Submit samples of the following:

1. 12 in. x 12 in. sample of filter fabric.

D. Test Reports: In addition to test reports required under the Paragraph, Quality Control Testing Requirements of Part 1, submit the following:

1. Mechanical gradation (sieve analysis) of each soil material proposed for fill and backfill from on-site materials and off-site borrow sources. Mechanical gradation shall be performed on off-site sources of fill and backfill materials using the same sieves as the materials specified. Mechanical gradation shall be performed on on-site fill and backfill materials using the same sieves or testing procedures as would be required for off-site borrow materials for which the on-site materials are proposed to replace.
2. One optimum moisture-maximum density curve for each soil material.

1.6 QUALITY CONTROL TESTING REQUIREMENTS

The Owner will provide Quality Control Testing through an independent testing agency and shall conform to the following:

A. Field in-place density tests shall be performed according to ASTM D 6938, ASTM D 1556, ASTM D 2167, or ASTM D 2937, as applicable. Testing laboratory shall submit test results directly to the Owner's Authorized Representative for review and acceptance.

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 10,000 sq. ft. or less of paved area, but in no case fewer than three tests as directed by the Owner's Authorized Representative.
2. Fills and Embankments: For each 500 cubic yards or fraction thereof per shift, perform at least one field in-place density test as directed by the Owner's Authorized Representative.

B. When subgrade, fills or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

C. Testing of soils shall be in accordance with the following:

Property	ASTM Test Method
Particle - Size Analysis	D 422
Liquid Limit	D 4318
Plasticity Index	D 4318

D. The Owner reserves the right to modify or waive testing laboratory services.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

B. Comply with applicable requirements of NFPA 495.

C. Pre-installation Conference: Before commencing earthwork, meet with representatives of the governing authorities, Owner, Landscape Architect, consultants, geotechnical engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least three working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

D. Compliance: Comply with local safety regulations and with provisions of "Accident Prevention in Construction" published by the Associated General Contractors of America, Inc.

1.8 EXAMINATION OF EXISTING CONDITIONS

A. The Contractor shall become thoroughly familiar with the existing conditions of the site, consult records and drawings of adjacent structures and of existing utilities and their connections, and note all conditions which may influence the work of this Section.

1. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Owner's Authorized Representative and then only after acceptable temporary utility services have been provided.
2. Provide a minimum 48-hours' notice to the Owner's Authorized Representative and receive written notice to proceed before interrupting any utility.

B. The Contractor may, at his own expense, conduct additional subsurface testing as required for his own information.

1.9 INFORMATION NOT GUARANTEED

A. Information on the Drawings and in the Specifications relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period, as no additional compensation will be made for errors and inaccuracies that may be found therein.

1.10 PERMITS, CODES, AND SAFETY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of the City or County or State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.

B. Comply with the provisions of the Manual for Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.

C. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Drawings.

D. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction. The Contractor shall so conduct his operations as to interfere as little as possible with the use ordinarily made of roads, driveways, or other facilities near enough to the work to be affected thereby.

E. The Contractor shall secure a Blue Stakes permit number for the project to certify notification of gas, electrical and telephone utilities. All other affected utilities shall be contacted by the Contractor, who shall secure notification. Contractor shall not commence work until Blue Stakes has responded. The work shall then be performed in such a manner, and with reasonable precaution taken to avoid damage to utilities under the surface in said areas of the work.

1.11 LAYOUT AND GRADES

A. Benchmarks: The Contractor shall establish, maintain and/or reestablish benchmarks and survey monuments necessary for the work of these Contract Documents and as shown on the Drawings or found to exist on the site to provide a base reference for the construction. Replace any which may become destroyed or disturbed. The Contractor shall employ and pay all costs for a registered Civil Engineer or Surveyor who is licensed within the jurisdiction of the project site to lay out all lines and grades in accordance with the Drawings and Specifications, and as necessary or required for the construction. The selection of the registered Civil Engineer or Surveyor shall be subject to the Owner’s Authorized Representative's approval.

B. All site layout and grade staking shall be performed using total-station survey methods or equivalent optical equipment providing the same accuracy. GPS or GNSS layout methods shall not be used for fine grading or placement of hardscape elements.

C. The Contractor shall be responsible for verifying the location and elevation of all control points and benchmarks provided. Any discrepancies shall be reported immediately to the Owner’s Authorized Representative prior to proceeding with layout or construction. The City shall not be

responsible for re-establishing property boundaries or control points disturbed during construction.

1.12 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Observe all rules and regulations governing the respective utilities in executing work under this Section. The work shall be executed in such manner as to prevent any damage to adjacent property and any other property and existing improvements such as, but not limited to: streets, curbs, paving, utility lines and structures, monuments, bench marks and other public and private property. Protect existing structures and foundations from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at his own expense, make good such damage or injury to the satisfaction of, and without cost to the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to their original condition at the completion of operations. The Contractor shall replace, at his own cost, existing bench marks, monuments, and other reference points which are disturbed or destroyed.

C. Buried structures, utility lines, etc., including those which project less than 18 in. above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of Project.

D. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain during operations. Do not interrupt existing utilities except when authorized in writing by authorities having jurisdiction.

E. When an active utility line is exposed during construction, its location and elevation shall be plotted on the Record Drawing by the Contractor and both the Owner’s Authorized Representative and the Utility Owner shall be notified in writing.

F. Provide barricades, fences, lights, signs, and all other safety devices required for the protection of the public.

1.13 DEFINITIONS

A. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

B. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

C. Embankment: Any area on the site where the Contractor is required to raise grades to proposed subgrade elevations. Embankments are placed in layers to a predetermined elevation and cross section.

D. Excavation: The removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

E. Finish Grade: Final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slope between points for which finished grades are indicated or between such points and existing established grades. Spot elevations shall govern over proposed contours. No

ponding of surfaces shall be allowed due to lack of improper pitches across surfaces that will not allow proper drainage to occur.

F. Rock: A sound and solid mass, layer, or ledge of mineral matter in place of such hardness and texture that it:

1. Mechanical Definition of Rock: Cannot be effectively loosened or broken down by ripping in a single pass with a late model tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design adequately sized for use with and propelled by a crawler type tractor rated between 210- and 240-net flywheel horsepower, operating in low gear, or
2. Manual Definition of Rock: In areas where the use of the ripper described above is impracticable, rock defined as sound material of such hardness and texture that it cannot be loosened or broken by a 6 lb. (2.7 kg) drifting pick. The drifting pick shall have a handle not less than 34 in. (0.86 m) in length.

G. Base Course: The layer placed between the subgrade and surface pavement in a paving system.

H. Rough grade: The top surface of subbase or base courses such as gravel, crushed stone, ordinary fill, etc., ready to receive the final surface material application. Unless stated otherwise, all rough grades shall represent compacted material depths, as specified herein.

I. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical action of *in situ* rock or the deposition of unconsolidated material in which more than 35 percent by weight will pass a No. 200 sieve.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

K. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

L. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below road base, drainage fill, or topsoil materials.

M. Topsoil: The upper layer of the soil profile which is supporting the growth of vegetation as evidenced by the existence therein of numerous roots and other organic matter.

N. Unauthorized excavation: Removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner’s Authorized Representative. Unauthorized excavation, as well as remedial work directed by the Owner’s Authorized Representative, shall be at the Contractor's expense.

O. Unsuitable Material: Material which is classified as "unsuitable" shall be material having at least one of the following properties:

1. Material with a maximum unit dry weight per cubic foot less than 90 lb. (40.9 kg) as determined by ASTM D 1557.
2. Material containing visible organic matter, topsoil, organic silt, peat, construction debris, roots, and stumps.
3. Material which has a Liquid Limit greater than 55 when tested in accordance with ASTM D 4318.
4. Material designated in the field by the Owner’s Authorized Representative or the testing laboratory.

P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

Q. Utility Trench Backfill: The area bounded by the proposed finished subgrade and the cover material over the respective pipe or conduit. This material shall conform with applicable requirements for embankment or structural backfill depending on the area or zone into which the utility is installed.

1.14 COORDINATION

A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Owner's Authorized Representative for the purpose of establishing Contractor's schedule of operations and scheduling inspection procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Owner's Authorized Representative prior to start of earthwork operations requiring inspection and/or testing.

C. In the event that the Contractor does not notify the Owner's Authorized Representative prior to the start of earthwork operations and inspections and tests are not made or performed by the Owner's testing agents, the Owner's Authorized Representative may require the Contractor to remove all earthwork performed without the necessary inspections and replaced under the required supervision, review, inspections or tests at no additional cost to the Owner.

D. The Contractor shall be responsible for obtaining test samples of soil materials proposed to be used and transporting them to the site sufficiently in advance of time planned for use of these materials for testing of materials to be completed. Use of these proposed materials by the Contractor prior to testing and approval or rejection, shall be at the Contractor's risk.

1.15 RECORD DRAWINGS

A. The Contractor shall submit to the Owner a set of as-built drawings for work covered under these Specifications. The drawings shall be prepared upon reproducible copies of the Contract Documents supplied by the Owner. As-built drawings shall record all changes made during construction with respect to materials, layout, grading contours and spot elevations, all as compared to the original Contract Drawings.

1.16 WARRANTY

A. Fill and Backfill: Correct settlement in backfill, fill, and in structures built over backfill or fill, which may occur within one year correction period. Restore structures damaged by settlement to original condition at no additional cost to the owner.

PART 2 PRODUCTS

2.0 GEOTECHNICAL REPORT

A. **If a Geotechnical Report has been provided for the site(s), it will be included in the Appendix to these Technical Specifications. The Geotechnical Report provides specific recommendations related to the earthwork for the site. The recommendations from the Geotechnical Report shall supersede any requirements outlined in this specification. Any work that is not covered or addressed by the Geotechnical Report shall conform to this specification. If any conflicts or discrepancies arise, the more stringent of the two shall apply.**

2.1 SOURCE OF MATERIALS

A. Material shall be obtained from required on-site excavation, to the extent that suitable material is available, and from off-site sources, to the extent that suitable material is not available from on-site excavation.

2.2 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. Gradation requirements shall be determined by AASHTO T11 and T27.

1. Borrow material that shall come from on-site or off-site sources shall contain salt levels less than 1.0 milliohms/com as measured by electrical conductivity (EC2) of a 1:2 soil-water suspension (Test minus sieve #4 material).

B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 in. (50 mm) in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.

D. Backfill and Fill Materials: Satisfactory soil materials as described above. On-site material for use in compacted backfill shall be natural, inorganic, granular soil, taken from areas of excavation after stripping of topsoil and removal of unsatisfactory soil materials as described above.

E. Use only backfill materials meeting the requirements of satisfactory soil materials that are free from rocks greater than 4 in. (200 mm) in diameter or length, that have largest dimension no greater than 3/4 lift thickness, or are no greater than 1/2 ft.3 in volume. Do not use any foreign matter, such as construction debris, trash, wood, roots, leaves, sod, organic matter, or soft clay and silt. Sound pieces of building stone, masonry, and concrete from on-site sources subject to the same size limitations as stone, may be employed in backfill. Individual pieces shall be mixed into general backfill material, leaving no voids between pieces. Backfill shall be clean, non-organic material, of non-swelling character, capable of being readily compacted to form a solid, stable embankment. Materials containing ice or frozen lumps shall not be employed.

F. All soil material shall conform to the Geotechnical Report, if provided.

2.3 FILL AND BACKFILL MATERIAL

A. Uses of Fill Materials: Fill materials listed above or as specified in APWA Section 321123 Crushed Aggregate Base and shall be utilized as follows and as otherwise indicated on the Drawings, specified or directed.

1. TYPE A:

Type A material may be used under concrete sidewalks, with a maximum uncompressed layer depth of 6” and a minimum relative compaction of 95%. Type A material shall be a clean gravel-sand mixture free from organic matter and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing

1-inch	100
3/4-inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-10

2. TYPE B:

Type B material may be used for bedding pipe, initial and subsequent pipeline backfill, with a maximum uncompressed layer depth of 8" and a minimum relative compaction of 95%. Type B material shall be a select granular material free from organic matter and of such size and gradation that the specified compaction can be readily attained. Material shall have a sand equivalent value of not less than 30 and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3/8-inch	100
No. 4	90-100
No. 50	10-40
No. 100	3-15
No. 200	0-7

3. TYPE C:

Type C material may be used as site fill, embankments, dikes, initial and subsequent pipeline backfill, with a maximum uncompressed layer depth of 8" and a minimum relative compaction of 95%. Type C material shall be unclassified material and may be obtained from excavation on site. The material shall be free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous materials. The maximum size of stone shall not exceed 6 inches.

4. TYPE D:

Type D material may be used as fill under slabs and structures, with a maximum uncompressed layer depth of 8" and a minimum relative compaction of 95%. Type D material shall be crushed rock commonly known as drain rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2-inch	100
3/4-inch	30-75
1/2-inch	15-55
1/4-inch	0-5
No. 200	0-2

Type D material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

5. TYPE E:

Type E material may be used as structural fill, fill under concrete sidewalks, with a maximum uncompressed layer depth of 12" and a minimum relative compaction of 95%. Type E material shall be crushed rock and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
1-1/2-inch	100
3/4-inch	81-91
1/2-inch	67-77
No. 4	43-53
No. 16	23-29
No. 200	6-10

Type E material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

B. Fill material shall be placed in horizontal layers and compacted with power operated tampers, rollers, idlers, or vibratory equipment. Unless otherwise specified, fill classes shall be used where specified as noted above under general application. Compaction of layers shall be accomplished in two passes of equipment with complete coverage across the width of the field.

2.4 CLASSIFICATION OF FILL

A. Fill material shall be placed in horizontal layers and compacted with power operated tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in Table A. Unless otherwise specified, fill classes shall be used where specified in Table A under general application.

Table A, Fill Classifications

Material Type	Maximum Uncompressed Layer Depth, Inches	Minimum Relative Compaction, Percent	General Application
A	6	95	Under concrete sidewalks
B	8	95	Bedding for pipe, initial and subsequent pipeline backfill
C	8	95	Site fill, embankments, dikes, initial and subsequent pipeline backfill.
D	8	95	Fill under slabs and structures
E	12	95	Structural fill, fill under concrete walkways

Compaction of layers shall be accomplished in two passes of equipment with complete coverage across the width of the field.

2.5 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 in. (760 mm) deep.

1. Tape Colors: Provide tape colors to utilities as follows:
   a. Red: Electric.
   b. Yellow: Gas, oil, steam, and dangerous materials.
   c. Orange: Telephone and other communications.
   d. Blue: Water systems.
   e. Green: Sewer systems.

C. Filter Fabric: Manufacturer's standard non-woven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.

1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:
   a. Grab Tensile Strength (ASTM D 4632): 100 lb.
   b. Apparent Opening Size (ASTM D 4751): No. 100 U.S. Standard sieve.
   c. Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Visit: Visit and inspect site; take into consideration known and reasonably inferable conditions affecting work. Failure to visit site will not relieve Contractor of furnishing materials and performing work required.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrade and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with the provisions of Section 312500, Erosion and Sedimentation Control.

3.2 GRADES AND ELEVATIONS

A. The Drawings indicate, in general, alignments, grade elevations and invert elevations. Establish the lines and grades in conformity with the Drawings. The Landscape Architect, however, may make such adjustments in the field in grades and alignments as are found necessary in order to avoid interference with any special conditions encountered.

B. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slopes between points for which finished grades are indicated or between such points and existing established grades.

C. Establish and maintain suitable stakes over all areas to be graded as directed, specified or required, and/or noted on the drawings. Maintain sufficient reference points at all times during construction to properly perform the contract installation

3.3 UNCLASSIFIED EXCAVATION

A. The work of excavation shall be conducted at such locations, at such rates of progress and in such a manner as will ensure the continued progress of the work, with a minimum inconvenience to the general public.

B. All material encountered during excavation shall be unclassified excavation and shall include the removal of boulders up to 3 cubic yards, earth, rock, concrete, covered pavements, abandoned utilities, abandoned foundations and all material encountered as required for excavation. Boulders and rock over 3 cubic yards shall be covered under "Rock Excavation" in this Section. The sequence of all excavation operations shall be such as to ensure the most efficient reuse of acceptable excavated borrow materials for particular improvement application. Acceptable materials shall be used or stockpiled for later use in backfill and subgrade preparation.

C. Excavate all materials to the elevations, dimensions and form as shown on the Drawings and as specified for the construction of drainage structures, utilities, lawn and site improvements necessary for the completion of the utilities and site work. Excavate to elevations indicated or required within a tolerance of plus or minus 0.10 foot and as will allow footings to rest on firm, undisturbed earth or rock, free of loose materials, and as will permit rough grades to be at indicated or specified depths. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

D. Trench Excavation: If the Contractor encounters unsuitable soils materials at the specified depths during trench excavation, he shall contact the Owner’s Authorized Representative and request instructions from the Geotechnical Engineer before proceeding further.

1. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
   a. Clearance: 12 inches each side of pipe or conduit, unless otherwise noted or specified.

2. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
   a. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
c. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

E. Hand Excavation: In general, machine excavation will be permitted with the exception of work in the vicinity of trees to remain, existing utilities and excavation of pipe bells which will be hand work. Excavate to 6 inches below the bottom of pipe or as shown on Drawings. Excavation to final grade shall be made in such a manner as to maintain the undisturbed bearing character of the soil exposed at the excavation level.

F. Inspection: After completion of the excavation and prior to commencement of foundation footings, pavements and concrete slab construction, the excavation will be inspected by the Owner's Representative to ensure that foundation elevations have been reached.

G. Stockpiling: No excavation shall be deposited or stockpiled at any time so as to endanger portions of the new construction or layout, either by direct pressure or indirectly by overloading banks contiguous to the operation. Stockpile soil materials away from edge of excavations. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling, and for moving the material back and forth from the storage area, at no additional cost to the Owner. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

H. Compliance: Comply with local safety regulations and with provisions of "Accident Prevention in Construction," published by the Associated General Contractors of America, Inc.

3.4 ROCK EXCAVATION

A. Rock excavation includes removal and disposal of rock material and obstructions encountered that cannot be removed by the following heavy-duty rock excavating equipment without systematic drilling, blasting, or ripping.

1. Rock excavating equipment for footings, trenches, and pits shall be equivalent to Caterpillar Model No. 215D LC track-mounted hydraulic excavator, equipped with a 42-inch-wide short-tip radius rock bucket, rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 pounds and stick-crowd force of not less than 18,700 pounds measured according to SAE Standard J1179.
2. Rock-excavating equipment for open excavations shall be equivalent to Caterpillar Model No. 973, heavy-duty, track-mounted loader, rated at not less than 210-hp flywheel power and developing minimum of 45,000-lb breakout force, measured according to SAE Standard J732c-69.
   a. Excavations more than 10 feet in width and pits more than 30 feet in either length or width are defined as open excavations.

B. Measurements:

1. When, during the process of excavation, rock or boulders larger than 3 cubic yards in volume and rock in beds, ledges, unstratified masses, and conglomerate deposits is encountered, such material shall be uncovered and exposed, and Owner’s Authorized Representative shall be notified by the Contractor, before proceeding further. The areas in question shall be cross-sectioned as specified in this Section. * (To the best of the Landscape Architect's knowledge there should be no rock encountered.) * Rock excavation and removal of rock or boulders over 3cubic yards in size shall be paid for as a Unit Price under Part 1 of this Section.

2. Failure on the part of the Contractor to uncover such material and to notify the Owner's Authorized Representative, and proceeding by the Contractor with the excavation before cross-sections are taken, will forfeit the Contractor's right to any credits.
3. The Contractor shall employ and pay for an approved registered Civil Engineer or Land Surveyor to take cross-sections of rock before removal and to make computations of rock quantities. Cross-sections shall be taken in the presence of the Testing Laboratory. The Owner has the option to perform independent cross-sections and computations of rock quantities.
4. Where removal of boulder or ledge is required outside the established payment lines, the extent of this removal and basis of payments shall be determined by the Owner's Authorized Representative.

3.5 CONTAMINATED MATERIAL

A. If, during the course of excavation or other performance of the Work, materials on the project are encountered which may be contaminated or hazardous, stop work immediately and notify the Owner within one hour of the discovery. Follow up telephone conversation with written correspondence hand delivered within 24 hours of discovery.

3.6 FILLING, BACKFILLING AND COMPACTION

A. Placing Fills and Compacting:

1. Preparation: All areas to be filled or backfilled shall be free of vegetation, topsoil, wet materials, unsatisfactory soil materials, obstructions, deleterious materials, construction debris, refuse, compressible or decayable materials and standing water from ground surface prior to placing fills. Do not place fill when fill materials or material below it are frozen. No fill materials containing ice or frozen lumps shall be used.
   a. Plow, furrow, till or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
   b. Distribute material to avoid formation of lenses or layers of material differing substantially from surrounding work.
2. Remove all concrete formwork, temporary shoring, bracing, and sheeting prior to inspection by the Owner.
3. The Contractor shall notify the Owner when excavation is ready for formal inspection. Filling and backfilling shall not be started until conditions have been approved by the Owner's Authorized Representative.
4. At the completion of excavation and before placing any fills, proof-roll compact subgrades to the same compaction levels required for placed fills as required hereinafter
   a. Notify Owner's Authorized Representative when excavations have reached required subgrade.
   b. When test results determine that unforeseen unsatisfactory soil is present, stop excavation work immediately and contact the Owner's Authorized Representative to determine whether or not to continue excavation and replace the unsatisfactory soil with compacted backfill or fill material as directed by the Owner's Authorized Representative.
5. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in work.
6. Reconstruct subgrade damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner's Authorized Representative.
7. Subgrade compaction shall be tested by the testing laboratory before proceeding further.
8. All fill is to be placed "in-the-dry", to which end dewatering may be required. Spreading and drying of each layer may also be required. Dewatering, as necessary, shall be a part of the work of this Section and shall be done at no additional cost to the Owner.

9. Conversely, if the testing laboratory determines that the fill is too dry for proper compaction, water shall be added, as necessary, to provide the specified optimum moisture content for proper compaction.
10. Compaction of each lift shall be as specified herein and as determined by ASTM Test, Designation D6938. Fill shall be placed in successive horizontal lifts no thicker than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Compact fill to the required density as specified in this Section. Maximum dry density shall be determined in accordance with ASTM D1557, Method D. The following percentages of maximum dry densities shall be achieved for fill materials or prepared subgrades.
11. Under structures, footings, paved surfaces, drainage piping, utilities and other improvements:
    a. All fills - 95%
    b. Top twelve inches of subgrades in cut - 95%
    c. Fills within lawn and planting areas to within eighteen inches of finished subgrade – 85%
    d. Fills within lawn and planting areas in top eighteen inches of finished grade – 85%
12. Place and compact backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
13. In the case of lawn and planting areas, compaction requirements for subgrades and fills shall be considered minimums and maximums within the density percentages called for, and any over-compaction of subgrades or fills which would be detrimental to lawn or planting objectives shall be corrected by loosening subgrades or fills through tilling or other means and re-compacting to specified compaction limits.
14. The Contractor shall notify the Owner's Authorized Representative 3 days in advance when the rough grades are established and ready for formal inspection. No loam shall be placed on rough grades before inspection by the Owner's Authorized Representative.

3.7 BACKFILLING OF TRENCHES AND STRUCTURES

A. All requirements for description, placement, compaction and spreading of fill materials as specified in this Section shall be applicable to backfilling operations for trenches and structures. If the Contractor encounters unsuitable soils materials at the specified depths during trench excavation, he shall contact the Owner's Authorized Representative and request instructions before proceeding further.

B. Backfill materials as specified in this Section shall be used as bedding and backfill around drainage pipes, around structures and for other uses as shown on the Drawings.

C. Approvals Prior to Backfilling: Do not commence backfilling operations for trenches and structures until all piping, etc., has been installed, tested and approved, and the locations of all pipe and appurtenances have been recorded.

D. Placement in Trenches: Bedding materials as specified shall be placed to the full width of the trench as indicated on the Drawings. Place and compact bedding course on rock and other unyielding bearing surfaces. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. After a pipe is bedded, the trench shall be filled to the centerline of the pipe with additional bedding material as specified except at the joint. After the joint is inspected, that portion shall be filled in. Material under and around the pipe shall be carefully and thoroughly compacted to the densities specified in this Section.

E. From the centerline of the pipe to a point 12 inches above the top of the pipe place additional bedding material as backfill by hand and compact with mechanical tampers to not less than 95% of maximum density at optimum moisture content of the material. Above this point, backfill

shall be placed by machine or by hand in layers 6 inches deep and compacted to the densities specified in this Section. This backfill shall be extended as shown on the Detail Drawings. Backfill simultaneously on all sides of pipe or structure. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

F. Coordinate backfilling with utilities testing.

G. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

H. Place and compact final backfill of satisfactory soil material to final subgrade.

I. Compaction requirements: Compact each layer by methods acceptable to Geotechnical Engineer with +/- 2 percent of optimum moisture content to minimum of following relative Proctor densities as determined by ASTM D1557.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

K. Once subgrade is compacted the Contractor shall place the geotextile/filter fabric in locations as shown on the Contract Drawings. The fabric shall overlap at seams by 6 inches and shall be laid flat prior to having gravel base material placed over the fabric. Fabric shall be placed in accordance with Manufacturer's instructions and recommendations.

3.8 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.9 ROUGH GRADING

A. Rough grading shall include the shaping, trimming, rolling, and refinishing of all surfaces of the subbase and base courses, shoulders, and earth slopes in preparation for final, finish grading of pavements, loams and site improvements as shown on the Drawings. The rough grading of shoulders and sloped areas may be done by machine methods. All ruts shall be eliminated. Traffic of men and equipment across soil subgrade areas shall be prohibited following excavation to the required lines and grades.

1. Shape subbase and base courses to required crown elevations and cross-slope grades.
2. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
3. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. If, during the progress of the Work, any pipe, drain or other construction is damaged due to operations under this Contract, the Contractor shall repair all damage at no additional cost to the Owner and restore damaged areas to their original conditions.

C. Do all other cutting, filling and grading to the lines and grades indicated on the Drawings. Grade evenly to within the dimensions required for grades shown on Drawings and as specified herein. No stones larger than 3 inches in largest dimension shall be placed in upper 6 inches of the subgrade. Fill shall be left in a compacted state at the end of the workday and sloped to drain.

D. Slope grades to direct water away from buildings and to prevent ponding. Rough grade to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
2. Paved Areas: Plus or minus 0.05 foot.

E. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase course and base course layer.

F. The Contractor shall bring all areas to grades as shown on the Drawings and in the details. The Landscape Architect, however, may make such adjustments in grades and alignments as are found necessary to avoid special conditions encountered.

G. No rubbish of any description shall be allowed to enter fill material. Such material shall be removed from the site.

H. Wherever streets, lawns, or sidewalks or other items contained within or outside the Limit of Contract lines have been excavated in fulfilling the work required under this Contract, the Contractor shall furnish and install all materials necessary to bring finish surfaces level with the existing adjacent surfaces. All work shall be installed to match the existing conditions in accordance with the governing authority. Notify the proper authorities prior to restoring surfaces outside the Contract Limit Lines.

I. Fill materials that become contaminated shall be removed and replaced, as directed by the Owner's Authorized Representative.

J. Contractor shall clean the subgrade of all stones greater than 2 inches and all debris and rubbish.

3.10 REMOVAL OF SURPLUS AND UNSUITABLE MATERIALS

A. Any surplus of excavated suitable fill material or topsoil shall not be removed from the site. Surplus off-site borrow materials not required to complete site construction and unsuitable excavated materials shall, unless directed otherwise by the Owner's Authorized Representative, become the property of the Contractor who shall remove such materials from the site and legally dispose of it at no additional cost to the Owner.

3.11 DRAINAGE, DEWATERING

A. The Contractor shall control the grading in areas under construction on the site so that the surface of the ground will properly slope to prevent accumulation of water in excavated areas and adjacent properties. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrade, and from flooding Project site and surrounding area. The Contractor shall grade and ditch the site as necessary to direct surface runoff away from open excavations and subgrade surfaces. Positive drainage (minimum 1.0 percent slope) shall be maintained at all times.

B. Protect subgrade and foundation soils from softening and damage by rain or water accumulation.

C. Should surface water, rain, or groundwater be encountered during the operations, the Contractor shall furnish and operate pumps or other equipment, and provide all necessary piping to keep all excavation clear of water at all times and shall be responsible for any damage to work or adjacent properties from such water. All piping exposed above surface for this use shall be properly covered to allow foot traffic and vehicles to pass without obstruction.

D. Water from trenches and excavations shall be disposed of in such a manner as will not cause injury to public health nor to public or private property, nor to existing work, nor to the work completed or in progress, nor to the surface of roads, walks, and streets, nor cause any interference with the use of the same by the public. Methods of disposal of pumped effluent shall not cause erosion or siltation. Comply with Section 312500, Erosion and Sediment Control.

E. There shall be sufficient pumping equipment, in good working order, available at all times to remove water.

F. Presence of ground water in soil will not constitute a condition for which an increase in the Contract price may be made.

G. Under no circumstances place fills, pour concrete, or install piping and appurtenances in excavations containing free water.

H. Where, in the opinion of the Owner's Authorized Representative, pumping of excavations is not effective in maintaining a dry, firm subgrade, provide other dewatering methods acceptable to the Owner's Authorized Representative.

3.12 FROST PROTECTION

A. Do not excavate to full indicated depth when freezing temperatures may be expected, unless footings or slabs can be poured immediately after the excavation has been completed. Protect the excavation from frost if placing of concrete is delayed.

B. Completed foundations that have not been backfilled shall be protected from freezing by temporary additional earth cover, insulating blankets, heaters, or other methods acceptable to the Owner's Authorized Representative.

C. Frozen material shall not be placed as fill or backfill.

D. No work shall be installed on frozen ground.

3.13 DUST CONTROL

A. During the construction period, the Contractor shall take special measures including, but not limited to, wetting down to control dust on site, in order to prevent annoyance/and or damage to adjacent property, whether public or private. Calcium chloride or any other chemical material may not be used on subgrades of areas to be seeded or planted.

B. The Contractor shall take all necessary measures to keep streets, over which equipment and service for project travel, clean and free from dirt, dust, mud and debris resulting from construction operations. The actions taken shall meet the requirements of all parties having jurisdiction.

3.14 FINISH GRADING

A. General: Cut and fill are areas to elevations and tolerances specified. Leave graded surface clean, free from rubbish and large clods and reasonably smooth.

B. Contaminated Material: Do not use earth that has been rendered unfit to receive planting due to concrete water, mortar or lime water dumped on it at areas to receive plantings.

C. Subgrade under sidewalk, curb, gutter, and slabs-on-grade: Finish grade to bearing surface. Tolerance: ±0.05 foot.

D. Subgrade under paving: Finish grade to bottom elevation of aggregate base course. Tolerance: ±0.05 foot.

E. Subgrade under sodded areas: Finish grade to elevations allowing for 1-1/2 inches of sod, maintaining top of sod at elevations indicated. Tolerance: ±0.1 foot.

3.15 CLEANUP

A. At the end of all excavation, filling and grading operations and before acceptance of the work, the Contractor shall remove all debris, rubbish, etc., from the site in a legal manner. The premises shall be left clean, presentable, and satisfactory.

END OF SECTION 312000

SECTION 312500 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work of this Section shall consist of providing all labor equipment, materials, incidental work, and construction methods necessary to provide and install erosion and sediment control, and related items as indicated on the Contract Documents and/or specified herein and includes but is not limited to the following:

1. Silt fencing and straw wattle
2. Protection of Drainage Structures
3. Straw Bales
4. Meeting all conditions for erosion control specified in these Specifications.

B. This Section specifies equipment and materials for an erosion and sediment control program for minimizing erosion and siltation during the construction phase of the Project. The erosion and sediment control provisions detailed on the Contract Documents and specified herein are the minimum requirements for an erosion control program. The Contractor shall provide additional erosion and sediment control materials and methods as required to affect the erosion and siltation control principles specified herein and comply with local and state requirements.

1.2 RELATED SECTIONS

A. Division 1 General
B. Specification Section 312000 - Earthwork.

1.3 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Society for Testing and Materials (ASTM):

a. D 3786 Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
b. D 4491 Test Method for Water Permeability of Geotextiles by Permittivity.
c. D 4751 Test Method for Determining the Apparent Opening Size of a Geotextile.
d. D 4833 Test Method for Index Puncture of Geotextiles, Geomembranes, and Related Products.

1.4 SUBMITTALS

A. Proposed methods, materials to be employed, and schedule for effecting erosion and siltation control and preventing erosion damage shall be submitted by the Contractor for approval to the Owner’s Authorized Representative. Submittals shall include:

1. Proposed methods for effecting erosion and siltation control including 1 in. = 50 ft. scale plans indicating location of erosion control devices and siltation basins.
2. List of proposed materials including manufacturer's product data.
3. Schedule of erosion control program indicating specific dates for implementing programs in each major area of work.

1.5 PERMITS, CODES, AND REGULATIONS

A. The Contractor shall comply with all rules, regulations, laws and ordinances of the City, County, State, and all other authorities having jurisdiction over the Project site. The Contractor shall provide all labor, materials, equipment, and services necessary to make the work comply with such requirements without additional cost to the Owner.

B. Comply with the most stringent provisions of all applicable regulations of the State of Utah; the Army Corps of Engineers (ACOE); and the United States Environmental Protection Agency (EPA).

1.6 EROSION CONTROL PRINCIPLES

A. The Contractor shall provide suitable and adequate means of sedimentation and erosion control during construction. Control measures shall prevent all wind and water caused erosion, siltation and sedimentation of stockpiled materials, wetlands, waterways, construction areas, adjacent areas and off-site areas. Work shall be accomplished adjacent to or in the following work areas:

1. Soil stockpiles and on-site storage and staging areas.
2. Cut and fill slopes and other stripped and graded areas.
3. Constructed and existing swales and ditches.
4. Adjacent to wetlands or other protected areas as shown on the Contract Documents.

B. Means of protection as noted on the Contract Documents indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional expense to the Owner.

C. Regular maintenance of all sediment control structures shall be provided to ensure intended purpose is accomplished. Sediment control measures shall be in working condition at the end of each day.

D. After significant rainfall, sediment control structures shall be inspected for integrity. Any and all damaged devices shall be repaired immediately.

E. The following erosion control principles shall apply to the land grading and construction phases:

1. Contractor shall perform the work in a manner that will minimize soil erosion. Erosion control devices shall be installed prior to start of any and all clearing and grubbing operations and excavation work.
2. Contractor shall use temporary seeding, mulching, or other approved stabilization measures to protect exposed areas during prolonged construction or other land disturbance.
3. Contractor shall install drainage provisions that will accommodate increased runoff that results from modifications of soil and surface conditions during and after disturbance. Such provisions shall be in addition to existing requirements and shall be installed at no additional cost to the Owner.

4. Contractor shall retain all sediment on-site.

F. Cut and fill slopes and stockpiled materials shall be protected to prevent wind and water caused erosion. Slopes shall be protected with permanent erosion protection when erosion exposure period is expected to be greater than or equal to one month and temporary erosion protection when erosion exposure period is expected to be less than one month.

1. Erosion protection shall be accomplished by seeding with grass and coverings approved by the Owner's Authorized Representative.
2. Temporary erosion protection shall be accomplished by covering the exposed soil with an erosion protection material, as appropriate for prevailing conditions and as approved by the Owner's Authorized Representative.
3. Except where specified slope is indicated on Contract Documents, fill slopes shall be limited to a grade of 3:1 (horizontal: vertical) cut slopes shall be limited to a grade of 2:1.

PART 2 - PRODUCTS

2.1 EROSION AND SEDIMENTATION CONTROL MATERIALS - GENERAL

A. Provide straw bales, silt fence, straw wattle and other materials in accordance with accepted Best Management Practices as required to prevent siltation and erosion. Contractor shall install, maintain and remove erosion control materials as required by the Owner's Authorized Representative.

2.2 SILT FENCE

A. Silt fence shall consist of 4 ft. hardwood stakes and filter fabric.

1. Filter fabric shall be woven geotextile fabric.
2. Provide filter fabric with integral plastic net backing for reinforced support and a tensioning belt to secure fabric to posts.
3. The filter fabric shall be Mirafi Envirofence as manufactured by TC Mirafi, 365 South Holland Drive, Pendergrass, GA 30567, (888) 795-0808; or approved equal.
4. Provide 2 in. x 2 in. by 4 ft. long hardwood stakes to support filter fabric.

2.3 STRAW WATTLE

A. Straw wattle shall be 9" diameter standard straw wattle and shall consist of certified weed free agricultural straw or excelsior (shaved wood fibers) inside a flexible and durable tubular netting with metal clips or knotted ends. Netting shall be either UV degradable plastic netting or 100% biodegradable burlap.

2.4 BALES

A. Bales for construction of erosion control devices shall be new, firm, wire-or nylon-bound straw. Straw shall be from threshed grain free of seed and seed heads.

B. Provide two (2) 1 in. x 1 in. by 3 ft. hardwood stakes or steel reinforcing bars of minimum No. 4 size to secure bales.

2.5 MISCELLANEOUS ITEMS

A. Crushed stone shall be durable, crushed stone from off-site sources, conforming to the following: largest dimension no greater than 3/4 in.

B. 2”-4” Coarse Aggregate for Washdown/Road Stabilization - shall be durable, crushed stone from existing material on-site or off-site sources.

PART 3 - EXECUTION

3.1 SILT FENCE

A. Silt fence shall be constructed and installed as indicated on the Contract Documents and as required by all governing agencies, prior to start of clearing and grubbing operations or any earthwork operations.

3.2 STRAW WATTLE

A. Install wattle as indicated on the Contract Documents and as required by all governing agencies, prior to start of clearing and grubbing operations or any earthwork operations. Install in accordance with manufacturer installation instructions and in accordance with Best Management Practices.

3.3 STRAW BALE DIKE

A. Straw Bale Installation

1. Bales shall be placed in a row with ends tightly abutting the adjacent bales.
2. Each bale shall be embedded in the soil a minimum of 4 in.
3. Bales shall be securely anchored in place by stakes or re-bars driven through the bales and driven a minimum of 18 in. into the soil. The first stake in each bale shall be angled toward the previously laid bale to force the bales together.

B. Inspection shall be frequent and repair or replacement shall be made promptly as needed.

C. Bales shall be removed when they have served their usefulness so as not to block or impede storm flow or drainage. Bales that have deteriorated due to weather conditions shall be replaced.

3.3 STRAW BALE CHECK DAM

A. Check dams shall be constructed and installed as required by site conditions.

3.4 DRAINAGE STRUCTURE SEDIMENT TRAP

A. Drainage structure filters and sediment traps shall be placed at all inlets to drainage structures as detailed. Outlet protection work shall be constructed before runoff is allowed to enter the drainage system.

3.5 MAINTENANCE AND REMOVAL OF EROSION CONTROL DEVICES

A. Erosion control devises shall include silt fence, straw bales, crushed stone or gravel sock filters installed in combination or installed separately.

B. Culverts and drainage ditches shall be kept clean and clear of obstructions during construction period.

C. Erosion Control Devices

1. Sediment behind the erosion control device shall be checked twice each month and after each heavy rain. Silt shall be removed if greater than 6 in. deep.
2. Condition of the erosion control device shall be checked twice each month or more frequently as required. Damaged and/or deteriorated items shall be replaced. Erosion control devices shall be maintained in place and in effective condition.
3. Straw bales shall be inspected frequently and maintained or replaced as required to maintain both their effectiveness and essentially their original condition. Underside of bales shall be kept in close contact with the earth below at all times, as required to prevent water from washing beneath bales.
4. Sediment shall be removed from the detention ponds at the completion of the Project and periodically during construction. Sediment deposits shall be removed when sediment has accumulated to a depth of 12 in. or as directed.
5. Sediment deposits shall be disposed of off-site, in a location and manner that will not cause sediment nuisance elsewhere.

E. Removal of Erosion Control Devices: Erosion control devices shall be maintained until all disturbed earth has been paved or vegetated, at which time they shall be removed.

1. Erosion protection material shall be kept securely anchored and in place until the acceptance of the finished slope.
2. All bales and anchoring stakes, silt fencing, and all other temporary erosion control devices and accessories shall be completely removed at the completion of project and legally disposed of off site at no additional cost to the Owner.
3. After erosion control devices are removed, areas disturbed by these devices the adjacent lawns or plantings.

END OF SECTION 312500

DIVISION 32 – EXTERIOR IMPROVEMENT

TABLE OF CONTENTS

SECTION 321216 - HOT-MIX ASPHALT PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work of this Section consists of providing all equipment and materials to construct the asphalt concrete pavement, as indicated on the Drawings and as specified herein.

A. Section includes:
1. Hot-mix asphalt paving

B. Related Sections:

1. General and Supplementary Conditions and Division 1 Specification Sections
2. Section 312000, Earthwork
3. 321123, Crushed Aggregate Base for Untreated Base Course

1.2 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Standard specifications for hot-mix asphalt paving for state and local Department of Transportation.
2. American Association of State Highway and Transportation Officials (AASHTO):

a. M323 Superpave Volumetric Mix Design, Single User Digital Publication
b. R 30 Mixture Condition of Hot-Mix Asphalt (HMA).
c. T 312 Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor.
d. T 324 Hamburg Wheel-Track Testing of Compacted Hot-Mix Asphalt (HMA).

3. AI Standards
a. MS-2 Mix Design for Asphalt Concrete and Other Hot-Mix Types
b. SP-2 Superpave serios No. 2

1.3 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definition of terms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by Owner's Authorized Representative at least two weeks before work is scheduled to begin.
2. Job Mix Designs: For each job mix proposed for the Work.

B. Qualification Data: for qualified manufacturer.

C. Material Certificates: For each paving material, from manufacturer. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

D. Material Test Reports: For each paving material.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the Utah Department of Transportation.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with applicable standards of owner and/or governing agency for asphalt paving work.

D. Asphalt-Paving Publication: Comply with AIMS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

E. All paving and base course work shall be done only after excavation and construction work that might damage them has been completed.

F. Pavement base course shall not be placed on a wet, excessively damp, muddy, or frozen subgrade. Pavement courses shall not be placed on frozen or contaminated base course or binder course.

H. Do not apply asphalt materials if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C)
2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at the time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

I. Existing pavement under state or local jurisdiction shall, if damaged during the course of this project, shall be repaired or replaced under this section of the specification. Materials and construction shall match local or state paving standards and cross sections, whichever is most stringent.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if the subgrade or base is frozen, during adverse climatic conditions such as precipitation, or when surface is wet, or excessively damp.

B. Temperature:

1. April 15 to October 15: Place pavement when air temperature in the shade and the paving area surface temperature are above 50 deg F. The ENGINEER may provide written approval if it is acceptable to place outside of this temperature limit.
2. Before April 15 and after October 15: Provide a Cold Weather Paving Plan. Engineer must accept the plan before proceeding. Include the following details: Haul details, placement details, Compaction aids used in production, Coordination procedures for acceptance testing.

PART 2 - PRODUCTS

2.1 BASE COURSE

A. Unless otherwise specified, base course materials shall conform to APWA Specification Section 321123, Crushed Aggregate Base, for untreated base course.

2.3 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound, angular crushed stone, crushed gravel, or properly cured, crushed blast furnace slag.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of total aggregate mass.

2.4 ADDITIVES

A. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

B. Reclaimed Apshalt Pavement (RAP): Free of detrimental quantities of deleterious materials, with a minimum sand equivalent value of 50.
1. Allowed up to 15 percent by weight with no change in specified binder grade.
2. Allowed from 15 to 30 percent by weight if the binder grade is adjusted according to AASHTO M 323 to meet the specified binder grade.

2.5 ASPHALT MATERIALS

A. Performance Graded Asphalt Binder, ASTM D 6373

1. Blending with polymers is allowed.
2. Do not use acid blends without documentation supporting need.
3. As a rule of thumb, if the two numbers in a binder designation are added together and are greater than 90, then the binder will most likely contain a polymer or natural bitumen.
4. Unless otherwise noted on the drawings, binder shall be in accordance with local jurisdiction selection and requirements.

5. If not otherwise noted on the drawings, performance graded asphalt binder (PGAB) should be substituted for asphalt cement (AC) as follows:

Asphalt Cement	**Substitute**
AC-10	PG58-22 or PG-58-28
AC-20	PG64-22

B. Asphalt Cement: AC 20 per ASTM D 3381 for viscosity-graded material and ASTM D 946 for penetration-graded material.

C. Tack Coat: ASTM D 977 or AASHTO M140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Prime Coat: Not required if paving is done within 48 hours of final compaction. Asphalt emulsion prime complying with owner requirements.

E. Water: Potable

2.6 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

C. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type 1, Type II or III, or Type IV, hot-applied, single-component, polymer-modified bituminous sealant.

2.7 MIXES

A. Hot-mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction. Mix design shall be as noted on the drawings. If not otherwise noted, select according to the following climate Conditions. If necessary, adjust binder grade according to AASHTO M 232 to account for any binder stiffness caused by RAP or ROSP aggregate addition.

1. Provide mixes with a history of satisfactory performance in the geographical area where project is located. Provide a Marshall Mix Design following AI MS-2 and the following characteristics:

   a. Total Compacted Pavement Thickness: As indicated on the Drawings.
   b. Number of compaction blows each end of specimen: 50.
   c. Satiability based on ASTM D5581: 1200 minimum.
   d. Flow in 0.01 inch units per ASTM D5581: 10-18.
   e. Voids in mineral aggregate VMA: 14.
   f. The percentage of bituminous material by weight added to aggregate will be between 3% and 5% of the weight of the bituminous mixture.

2. Mix Designs for Minor Roads, Drives, and Parking Lots:
   a. Use the following binder grade on this project: As noted on the drawings. PG58-28 shall be used if binder grade is not noted on the drawings.

b. Classification: Medium (50 Blow) Use this classification anywhere the standard specification refers to Traffic Classification
c. Surface Course: Minimum compacted thickness as indicated on the Drawings with aggregate meeting the DM-1/2 APWA Master Grading Band.

DM-1/2 APWA Master Grading Band

Sieve Size	Percent Passing by Weight
1/2"	100
#4	60-80
#16	28-42
#50	11-23
#200	3-7

B. Complete job mix formula, listing quantities and pertinent ingredient properties, shall be submitted to and approved by Owner's Authorized Representative at least two weeks before work is scheduled to begin.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 ton or other vehicle with similar axle weight.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's Authorized Representative, and replace with compacted backfill or fill as directed.
4. Verify that base course has been properly compacted and graded to the correct line, grade, and slope.
5. Verify that the base course thickness is as indicated on the project plans.
6. Verify that sufficient depth at curbs, walks, lips and other vertical edges is available to place the required thickness of compacted asphalt.
7. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 GRADING

A. Areas to be paved will be compacted and brought approximately to subgrade elevation under Section 312000, Earthwork before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be done under this Section.

B. Proof-roll subgrade using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed shall be material conforming to this Section.

C. Subgrade of areas to be paved shall be recompacted as required to bring top 8 in. (200 mm) of material immediately below gravel base course to a compaction of at least 95% of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 12 inches (300 mm) beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Owner's Authorized Representative as specified in Section 312000, Earthwork Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 in. (50 mm) deep in subgrade, shall be graded out, reshaped as required, and recompacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this Section shall be legally disposed of off-site.

H. Proceed with paving only after unsatisfactory conditions have been corrected. Subgrade shall be approved by the Owner's Authorized Representative before installation of paving base course.

3.3 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base.
   1. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated.
   2. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new base.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq/ yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Fill excavated pavements with hot-mix asphalt base course mix for full thickness of patch, and, while still hot, compact flush with adjacent surface.

3.4 REPAIRS

A. Leveling Course: Install and compact levelling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of ¼ inch.
   1. Clean cracks and joints in existing hot-mix asphalt pavement.
   2. Use emulsified asphalt slurry to seal cracks and joints less than ¼ inch wide. Fill flush with surface of existing pavement and remove excess.
   3. Use hot-applied joint sealant to seal cracks and joints more than ¼ inch side. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

   1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Spot treat subgrade with high potency herbicide if asphalt path passes within 30’ of existing trees. Apply herbicide according to manufacturer’s recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Not used if paving takes place not more than 24 hours after final compaction and grading of base course. Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.1 5 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.

   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

   2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings.

   3. Remove and replace items damaged by overspray or clean affected surfaces as directed by Owner’s Authorized Representative at no additional cost to the owner.

3.6 AGGREGATE BASE COURSE

A. Aggregate base course for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. APWA Specification section 321123, Crushed Aggregate Base.

B. Compaction of aggregate base course shall be to 95% of maximum density as determined by ASTM D 1557, Method D. Stone greater than 2 inches (64 mm) shall be excluded from course.

C. Width of base course shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend a distance of at least twice the base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 in. (150 mm) thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.
3. Surface irregularities which exceed 1/2 in. (12 mm) measured by means of a 10 ft. (3 m) long straightedge shall be replaced and properly compacted.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and area repaired.

3.7 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Spread mix at minimum temperature of 250 deg F (121 deg C).
2. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
3. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix, use suitable hand tools to smooth surface.

3.8 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct lay down and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Place asphalt so that final compacted asphalt is even with lip of gutter on curbs that drain away from the curb and gutter (open face or depressed curb and gutter). Place asphalt so that final compacted asphalt is 1/4-inch above lip of gutter on curbs that carry water (slope of parking lot is towards the curb). In transition areas, use extra care to make sure that no ponds, bird baths, or depressions are left after paving.

G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.11 PAVEMENT MARKING

A. Apply pavement-marking in accordance with Specification Section 321723 “Pavement Marking”.

B. Allow paving to age for 30 days before starting pavement marking.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: The Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979 or AASHTO T168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt paving mixture delivered daily to the site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D2726. Cores will also be measured for compacted thickness. The owner and Landscape Architect may also direct additional cores to be taken at locations of their choosing to verify final pavement thickness.

    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    b. Field Density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D 1188 or ASTM D 2726.
    c. Coordinate the time and location of all holes so that cores may be filled.

E. The contractor will replace and compact hot-mix asphalt where core tests were taken.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site, and legally dispose of them in an EPA-approved landfill.

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

END OF SECTION 321216

SECTION 321313 – SITE CONCRETE

PART 1 - GENERAL

1.0 DESCRIPTION

A. The work to be performed under this section shall consist of furnishing all labor, materials, and equipment to form, pour, finish, and cure concrete walks, drives, and roadways, flat work, retaining walls, footings, mowstrips, as per the plans and specifications. The work may include but not be limited to excavation, forming, pouring, finishing, jointing, curing, protecting, removing forms, restoring earth or sod around the edges, and guaranteeing the work.

1.1 RELATED SECTIONS AND REQUIREMENTS

A. Section 312000 – Earthwork: Preparation of the site for paving and base and preparation of subsoil.

B. Section 321723 – Pavement Markings.

1.2 REFERENCES

A. American Public Works Association (APWA) Specifications:

1. Section 321123: Crushed Aggregate Base.
2. Section 312326: Compaction.
3. Section 033004: Concrete.
4. Section 032000: Concrete Reinforcing.
5. Section 033900: Concrete Curing.
6. Section 321314: Colored Exposed Aggregate Concrete

1.3 SUBMITTALS

A. See section 013000 – Administrative Requirements, for submittal procedures.

B. Installer Qualifications and ACI Certification for Supervisor/Foreman

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

D. Product Data: For each type of product indicated. Submit manufacturer’s product data, installation instructions. Product data will include limitations and recommendations for each material.

E. Test and Performance Data: Submit independent test data substantiating compliance with ASTM C 1116 as specified.

F. Field quality-control test reports.

G. Shop Drawings for concrete joint layout (expansion and control joints) for review and approval by Landscape Architect.

H. Integral Colored Concrete Samples: At location on Project selected by Landscape Architect, place and finish 2' x 2' mockup samples for each of the three colors listed as well as mock up samples for each color using 50% of the color additive, for a total of 6 samples. These samples will be used for approval of colored concrete color. Mock up samples shall also demonstrate methods of obtaining consistent visual appearance, including materials, workmanship, and curing method to be used throughout Project.

1.4 QUALITY ASSURANCE

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

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

1.5 SAMPLING AND TESTING

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

B. All concrete shall be sampled and tested in accordance with AASHTO Designation T-141 for air entrainment, slump, and strength. The Contractor shall have the test made at the appropriate times and places. All test results shall be sent to the project Owner's Authorized Representative by the testing laboratory at the Contractors expense.

1. Slump Test: Slump tests shall be made in accordance with AASHTO Designation T-119. 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. If a slump test does not meet the specifications, a second slump test shall be made immediately on the same load. The load will be accepted or rejected from the site by the inspector depending on the results of the second test. Perform one slump test for each set of test cylinders taken.

2. Air Entrainment: Air entrainment tests shall be made in accordance with AASHTO Designations T-152. One test for each truck. If an air entrainment test does not meet the specification, a second test shall be taken immediately on the same load. The load will be accepted or rejected from the site by the Inspector depending on the results of the second test.

3. Temperature: One test for every truck. Maximum temperature allowed is 90 degrees Fahrenheit.

4. Compression Tests: Making, curing, and determining compressive strength of concrete cylinders shall be in accordance with AASHTO Designation T-22 and T23. For each test, mold and cure one set of four (4) standard cylinders for every 100 cubic yards placed or 5000 sq. ft. or fraction thereof of each concrete mix place each day. 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 use. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete represents.

a. Compressive Strength Tests: 1 specimen at 7 days and 2 specimens at 28 days. 1 Specimen held in reserve for additional testing if required.
b. Compressive strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days. Cylinders for strength tests shall be taken by the testing laboratory, which will also inspect the batching procedure to ascertain compliance with the mix design.
c. If any individual strength test is below 4,000 PSI, the concrete may be accepted by the project Owner's Authorized Representative after reviewing the circumstances. The price the Owner shall pay for the concrete will be reduced in accordance with the following schedule:

PSI Below Specified Strength Specification	Pay Factor (Percent)
1-100	98
101-200	94
200-300	88
301-400	80

5. Proctor Tests: Compaction of the natural or imported base shall be tested in accordance with AASHTO Designation T-191. All testing procedures and any additional tests which may be required shall follow those specified in the most recent edition of State of Utah Standard Specifications for Road and Bridge Construction.

C. All costs incurred in sampling and re-sampling, testing and retesting shall be paid by the Contractor.

D. All batching and mixing procedures shall be followed based upon the most recent edition of the State of Utah Standard Specifications for Road and Bridge Construction

1.6 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

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

PART 2 - MATERIALS

2.0 CONCRETE MATERIALS

A. Cement: The cement shall be Portland Type II cement meeting current AASHTO Designation M-85 Specifications. The supplier and type of cement shall not be changed during the complete concrete phase of the project. Supplement with the following:

1. Fly Ash: ASTM C 618, Class F, Sourced from Bridger Power Plant, Wyoming, or Navajo Power Plant, Arizona

B. Aggregate: The aggregate shall be well graded from fine to coarse. The fine aggregate

shall be uniformly graded meeting the requirements of AASHTO Designation ASTM-C33. The coarse aggregate shall be 1" to #4 conforming to the requirements of AASHTO Designation M-92.

C. Water: All water used in mixing the concrete shall be as per ASTM C94/C 94M.

D. Fill and Back Fill: The entire area beneath the concrete shall be excavated to the proper depth to allow for the specified thickness of untreated base course compacted to minimum 95% or as indicated in Geotechnical Report, as measured by a Procter test.

1. All excavated material shall be either re-used on the site or hauled away as specified on the plans.
2. Where untreated base course (free drainage material) is specified, the contractor shall import the required quantities from a local supplier. The contractor shall submit samples of the material to be used to the Inspector 3 days prior to use on the site. The untreated base course shall meet the requirements of Section 301 of the most recent edition of State of Utah Standard Specifications for Road and Bridge Construction. This refers to AASHTO Designations I-90, T-27, T-11, T-19 for mineral aggregate requirements. The gradation shall be for 3/4 or 1" maximum passing through the sieves in the percentages and with the tolerances shown on page 108, section 301.03 of the State Standard Specifications referred to above. (Base material shall be installed 6" wider than concrete walk width, both sides.)

E. Air Entrainment Admixture: ASTM C260.

F. Chemical Admixtures: ASTM C494/C 494M, of type suitable for application, 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.

2.1 COLOR ADDITIVES FOR INTEGRALLY COLORED CONCRETE

A. Color Additives for Integrally Colored Concrete:

1. Manufacturer: Unless specified otherwise on Product and Materials schedule, Davis Colors, phone 800.356.4848, or approved equal
2. Materials: Color additives shall contain pure, concentrated mineral pigments specially processed for mixing into concrete and complying with ASTM C979. Color additives containing carbon black are not acceptable.
3. Colors: Basis of Design colors as indicated on the Plans. Contractor to submit color chart to Landscape Architect for selection of 3 colors for each basis of design color. Contractor to provide colored concrete mockups for 3 colors selected, and mockups for each color using 50% of the specified color additive for a total of 6 color mockups for each basis of design color.

B. Curing Compound for Colored Concrete: Curing compound shall comply with ASTM C309 and be approved by color additive manufacturer for use with colored concrete.

C. Dosage rate for color additive shall not exceed 10 percent of weight of cementitious materials in mix.

2.2 FORMS: Forms shall be of suitable materials such as wood, plastic, metal, or combinations thereof. Forms shall be of the shape and dimensions shown on the plans and true to line and grades specified. All forms shall be free from knotholes, loose knots, cracks, splints, warps, or

other defects affecting the strength or appearance of the finished product. All forms shall be free of bulges and warping. They shall be cleaned thoroughly before they are used on this project. There shall be no split holes, bolts, or nuts on the final concrete surface when the forms are removed.

A. If at any stage of work, during or after placing the concrete, the forms sag or bulge the affected concrete shall be removed. Exceptions may be considered by the Inspector if the concrete is going to be covered with earth.

2.3 METAL REINFORCEMENT

A. Steel reinforcing bars: shall conform to ASTM A 615.

1. Bars employed as reinforcement shall be deformed type.
2. Bars employed as dowels shall be hot-rolled plain rounds.
3. Unless otherwise indicated on the Drawings, reinforcing bars shall be Grade 60.

B. Steel expansion dowels: conform to AASHTO M31.

1. Hot-rolled plain steel rounds.
2. Grade 60 - 1/2 inch by 24 inches (610 mm) smooth steel dowel and compatible waxed tube sleeve, 12 inches in length.
3. Dowels and sleeves shall be as furnished by U.S. Steel Corp., or approved equal.
4. Bars employed as dowels shall be hot-rolled plain rounds.
5. Dowels shall be epoxy coated.

2.4 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:

1. All concrete shall be Class AA (AE) Type II.
2. Compressive Strength (28 days): 4,000 P.S.I.
3. 6.5 bag cement mix shall be used, with adjustments made as necessary due to the use of fly ash.
4. Fly Ash Content: Maximum 15% of cementitious materials by weight, subject to mix design verification.
5. Water-Cement Ratio: .45 maximum water/cement ratio at point of placement, or as little water content as practicable.
6. Air Content: 6%, with a plus or minus variable of 1%.
7. Slump Limit: 4 inch maximum.
8. The supplier and mix of concrete shall not be changed during the complete concrete phase of the project.

C. Color Additives: Mix color additives into concrete mixture according to manufacturer’s written instructions.

2.5 FIBER REINFORCEMENT - NOT REQUIRED FOR THIS PROJECT

2.6 SEALANT

A. Joint Sealant shall be a one-part, self-leveling, low-modulus silicone sealant suitable for concrete paving and expansion joint applications.

1. Basis of Design Product: DOWSIL™ 890-SL Silicone Joint Sealant by The Dow Chemical Company (Dow Performance Materials, www.dow.com) or approved equal meeting the following requirements:
    A. ASTM C920, Type S, Grade SL, Class 100/50, Use T, M, G, A, and O.
    B. Self-leveling, non-sag, and cold-applied.
    C. Movement capability: ±100 % extension, ±50 % compression.
    D. Service temperature range: –40 °F to +300 °F (–40 °C to +150 °C).
    E. Primer: As recommended by manufacturer for the substrate and conditions encountered.
    F. Color: To be selected by Landscape Architect from manufacturer's standard range.
2. Joint Types:
    A. Use DOWSIL™ 890-SL for horizontal expansion and control joints in concrete walks, plazas, and paving subject to pedestrian or light vehicular traffic.
    B. Use compatible non-slump silicone or polyurethane sealant for vertical or sloped applications as recommended by the manufacturer.
3. Backer Rod: ASTM C1330, closed-cell, non-gassing polyethylene foam sized to control sealant depth as recommended by sealant manufacturer.
4. Joint Preparation and Installation: Clean joints and install backer rod and sealant in accordance with DOWSIL™ 890-SL manufacturer's written instructions.
5. Do not use polyurethane sealants adjacent to silicone joints.

2.7 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

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

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.8 RELATED MATERIALS

A. Expansion Joint Filler: Non-bituminous, closed-cell, flexible polyethylene foam such as ZIP Expansion Joint Filler by W.R. Meadows, or approved equal conforming to ASTM D1752 Type IV
    a. Thickness: ½ inch unless otherwise noted
    b. Install full-depth between adjacent slabs and along fixed structures where shown.
    c. Leave top ½ inch recess to form sealant reservoir.
    d. Provide a removable cap/strip to protect the joint during placement and to

facilitate the installation of sealant after curing.

e. Do not use asphalt-impregnated fiberboard or bituminous materials in joints to be sealed with silicone

B. Pavement Marking Paint: See specification section 321723-Pavement Marking.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted base course is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 PREPARATION

A. Construct subgrades to plan elevations following Division 31 Earthwork specification sections.

B. Place and compact fill material and untreated base course in accordance with Division 31 Earthwork specification sections.

C. Moisten base to minimize absorption of water from fresh concrete.

D. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.

E. Notify architect minimum 24 hours prior to commencement of concreting operations.

3.3 PLACEMENT (Supervisor/Foreman must have A.C.I. Training): All debris shall be removed from the inside of the forms prior to placement of any concrete. The Contractor shall take all necessary measures to protect the concrete after placement to prevent rain, graffiti, or other damage to the surface.

A. Concrete mix trucks shall be routed to each pour over areas where the least possible damage will occur to the existing sprinkler irrigation system, utilities, lawn, or plant materials. The Contractor shall be responsible for repair of damage done by the concrete mix trucks and any other vehicles involved in these operations.

B. The concrete shall be spread in horizontal layers insofar as practical and only of the thickness that can be satisfactorily hand worked or compacted with vibrators and other such equipment.

C. The concrete shall be deposited as near the final resting place as possible so as to minimize working it and to prevent separating the ingredients.

D. The concrete slope shall be a minimum 1" per 10' or 1% in the direction of the natural grade or as indicated on the plans. Flat work will have not more than an 1/8” difference in a 20’ radius.

3.4 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

1. Winter Concrete: When outside temperatures reach 35 degrees Fahrenheit, a 7-1/2 bag mix shall be used; heated water shall be used in the concrete mix. Heaters shall be used to heat the aggregate to a temperature of 70-150 degrees Fahrenheit. The aggregates shall be uniformly heated and the development of “hot spots” shall be avoided. The temperature of the mixed concrete shall be 60-90 degrees Fahrenheit. A straw blanket shall be used on all surfaces. Concrete shall not be poured on frozen ground and shall meet A.C.I. 305 and 306 requirements for hot and cold weather precautions. Concrete temperature must be maintained at 50 degrees Fahrenheit or greater but never more than 90 degrees Fahrenheit for 7 days.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.6 STEEL REINFORCEMENT

A. Reinforcing for reinforced concrete shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between the concrete and reinforcing. Where there is delay in placing concrete after reinforcement is in place, bars shall be re-inspected and cleaned when necessary.

B. Reinforcing Steel: After forms have been coated with form release agent, but before concrete is placed, reinforcing steel anchors shall be securely wired in the exact position called for, and shall be maintained in that position until concrete is placed and compacted.

1. Any bar showing cracks after bending shall be discarded.
2. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Landscape Architect.

C. Unless otherwise indicated on the Drawings, reinforcing shall extend to within two (2) inches of formwork and expansion joints.

1. Reinforcing shall continue through control joints.

D. The Owner may do core testing to make sure that reinforcement is in the proper position. If testing shows otherwise, concrete will be rejected and the Contractor shall remove all rejected slabs and re-pour new slabs at no additional cost. Contractor shall repair cored holes as directed by the Landscape Architect.

3.7 FINISH

A. Unless specified on the plans, the finish for all concrete flat work shall be a non-skid surface by medium brooming, perpendicular to direction of travel with troweled and radius edges ½” radius.

B. Formed Surfaces: Allow concrete to cure not more than 72 hours before commencing surface finish operations, unless otherwise approved. Revise the finishes as needed to secure approval.
1. Smooth Form Finish per ACI 301 for all vertical wall faces including seat wall.

Use clean, tight, defect-free form panels to produce a uniform surface free of seams and discoloration.

2. Patch all tie holes, fins, and surface defects using a non-shrink patching compound matching adjacent concrete color.
3. Lightly rub or sack-finish surfaces to achieve a uniform color and smooth texture.
4. Seat wall tops shall receive a light broom finish for a smooth, slip-resistant texture
5. When surface texture is impaired and form joints misaligned, grind, brush hammer, or correct affected concrete.
6. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete
7. Repair major mortar leakage as a defective area.
8. When workmanship is less than acceptable standard, provide one of APWA rubbed finishes at no additional cost to the owner.

C. Stamped Concrete Finish: Stamped concrete pattern as indicated on the drawings and installed in accordance with manufacturer's instructions. Stamped concrete areas shall receive 2 coats of UV protective concrete sealant.

3.8 JOINTING

A. Joints shall be placed in the concrete by the Contractor to control and minimize cracking. Any jointing shown on drawings is to convey design intent only. Contractor shall submit Shop Drawings, noting any deviations from the design intent, for approval by the project Landscape Architect.

1. Wall Joints: Shall be as noted and detailed on the drawings.
2. Control Joints: Sidewalk joints shall be in linear feet equal to the width of the walk (for example, a 6-foot wide walk shall be scored every 6 linear feet.) unless otherwise noted on the plans Slab work shall be jointed a maximum in feet of 2 -1/2 times the thickness of the concrete in inches (for example, the joints would be less than 15 feet apart for a slab 6 inches thick) and never more than 15 feet apart - for a 4" slab, between 8 - 10 feet.

   a. The control joints shall be a depth of 1/4 the thickness of the slab. Control joints shall be made before shrinkage cracking occurs. All control joints shall be continuous across the concrete except where interrupted by a post, wall, joint, or other obstacle.

   b. Saw cutting control joints will not be allowed except where specifically called for in the drawings.

2. Construction Joints: Shall be created longitudinally by the edges of paving or transversely at the end of each days work. A key way shall be formed by fastening a key of wood, plastic, or PVC to the form of the first slab. The thickness of the key way shall be 1/5 of the thickness of the slab. The edges shall be rounded 1/4" radius, never on slabs less than 6" thick. Use a release agent on wood formed key ways.

3. Doweled joints: should be installed as detailed at all intersecting walks, where new concrete ties into existing concret,e and at expansion joints in the concrete drive and parking paving.

4. Expansion Joints: Shall be created at junctions of new and existing pavement, at buildings, or other abutting objects, between gutter and concrete drive and parking paving and where shown on the drawings. Expansion joints shall not be

spaced greater than 50' apart. An 1/2" expansion joint material (full depth) shall be placed against the existing object to prevent bonding.

a. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
b. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
c. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
d. 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 the joint.

5. Sealing Joints: Expansion joints in concrete walkways shall be sealed with DOWSIL 890-SL Silicone Joint Sealant after concrete has cured a minimum of 7 days. Clean and dry joint surfaces; install backer rod and sealant per manufacturer's instructions. Sealant depth 3/8 inch unless otherwise noted.
   a. Contractor to apply a light dusting of oven-dried silica sand over the sealant surface once the sealant becomes slightly tacky (after initial skin formation).
   b. The dusting shall be lightly broadcast only; do not rake, trowel, or embed sand into the sealant. Any excess loose sand shall be blown or swept off once the sealant is fully cured.
   c. The dusting shall not impair the cured sealant's adhesion, flexibility, integrity, or ability to accommodate joint movement.
   d. Contractor shall coordinate all dusting practices with the Sealant Manufacturer's technical representative. Manufacturer approval may be required, and warranty coverage may be contingent upon compliance with the manufacturer's published guidance.
   e. Contractor shall not interpret this clause to override or modify manufacturer-published limitations, installation instructions, or warranty requirements.
6. Expansion Joint Assembly: Install ½-inch closed-cell polyethylene expansion joint filler (ZIP™ or equal) full depth between adjacent slabs and along fixed structures. Recess top ½ inch to form sealant reservoir. Remove protective cap immediately prior to sealant installation. Do not cover cured silicone joints with sand or other materials.

3.9 CARE AND CURING

A. All concrete shall be cured for a minimum of 7 days before heavy loads may be placed upon it. Care shall be taken by the Supplier and the Contractor to prevent too rapid curing and the improper aging of the concrete. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.

E. After pouring and during the curing process, the Contractor shall see that no initials or other unnecessary marks are made into the surface. The Contractor shall replace any section containing permanent marks at the completion of the project. Prior to that time, the Contractor may grind the surface or take measures to erase any permanent marks in a section if approved by the Inspector or Owner's Authorized Representative.

3.10 FORM REMOVAL

A. After the concrete is cured, all forms, stakes, and fastening materials shall be removed from the concrete. Care shall be taken to protect the edges from chipping and to prevent damage to the concrete during removal.

All forming materials shall be taken from the site as soon as possible after removal. The area taken up by the forms shall be filled with approved backfill, if needed, and compacted so that top soil shall be placed on top to meet finished grade. If the area is in existing lawn, the sod shall be removed back from the edges of the concrete the standard width of new commercial sod. Then new commercial sod shall be laid full width along the edges of the new concrete until all areas are repaired. The finish grade against the concrete shall be 1 to 2" below the top of the concrete.

3.11 CONCRETE RETAINING WALLS

A. Retaining Wall Reinforcing steel:
1. Detailing, fabrication and placement of reinforcing bars (unless otherwise noted) must follow the A.C.I. Manual of Standard Practice for detailing reinforced concrete structures, A.C.I. 315 – Latest Edition.
2. All reinforcing bars for retaining walls shall conform to the standard specification for deformed billet-steel bars for concrete reinforcement, ASTM A615-85: grade 60 except #3 re-bars shall be grade 40.
3. Lap all splices in concrete as "Class B" splices minimum, as per the IBC, referenced addition, unless otherwise shown.
4. Reinforcing steel shall have a minimum concrete cover as tabulated below unless otherwise noted.
   a. Footings and walls cast against earth – 3 inches
   b. Walls exposed to weather or soil – 2 inches
5. Where continuous bars are called out, provide contact splices (as required) in accordance with A.4 above.
6. Bottom of steel of slabs, footings, and grade beams shall be supported off of the earth or forms by precast concrete blocks wire tied to the reinforcement.

B. Retaining Wall Concrete
1. All reinforcing bars, anchor bolts and inserts shall be well secured prior to placing concrete.
2. Concrete compressive design strength at 28 days shall be as specified above. Concrete shall have been tested and have reached minimum strength psi prior to backfilling walls.
3. All exposed concrete edges shall have ¾" chamfer.
4. Construction requirements shall conform to ACI 301 and ACI 318 Latest Edition.
5. Concrete work shall conform to the requirements of Chapter 19 of the IBC, reference edition.

B. Retaining Wall Earthwork
1. Retaining wall backwall backfill shall be free from frozen lumps, rocks larger than

4 inches in the largest dimension, and other deleterious material.

2. Structural fill placed beneath footings shall be placed in maximum 9 inch thick loose lifts compacted to at least 95 percent of maximum dry density with a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557
3. All other backfill shall be placed and compacted to at least 90 percent of maximum dry density with a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.
4. Excavation shall be braced and supported to prevent ground adjacent to the excavation from sliding or settling.

3.12 PAVEMENT TOLERANCES

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

1. Elevation: 1/4 inch.
2. Thickness: minus ¼ inch.
3. Surface: Gap below 10-foot long, unleveled strait edge not to exceed ¼ inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus ¼", no minus.
6. Joint width: Plus 1/8", no minus.

B. Minor variations in appearance of colored concrete, which are similar to natural variations in color and appearance of uncolored concrete, are acceptable.

3.13 PAVEMENT AND CURB MARKING

A. See specification section 321723-Pavement Marking

3.14 CLEAN-UP

A. Upon completion of the concrete work, the entire affected area shall be cleaned up by the Contractor. All wood, forms, stakes, rocks, sod, and other extraneous material shall be removed from the premises.

3.15 PROTECTION, GUARANTEE AND REPLACEMENT

A. The Contractor shall guarantee all concrete materials, labor, and workmanship for 1 year following final approval of the contract. Sections containing cracks deemed to be unacceptable by Owner's Authorized Representative shall be replaced at no expense to the Owner.

B. Protect concrete from damage, Exclude traffic from pavement for at least 14 days after placement.

C. Maintain concrete free of stains, discolorations, dirt, and other foreign material. Sweep concrete pavement not more than two days before dated scheduled for Substantial Completions inspection.

END OF SECTION 321313

SECTION 321540 - STONE DUST SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section consists of but not limited to providing all equipment and materials to construct the **(Stabilized)** stone dust surfacing, including aggregate base, temporary forms or edging**.**

1.2 GENERAL PROVISIONS:

A. The Contract and General Conditions and all Sections of the Construction Documents are a part of this Section.

1.3 RELATED WORK UNDER OTHER SECTIONS:

A. The following items of related work are specified and included in other Sections of the Specifications:
1. Division 31 – Earthwork
2. Section 329000 –Exterior Planting

1. 4 REFERENCES

A. The following standards will apply to the work of this Section:
1. American Society for Testing and Materials (ASTM):
a. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort Using [56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)]
b. D4546 - One Dimensional Swell or Settlement Potential of Cohesive Soil

1.5 SUBMITTALS

A. Submit for Landscape Architect's approval a 5 pound (2.3 kg) sample of stone dust material demonstrating material gradation and color for review and acceptance.

1. Proctor Tests: Compaction of the natural or imported base shall be tested in accordance with AASHTO Designation T-191. All testing procedures and any additional tests which may be required shall follow those specified in the most recent edition of State of Utah Standard Specifications for Road and Bridge Construction.
2. Metal Edging product sheet
3. Binder Product Cutsheet

1.6 TESTING

A. Proctor Tests: Compaction of the natural or imported base and compacted stone dust surfacing shall be tested in accordance with AASHTO Designation T-191. All testing procedures and any additional tests which may be required shall follow those specified in the most recent edition of State of Utah Standard Specifications for Road and Bridge Construction.

B. All costs incurred in sampling and re-sampling, testing and retesting shall be paid by the Contractor.

1.7 QUALITY ASSURANCE

A. The Owner reserves the right to test and inspect materials and construction of stone dust surfacing.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Aggregate for base course shall be Untreated Base Course meeting APWA Section 321123, Part 2, and Paragraph: Untreated Base Course. Gradation shall be Aggregate Grade 1-1/2 with Sieve as follows:

Sieve No.	Percent Passing by Weight
1-1/2	100
3/4"	70-85
3/8”	55-75
#4	40-65
#16	25-40
#200	7-11

2.2 STONE DUST

A. Stone dust will 1/4” crushed aggregate screenings meeting the warranty requirements of the stone dust binder requirements. Crushed stone siee analysis of with passing a square mesh sieve AASHTO T11-82 and T2782 as follows:

1/4” Minus Aggregate Grading:

US Sieve No.	Percent Passing By Weight
#3/8”	100
#4	90-100
#8	75-80
#16	55-65
#30	40-50
#50	25-35
#100	15-20
#200	10-15

B. Stone dust will be light tan to brown in color and or overall visual appearance.

C. Color will be relatively uniform.

2.3 STONE DUST BINDER

A. Stone Dust Binder shall be Stabilizer, available via Stabilizer Solutions, 602.225.5900, or approved equal. Add stabilizer per product recommendations

2.4 METAL EDGING

A. Raw Steel Edging- See Materials Schedule

PART 3 - EXECUTION

3.1 GRADING:

A. Existing subgrade material that does not readily compact as required will be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to replace unsuitable material removed will be material conforming to this Section.

C. Subgrade of areas to receive stone dust surfacing will be re-compacted as required to bring top 4 inches (100 mm) of material immediately below stone dust to a compaction of at least 92 percent of maximum density, as determined by ASTM D 1557. Subgrade compaction will extend for a distance of at least 6 inches (300 mm) beyond proposed edge of stone dust surface.

D. Excavation required in subgrade will be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or base course, subsequent backfill and compaction will be performed as directed by the Landscape Architect as specified in Division 31 Section, EARTHWORK. Completed subgrade after filling such areas will be uniformly and properly graded.

E. Areas being graded or compacted will be kept shaped and drained during construction. Ruts greater than or equal to one inch (25 mm) deep in subgrade will be graded out, reshaped as required, and re-compacted before placing stone dust surfacing.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this section will be disposed of off-site.

3.2 BASE COURSE

A. Base course shall be spread in layers from self spreading vehicles equipped with automated grade controlled equipment for cross sections greater than 10 feet (3.00 m) in width and by hand for cross sections less than or equal to 10 feet (3.00 m) in width. Power graders or conventional self spreading vehicles may be used only with prior written approval of the Owner’s Representative. Base course shall be compacted until the surface is even and true to the required lines and grades within a tolerance of 3/8 inch (9mm) above or below the required cross sectional elevations and to a maximum irregularity not exceeding 3/8 inch (9 mm) under a 10 foot (3.00 m) line longitudinally.

B. Any specific area of base course which, after being rolled, does not form a satisfactory, solid, stable foundation shall be removed, replaced and recompacted by the Contractor at no additional cost to the Owner.

C. Compaction of base course shall be to 95 percent of maximum density as determined by ASTM D 1557 and shall be verified by compaction testing. Compaction testing shall be completed at the contractor’s expense. Test results shall be provided to Landscape Architect for review and approval.

D. Width of base course shall be greater than or equal to the width of stone dust surface, if continuous lateral support is provided during rolling, and shall extend at least 2 x base thickness beyond edge of the course above, if not so supported.

E. Material shall be applied in lifts less than or equal to 3 inches (75 mm) thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.

F. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with base course. Materials spilled outside stone dust surfacing lines shall be removed and area repaired.

G. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise injured, shall be cleaned, replaced, re-compacted, or otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

H. Water shall be added to stone dust surface as required to achieve dense, hard packed surface conforming to the finish grades indicated.

I. Variations in smoothness of finished stone dust surface will be less than or equal to 1/4 inch (6.4 mm) when tested with a 10-foot (3.00 m) straightedge, applied both parallel to and at right angles to centerline of stone dust surface areas. Irregularities exceeding these amounts or which retain water on surface will be corrected by removing defective work and replacing with new material conforming to this specification.

3.3 STABALIZED STONE DUST SURFACING INSTALLATION

A. Pre-mix Stabilizer with crushed aggregate at the rate of 15-lbs of Stabilizer per 1-ton of aggregate. Drop spreading of Stabilizer over pre-placed aggregate or mixing by rototilling is NOT acceptable. Stabilizer should be mechanically blended (Bucket blending is not an approved blending method). Stabilizer can be blended by cement mixer, pug mill, Dakota blender, generally any paddle type blenders (no screw type blenders). If you wish to use another type of blender, please verify with the company. Always blend the material DRY and leave material in mixer for several passes of the mixing paddles. Stabilizer will disappear within the material quickly, but may not be blended completely. After Stabilizer is blended into aggregate, confirm that Stabilizer has been thoroughly blended. The best way to do this is the ‘ball test.’ The result should be an aggregate ball with a doughy consistency that holds together. You should be able to toss the ball in your hand without it breaking apart.

B. Stabilized Stone dust surfacing will be placed only after excavation and construction work that might injure the surfacing have been completed. Stone dust surfacing shall be placed after adjacent concrete work or edgings have been installed. Damage to concrete walks, edging, stone dust surfacing, adjacent grades or materials occurring during construction will be repaired by the Contractor before acceptance at no additional cost to the Owner.

C. Stabilized Stone dust surfacing shall be constructed on the compacted base course as detailed.

D. Stabilized Stone dust surfacing shall be installed in two lifts of 2” each constructed on the compacted base course as detailed.

E. Spread Pre-Mixed Binder and stone dust evenly over the base course and rake smooth to the required grade and cross section as shown on the Contract Documents. Place material to sufficient depth to allow 4 inch depth after compaction. Do not install Stabilized aggregate during rainy conditions or below 40 degrees Fahrenheit and falling.

F. Water shall be added to stone dust surface to achieve saturation of entire depth of Stabilized Stone Dust aggregates. To achieve saturation of Stabilized aggregate profile, 25 to 45-gallons of water per 1-ton must be applied. During water application, test moisture penetration using a probing device reaching full depth.

G. Contractor will wait a minimum of 6 hours or until such time that the paving material is able to accept compaction from a one-ton roller without separation, plowing or any other physical compromise of the paving material. The aggregate will begin to dry out and setup. Compaction can begin when you can walk on the material without significantly sinking in and material does not feel too muddy. Do not allow material to dry out completely. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction. Compact the material to 95 percent of maximum density as determined by ASTM D 1557 with a compactor as specified above. DO NOT use a vibratory plate compactor or vibration feature on roller, as vibration separates large aggregate particles. Compaction shall be verified by compaction testing. Compaction testing shall be completed at the contractor’s expense. Test results shall be provided to Landscape Architect for review and approval.

H. Variations in smoothness of finished stone dust surface will be less than or equal to 1/4 inch (6.4 mm) when tested with a 10-foot (3.00 m) straightedge, applied both parallel to and at right angles to centerline of stone dust surface areas. Irregularities exceeding these amounts or which retain water on surface will be corrected by removing defective work and replacing with new material conforming to this specification.

3.4 WARRANTY

A. Contractor shall provide, for a period of 60 days, unconditional maintenance to include complete repairs to any area of the stabilized stone dust surface that fails.

END OF SECTION 321540

SECTION 321613 - CURBS, GUTTERS, DRIVEWAYS, AND ADA RAMPS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Materials and procedures for constructing curbs, gutter transitions, ADA pedestrian ramps, and plowable end sections.
B. Work shall comply with APWA 321613 and City Standard Details unless modified herein.

1.2 RELATED SECTIONS

A. Section 312000 – Earthwork
B. Section 321313 – Site Concrete

1.3 REFERENCES

A. American Public Works Association (APWA) Specifications:

1. Section 321123: Crushed Aggregate Base.
2. Section 312326: Compaction.
3. Section 033004: Concrete.
4. Section 032000: Concrete Reinforcing.
5. Section 033900: Concrete Curing.

1.4 SUBMITTALS

A. Product Data:
   1. Concrete mix design with proportions and admixtures.
   2. Joint filler and sealant product data.
B. Material Certificates: Aggregates, cement, and reinforcement.
C. Field test reports verifying compressive strength and air content.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with APWA and City standards.
B. Contractor shall have a minimum of three years of successful experience installing similar concrete improvements.
C. All materials and work shall be subject to inspection and approval by the Landscape Architect or City Engineer.

PART 2 PRODUCTS

2.1 CONCRETE MIX

A. Cast-in-place: Class 4000, Refer to APWA Section 033004.
B. Maximum slump per mix design.

2.2 EXPANSION JOINT FILLER

A. Preformed, non-bituminous, closed-cell, flexible polyethylene foam expansion joint filler, ASTM D1752 Type IV, such as ZIP™ Expansion Joint Filler by W. R. Meadows, or approved equal.
B. Thickness: ½ inch unless otherwise indicated.
C. Install full-depth between curb/gutter sections and adjacent concrete or structures.
D. Leave top ½ inch recess to receive sealant where indicated.

2.3 JOINT SEALANT

A. Joint Sealant: One-part, self-leveling, low-modulus silicone, ASTM C920 Type S Grade SL Class 100/50, such as DOWSIL™ 890-SL Silicone Joint Sealant or approved equal.
B. Primer: As recommended by sealant manufacturer.
C. Backer Rod: Closed-cell polyethylene foam, ASTM C1330, sized to control sealant depth.

2.4 UNTREATED BASE COURSE

A. Refer to APWA Section 321123, Part 2, and paragraph: Untreated Base Course.

2.5 REINFORCEMENT

A. Reinforcing Steel: Grade 60 ksi galvanized or epoxy coated steel. Refer to APWA Section 032000.

2.6 DETECTABLE WARNING PLATES FOR ADA RAMPS

A. Cast In Place Detectable Warning Plates: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
    1. Material: Cast-fiber-reinforced polymer concrete tile
    2. Color: As specified on the drawings and as approved by Owner’s representative.
    3. Dome spacing and configuration: Manufacturer’s standard compliant spacing in square pattern.
    4. Mounting: Permanently embedded detectable warning tile wet-set into freshly poured concrete.

PART 3 – EXECUTION

3.1 PREPARATION

A. Construct subgrade to plan elevations following APWA Section 320510, Backfilling Roadways.

B. Place and compact fill material and untreated base course. Follow APWA Section 312326, Compaction.

C. May use a slip form curb and gutter machine.

D. Dampen the untreated base course before placing concrete.

E. Curbs and Gutters: Refer to Construction Details.

F. ADA Pedestrian Access: Refer to Construction Details.

G. Detectable Warning Plates: Embed in concrete in accordance with Manufacturer's installation instructions in locations indicated and detailed on the drawings.

G. Forms: Refer to APWA Section 031100.

3.2 PLACING CONCRETE

A. Furnish materials and construct concrete following APWA Section 033010, Concrete Placement.

B. Make sure base course is uniformly damp at time of concrete placement

C. Place concrete so time between end of placement and beginning of finishing is less than 15 minutes.

D. Do not use mechanical vibrators.

E. Hand tamp forms to eliminate honeycomb.

F. Deposit concrete continuously when using a slip form machine.

G. Use dowels as shown on the plans when placing curb next to existing pavement.

3.3 FINISHING CONCRETE

A. Finish concrete following APWA Section 033500, Concrete Finishing.

B. Round edges to a 1/2 inch radius.

C. Use a float to finish the top and front face of the curb and the top of the gutter.

D. Apply broom finish longitudinal to curb and gutter flow ling.

E. Finish the traveled portion of the driveway with a broom finish.

F. Remove form marks or irregularities from finish surfaces.

G. Install detectable warning strips on disabled pedestrian ramps as shown.

3.4 CONTRACTION JOINTS

A. Tooled Joints Depth = T/4 where T is depth of the concrete slab in inches.

B. Saw Cut Joints: Saw cut joints before uncontrolled shrinkage cracking occurs. Do not tear or ravel concrete during sawing.

C. Joints for curbs, gutters, and waterways at intervals not exceeding 10 feet.

D. At curb radius and walk returns make the joints radial.

E. Where integral curb and gutter is adjacent to concrete pavement, align joints with the pavement joints where practical.

3.5 EXPANSION JOINTS

A. Install filler full-depth, flush with the top surface, and recess top ½ inch where sealant is specified.

B. Provide backer rod and DOWSIL™ 890-SL Silicone Joint Sealant (ASTM C920 Type S Grade SL Class 100/50) at exposed expansion joints unless otherwise noted.

B. Place expansion joints between sidewalks and the back of curb returns and between the sidewalk and sidewalk ramps.

C. Do not place expansion joints in sidewalk ramp surfaces.

D. Do not place longitudinal joints in drain gutter flow-line.

E. Where drain gutter transitions extend beyond the curb return, place expansion joints at the ends of the drain gutter transition.

E. Place expansion joints at the beginning of curb radius and end of curb radius.

F. Use preformed, non-bituminous, closed-cell polyethylene foam expansion joint filler, ASTM D1752 Type IV, such as ZIP™ Expansion Joint Filler by W.R. Meadows or approved equal.

G. Align filler accurately with adjacent surfaces; do not permit displacement during concrete placement.

H. Sealant and filler shall match the requirements of Section 321313 “Site Concrete.”

3.6 CONCRETE CURING

A. Cure the surface. Refer to APWA Section 033900.

B. Type ID Class A (clear with fugitive dye) membrane forming compound. Apply total coverage in 2 directions after texturing.

B. Eliminate thermal shock of concrete by keeping cure temperature even throughout extent and depth of concrete slab.

3.7 PROTECTION AND REPAIRS

A. General: All expenses are at no cost to Owner.

B. Protection: APWA Section 033010.

1. Protect concrete work from deicing chemicals during 28 day cure period.
2. Immediately after placement, protect concrete from graffiti or other types of mechanical injury.

C. Repairs: APWA Section 033010.

1. Correct all humps or depressions.

END OF SECTION 321613

SECTION 321723 - PAVEMENT AND CURB MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish traffic paint meeting Federal Specification TT-P-1952.

B. Apply to asphaltic or concrete pavement and curbs as edge lines, centerlines, skip lines, guidelines, symbols, and other related markings.

C. Remove pavement markings.

1.2 RELATED SECTIONS

A. Section 321216 – Hot Mix Asphalt Paving
B. Section 321313 – Concrete Paving.
C. Section 321613 – Curbs, Gutters, Driveways, and ADA Ramps.

1.3 REFERENCES

A. Miscellaneous:

1. Federal Standards 595B, 37875, 33538, 11105.
2. TT-P-345: Federal Standard Color Number.
3. TT-P-410: Federal Standard Color Number.
4. TT-P-445.

B. American Association of State Highway and Transportation Officials:

1. AASHTO M 247: Glass Beads Used in Traffic Paint.

C. American Society for Testing and Materials (ASTM):

1. ASTM D 476: Titanium Dioxide Pigments.
2. ASTM D 600: Liquid Paint Dryers.
3. ASTM D 603: Aluminum Silicate Pigments (Hydrous).
4. ASTM D 605: Magnesium Silicate Pigment (Talc).
5. ASTM D 711: No-Pick-Up Time of Traffic Paint.
7. ASTM D 740: Methyl Ethyl Ketone.
8. ASTM D 1155: Roundness of Glass Spheres.
9. ASTM D 1214: Sieve Analysis of Glass Spheres.
10. ASTM D 2243: Freeze-Thaw Resistance of Water-Borne Coatings.
11. ASTM D 1199: Calcium Carbonate Pigments.
12. ASTM D 1214: Sieve Analysis of Glass Spheres.
13. ASTM D 2635: Methyl Isobutyl Carbinol.

1.4 SUBMITTALS

A. Furnish for approval all Manufacturers’ specifications for all items listed in this Section

B. Shop Drawings: The contractor shall submit Shop Drawings for review and acceptance prior to product fabrication or delivery to the site. Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, color, and similar data to enable an adequate review of the information required.

C. Color Samples: Provide color samples for approval of pavement and curb marking paint colors.

PART 2 - PRODUCTS

2.1 PAVEMENT AND CURB MARKING PAINT

A. Pavement and Curb Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS tt-p-1952.

B. Color:

1. Yellow: Not Used
2. White: Parking lot lines, ADA Parking Symbol, Pedestrian Crossings & Traffic Arrows & Striping
3. Blue: Not Used
4. Red: No parking zone, unloading area (see drawings)

C. Paint and reflective media shall be in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, formulation number and directions, all of which shall be plainly legible at time of use.

A. Paint shall be homogeneous, easily mixed to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of six months.

2.2 GLASS BEADS

A. Required gradation: ASTM D 1214.

Sieve Size µm	Percent Passing
600	100
300	40-70
212	15-35
150	0-10

B. Minimum of 75 Percent (by weight) true spheres. ASTM D 1155.

C. Required characteristics:

1. Colorless.
2. Free of dark spots, milkiness, and air inclusions.
3. Silane coated.
4. Minimum index of refraction of 1.50 when tested by liquid immersion at 25 degrees C. AASHTO M 247.

2.3 PAVEMENT MARKING EQUIPMENT

A. Use equipment manufactured specifically for applying paint and only by workers experienced in operating such equipment.

B. The equipment for applying paint to pavements shall be self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph (8.05 km/hour), and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph "Application", below, and of even uniform thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of three different colors of paint as specified. The paint applicator shall have paint reservoirs with tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gages in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

C. Push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking roadway and parking areas. Applicator machine shall have the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

D. Provide sandblasting equipment as required for cleaning surfaces to be painted.

E. Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required. Compressor shall be capable of furnishing not less than 150 cfm (4.2 m^3/minute) of air at a pressure of not less than 90 psi (620.5 kPa) at the nozzle for each nozzle used.

F. Locate glass bead applicator directly behind and synchronized with marking applicator.

G. Shield devices properly to avoid applying marking or losing beads outside designated area.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. New pavement and curb surfaces shall be allowed to cure for a period of not less than 30 days before application of marking materials

B. Where oil or grease is present on old pavements to be marked, affected areas shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint.

C. Sweep and clean surface to eliminate loose material and dust.

3.2 PAVEMENT MARKING APPLICATION

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner's Authorized Representative.

B. Apply no later than 24 hours after receiving written order from the Owner's Authorized Representative.

B. Apply marking materials to clean, dry surfaces in accordance with the requirements of UDOT Specification Section 02765 Supplemental.

C. Apply paint pneumatically with approved equipment.

D. Revise rate for reflectorized paint.

E. Apply pavement marking materials evenly to the pavement surface to be coated at the rate recommended by manufacturer.

F. Use guidelines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols.

G. Edges of markings shall be sharply outlined.

H. Maximum drying time requirements of the paint manufacturer shall be enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by vehicle tires.

I. If markings require more drying time than stated by the paint manufacturer, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

1. Apply paint during the following conditions:
   a. When pavement surface is dry, clean, and free of oil.
   b. When pavement and air temperatures are at least 40 degrees F (4 degrees C).
   c. During daylight hours.
2. Apply paint and glass beads for parking lot striping, letters, arrows, railroad crossing markings, crosswalks, and stop bars:
   a. With well defined outside edges and uniform thickness.
   b. At recommended rate to provide a minimum wet film thickness of 15 mils (0.4mm).
   c. Apply glass beads uniformly into wet pavement markings at a rate of 6 lb./gal (72 Kg/L) of paint.
3. Operate equipment in the direction of the normal flow of traffic.

3.3 PROTECTION OF MARKINGS

A. Markings shall remain protected in accordance with UDOT Specifications.

3.4 ACCEPTANCE STANDARDS

A. The following acceptance standards shall be applied to this Contract. These standards are considered superior to typical industry standards. Any portion of the pavement markings that does not come up to these required acceptance standards will be removed at the direction of the Owner's Authorized Representative. Sandblast or otherwise remove unacceptable

pavement markings as required by the Owner's Authorized Representative and replace with new pavement markings that meet the requirements of this Section.

1. Puddles and thick accretions at the ends of lines of pavement markings.
2. Pavement markings that diverge from alignment.
3. Solid line pavement markings that show kinks, bends, bumps, or other deformities from true alignment.

END OF SECTION 321723

SECTION 323100 - SITE IMPROVEMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, General Requirements, will be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, coordinating with owner's vendor (for owner provided materials), incidental work, and construction methods necessary to furnish and install designated Site Improvements and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Pavilion
2. Shade sail
3. Site Furnishings (picnic table, benches, trash receptacles, etc.)
4. Cooling Station
5. Concrete Seat Wall – Freestanding
6. Skate Deterrents
7. Concrete Retaining Walls (less than 4')
8. Concrete Retaining Wall with Guardrail
9. Boulder Walls
10. Misc. Signage

B. Contractor shall furnish and install all other incidental items and accessories necessary to complete the Site Improvements as shown and specified, whether specifically mentioned or not

1.3 RELATED WORK UNDER OTHER SECTIONS

A. Related work specified and included in other Sections of the Specifications:

1. Division 31 - Earthwork
2. Section 321313 – Concrete Paving

1.4 REFERENCES

A. The following standards will apply to the work of this Section:

1. American Society for Testing and Materials (ASTM).
   a. ASTM A-53/A53M-01 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   d. ASTM E 228-95 Standard Test Method for Linear Thermal Expansion of Solid Materials With a Vitreous Silica Dilatometer.

2. TT-C-490C, Methods I and III.
3. AWS standard D1.1.

1.5 SUBMITTALS

A. Furnish for approval all Manufacturers' specifications for all items listed in this Section

B. Shop Drawings: The contractor shall submit Shop Drawings where noted for review and acceptance prior to product fabrication or delivery to the site. Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, color, and similar data to enable an adequate review of the information required.

C. Color Samples: Provide physical color samples for all equipment.

D. Sample Panels and Mockups

1. Job mock-up: Prior to installation of boulder walls, erect sample wall mock-ups in accordance with section 329000 Planting and Landscape Work for boulder walls.
2. Obtain Landscape Architect's and Owner's Authorized Representative's acceptance of the visual qualities of the mock-up before the start of any remaining boulder wall construction.
3. Mock-ups may remain in place as part of finished construction once approved.

1.6 SUBSTITUTIONS

A. Any proposed product substitutions shall be in accordance with the General Conditions; shall meet or exceed the specified warranty; shall be equivalent in specific features and qualities such as performance, weight, size, durability, visual effect; shall be compatible with the rest of the work; and **shall not require any changes or revisions to the Construction Documents**.

1.7 QUALITY ASSURANCE AND STANDARDS

A. Workmanship and finish will be equal to the best practice of modern shops for each item of work.

B. Inspect all components for correct fabrication and compliance with Specifications.

1.8 DELIVERIES, STORAGE, AND HANDLING

A. Store delivered Site Improvement items under this Section in a manner to prevent wracking or stress of components, and to prevent mechanical damage or damage by the elements.

B. Protect all stored materials and items from weather, careless handling and vandalism.

C. Items, which become rusted or damaged because of non-compliance with these conditions, will be rejected and will be replaced without additional cost to the Owner.

1.9 GENERAL INSTALLATION

A. Configure or secure exposed anchors, bolts or fasteners in such a way as to prevent their casual removal by use of vandal-proof heads or fastenings unless otherwise specified on Drawings.

B. Provision, delivery and installation of all materials, except as otherwise specified under other Sections of this Specification, will be in accordance with and paid for under the work of this Division 32 Section, Site Improvements.

C. Unless specifically called out in the Contract Documents, galvanized steel or cast iron sections to be joined will not be welded after galvanizing but will be mechanically attached by means of unexposed sleeves and fasteners sufficient to provide secure attachment under normal usage.

D. Set freestanding site improvement items plumb vertically and horizontally, regardless of the pitch of the finished surrounding grade unless otherwise shown on the Contract Documents.

E. The Contractor will be responsible for timing the delivery of site improvement items to minimize the on-site storage time prior to installation.

F. Protect all stored materials from weather, careless handling, and vandalism.

G. Contractor will be responsible for the correct location of site improvement items. Take particular care to maintain shapes, plumb and level during the pouring of concrete.

H. All Work will be accurately set to established lines and elevations and rigidly set in place to supporting construction.

1.10 COORDINATION

A. The Work of this Division 32 Section, Site Improvements, will be completely coordinated with the work of other Sections. Verify dimensions and work of other trades that adjoin materials of this Section before installing items specified.

B. Contractor shall work with the City and necessary equipment representatives to coordinate delivery of all Owner Provided Materials in a timely manner as necessary to keep construction on schedule.

1.11 GUARANTEE

A. The Contractor will furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Division 32 Section, Site Improvements, in addition to, and not in lieu of, guarantee requirements set forth under Division 1, General Requirements, and other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

B. Pay for repairs of any damage to any part of the project, or caused by defects in his work and for any repair to the materials or equipment caused by replacement. Complete all repairs to the satisfaction of the Owner's Representative.

C. Replace any part of the work installed under this contract requiring excessive maintenance. Work of this nature will be considered defective. Replace at no cost to the Owner upon notification during the one-year guarantee period.

PART 2 PRODUCTS

2.1 CONTRACTOR PROVIDED & CONTRACTOR INSTALLED SITE IMPROVEMENTS

A. Concrete Seat Wall - Freestanding: Provide as detailed and in accordance with specification Section 321313 Concrete

1. Skate Deterrents: Provide skate deterrents as indicated on the drawings.

B. Concrete Retaining Wall <4’: Provide as detailed and in accordance with specification Section 321313 Concrete.

C. Concrete Retaining Wall With Guardrail: Details in drawings are for reference only. Contractor to provide engineered drawings for retaining wall and guardrail.

D. Boulder Walls: Provide as detailed and as specified in Section 329000 Exterior Planting and Landscape Work.

E. Misc. Signage: Provide Signage as detailed and in locations shown on the drawings. Provide shop drawings for approval.

2.2 OWNER PURCHASED, CONTRACTOR INSTALLED

A. The following items will be owner-purchased and contractor-installed. The contractor is fully responsible for all coordination with the manufacturer, including confirming shop drawings, scheduling delivery to the site, receiving and inspecting materials upon delivery, and notifying the manufacturer of any missing or damaged components. The Contractor shall store, protect, and install these structures in accordance with the drawings, specifications, and manufacturer requirements. The Contractor shall serve as the primary point of contact with the manufacturer for all communication, scheduling, and warranty coordination related to these items. The owner's role is limited to purchasing the structures only.

For owner-purchased items that include vendor-provided installation the Contractor shall coordinate, schedule, and integrate the vendor’s work into the overall construction sequence as if the vendor were a subcontractor. The Contractor shall be responsible for site access, sequencing, safety coordination, and ensuring the vendor’s work is properly integrated with all other trades.

B. Pavilion: Contractor shall coordinate delivery with Vendor to allow proper time for construction sequencing to keep the project on schedule. Contractor will be responsible for grading work, footings, installation and erection of Pavilion, concrete pad, electrical and lighting work.

C. Shade Sail: Contractor shall coordinate delivery with Vendor to allow proper time for construction sequencing to keep the project on schedule. Contractor will be responsible for grading work, footings, installation and erection of Shade Sail, concrete pad, electrical and lighting work.

D. Picnic Table: as specified in the products and materials schedule and in locations as shown on the drawings.

E. Benches: as specified in the products and materials schedule and in locations as shown on the drawings.

F. Trash Receptacles: as specified in the products and materials schedule and in locations as shown on the drawings

G. Bike Racks: as specified in the products and materials schedule and in locations as shown on the drawings.

H. Scooter/Skateboard Racks: as specified in the products and materials schedule and in locations as shown on the drawings.

I. Bike Repair Station: as specified in the products and materials schedule and in locations as shown on the drawings.

J. Dog Waste Stations: as specified in the products and materials schedule and in locations as shown on the drawings.

K. Cooling Station: as specified in the products and materials schedule and in locations as shown on the drawings.

2.3 EARTHWORK MATERIALS

A. All backfill materials, including base and sub-base materials, ordinary borrow, drainage fill and structural fill will be as specified under the Division 31 Section, Earthwork, of this Specification, and provided, delivered and paid for under the work of this Division 32 Section, Site Improvements.

PART 3 EXECUTION

3.1 EARTHWORK

A. All excavation, filling, compacting and grading of backfill materials, including base and sub base materials, ordinary borrow, drainage fill and structural associated with and used in the installation of the items of this Division 32 Section, Site Improvements, will be as specified under the Division 31 Section, Earthwork, and performed and paid for under the work of this Division 32 Section, Site Improvements.

3.2 CONCRETE

A. Concrete footing placement, protection, and formwork will be as specified under the Division 32 Section Site Concrete, of this Specification and installed and paid for under the work of this Division 32 Section, Site Improvements. Concrete footings will be to the sizes noted on the Contract Documents.

3.3 CONTRACTOR PROVIDED & CONTRACTOR INSTALLED EQUIPMENT/IMPROVEMENTS INSTALLATION

A. Concrete Seat Wall - Freestanding: Shall be installed as detailed and in the locations shown on the drawings
   1. Skate Deterrents: Install as detailed in the location indicated on the drawings

B. Concrete Retaining Wall <4': Shall be installed as detailed and in the locations shown on the drawings.

C. Concrete Retaining Wall With Guardrail: Details in drawings are for reference only. Contractor to provide engineered drawings for retaining wall and guardrail.

D. Boulder Wall: Per Specification section 329000 Exterior and Landscaping

E. Misc. Signage: Install signs as detailed in all locations shown on the drawings.

3.4 OWNER PURCHASED, CONTRACTOR INSTALLED

A. Pavilion: Contractor to install Pavilion, as detailed and in accordance with the Manufacturer's installation instructions.

1. Contractor shall be responsible for grading work, concrete pad, concrete footings, and electrical and lighting work associated with the pavilion, in addition to erecting and installing the structures.

2. Coordinate structure footings with electrical work for electrical conduits at post footings. Electrical to run within the pavilion with **NO** exposed conduit.

B. Shade Sail: Contractor to install Shade Sail, as detailed and in accordance with the Manufacturer's installation instructions.

   a. Contractor shall be responsible for grading work, concrete pad, concrete footings, and electrical and lighting work associated with the shade sail, in addition to erecting and installing the structures.

   b. Coordinate structure footings with electrical work for electrical conduits only at post footings. Conduits for future lighting purposes.

C. Picnic Table: Shall be installed as per the manufacturer's installation instructions in locations shown on the drawings.

D. Benches: Shall be installed as per the manufacturer's installation instructions in locations shown on the drawings.

E. Trash Receptacles: Shall be installed as per the manufacturer's installation instructions in locations shown on the drawings.

F. Bike Racks: Shall be installed as per the manufacturer's installation instructions in locations shown on the drawings.

G. Scooter/Skateboard Racks: Shall be installed as per the manufacturer's installation instructions in locations shown on the drawings.

H. Bike Repair Station: Shall be installed as per the manufacturer's installation instructions in locations shown on the drawings.

I. Dog Waste Stations: Shall be installed as per the manufacturer's installation instructions in locations shown on the drawings.

J. The Cooling Stations: Shall be installed in the location shown on the Drawings. The Contractor shall coordinate with the cooling station manufacturer (Vortex) and install per manufacturer's requirements, Drawings and Details.

   a. The Contractor shall provide and coordinate water service line to the cooling station locations and all other items required to complete the work and shall coordinate final connection requirements.

END OF SECTION 323100

SECTION 328400 - IRRIGATION SYSTEMS

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 piping, valves, sprinklers, specialties, controls, and wiring for automatic-control irrigation system.

1.3 WORK TO BE DONE

A. Work to be done includes furnishing all labor, materials, equipment and services required to complete all irrigation work indicated on the Drawings, as specified herein, or both. The work to be performed under this Section shall consist of furnishing all labor and materials necessary to construct a complete working and tested irrigation system as per all drawings and specifications, providing full head-to-head coverage on all lawns and planting areas on the site. Included also will be maintenance and warranties. Work shall also include coordinating with supplier and Provo City for commissioning, programing, and training by the manufacturer's certified service representative.

B. The Contractor shall perform, but not be limited to, all of the following functions: Paying all connection fees, deposits and all other charges related to the connection to the water source. Obtain all permits, complete all excavation, backfill, provide backflow device, tapping saddle, yoke, stop and waste, corp. cock, concrete vaults and miscellaneous pipe fitting. Make necessary road repairs, provide safety barrier, and make connection to water source. All in compliance to applicable codes and requirements of the utility companies involved.

C. The electrical point of connection for the irrigation system shall be 120-volt electrical supply.

D. The Drawings and Specifications must be interpreted and are intended to complement each other. The Contractor shall furnish and install all parts, which may be required by the Drawings and omitted by the Specifications, or vice versa, just as though required by both. Should there appear to be discrepancies or questions of intent, the Contractor shall refer the matter to the Owner's Representative for decision, and his interpretation shall be final, conclusive, and binding.

E. All necessary changes to the Drawings to avoid any obstacles shall be made by the Contractor with the approval of the Owner's Representative.

F. Trench excavation, back filling, and bedding materials, together with the testing of the completed installation shall be included in this work.

G. The work shall be constructed and finished in every respect in a good, workmanlike, and substantial manner, to the full intent and meaning of the Drawings and Specifications. All parts necessary for the proper and complete execution of the work, whether the same may have been specifically mentioned or not, or indicated on the Drawings, shall be done or furnished in a manner corresponding with the rest of the work as if the same were specifically herein described.

H. Record Drawings as well as Operating & Maintenance Manual generation, in accordance to these specifications shall also be included in this work.

I. If electrical service is not already in place, the Contractor will be required to make all necessary arrangements with the Power Company including, but not limited to, paying fees, making power connections, providing poles, weatherhead and meter, etc., as specified on the plans. All permits, fees, and compliance with electrical company requirements, shall be the Contractor's responsibility.

1.4 SCOPE

A. The irrigation system shown on the Drawings and described within these Specifications represents an automatic controller irrigation system. The system is designed for a **minimum operating pressure at the irrigation mainline point of connection and maximum flow demand as noted on the drawings. The irrigation contractor shall verify water pressure prior to construction and report any differences to Owner's Representative**.

1.5 RELATED WORK UNDER OTHER SECTIONS

A. Carefully examine all of the Contract Documents for requirements that affect the Work of this Section.

1.6 ORDINANCES, PERMITS AND FEES

A. The Work under this Section shall comply with all ordinances and regulations of authorities having jurisdiction.

B. The Contractor shall obtain and pay for any and all permits, tests and certifications required for the execution of Work under this Section.

C. Furnish copies of Permits, Certifications and Approval Notices to the Owner's Representative prior to requesting payment.

D. Call Blue Stakes to verify location of existing utilities prior to commencement of work.

1.7 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself of existing conditions on the site before submitting his bid, and shall be fully responsible for carrying out all work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual Work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed, except those conditions described in the General Conditions.

B. Investigate and determine available water supply pressure and flow characteristics.

1.8 QUALITY ASSURANCE

A. Installer: A firm that has at least five (5) years' experience in work of the type and size required by this Section and which is acceptable to the Owner's Representative.

B. References: The Contractor must supply three references for work of this type and size with their bid including names and phone numbers of contact person(s).

C. Applicable requirements of accepted Standards and Codes shall apply to the Work of this Section and shall be so labeled or listed:
1. American Society for Testing & Materials (ASTM)
2. National Plumbing Code (NPC)
3. National Electric Code (NEC)
4. National Sanitary Foundation (NSF)
5. American Society of Agricultural Engineers (ASAE)
6. Underwriters Laboratories, Inc. (UL)
7. Occupational Safety and Health Regulations (OSHA)

1.9 TRAINING AND CERTIFICATIONS

A. Harco or an approved equal Joint Restraint Training: The irrigation contractor superintendent, project foreman, supervisors, and all installation personnel who will perform work using Harco or an approved equal Joints and Joint Restraints shall participate in an on-site training with a joint restraint authorized representative prior to beginning installation. It is the responsibility of the contractor to obtain such training and certifications and to provide copies of the “Certificate of Completion” for each person in accordance with the Submittal Requirements.

Certifications: All General laborers or workers on the Project shall be previously trained and familiar with sprinkler installation and have a minimum of one-year of experience.

Those workers performing tasks related to PVC pipe, HDPE and electrical components shall have certificates designated below:
1. All workers engaged in handling, assembling and gluing of PVC pipe shall carry on Project site a Certificate of Training from the IPS factory representative authorizing said worker to prime and glue PVC pipe. (Contact Bill Godwin, G & S Sales, 801 972-0659).
2. An HDPE training certificate is required by all personnel engaged in assembly and the fusion of HDPE pipe from approved pipe manufacturers. The certification shall be performed on-site by the successful pipe and fitting supplier. A supplier who fails to provide the training and certification will not be an approved supplier (unless technicians have certification within the past 24 months).
3. All workers engaged in the handling and installation of buried power wire, remote control valve wire, wire connectors, controllers and grounding equipment shall carry on Project site a Certificate of Training from Paige Wire factory representative authorizing said worker to install wire, wire connectors and grounding equipment. (Contact Vince Nolletti, Vice President Irrigation Operations, Paige Electric Co., LP, 559-431-2346).
4. **Documents verifying Certified Irrigation Contractor, PVC, and HDPE pipe certification and electrical component certification shall be provided to OAR at least 30 days in advance of any irrigation installation on Project site**.

1.10 TESTS

A. Observation: The Owner’s Representative will be on site at various times to ensure the system is being installed according to the Specifications and Drawings.

B. Operational Test: After completion of the system, test the operation of entire system as directed by the Owner's Representative. Demonstrate to the Owner's Representative that all irrigated areas are being adequately covered (See Part 3 - Execution). Any deficiencies identified at this time will require revisions and adjusting by the Contractor at the Contractor’s expense. Any deficient irrigation head will be adjusted for proper coverage and set to proper depth at this time.

C. Inspections will be required for:

1. Hydrostatic test of irrigation main line – 150 psi for not less than 2 hours.
2. All piping system layout before backfilling.
3. Coverage test.
4. Final inspection / Start of Maintenance.

D. Inspection Requests: Contractor shall notify the Project Manager a minimum of 48 hours (two working days) in advance for all inspections.

1.11 SUBMITTALS

A. Refer to 010000 General Requirements for additional submittal requirements.

B. Submittals shall be submitted for approval in **Electronic PDF format.**

C. List of Materials: Submit for approval **Electronic PDF** copies of the complete list of materials proposed for use. Quantities of materials and equipment need not be included. No deviations from the specification shall be allowed, except as provided for in these documents.

D. Product Data: Submit manufacturer's technical product data and installation instructions for all irrigation system materials and products to be installed to the Owner's Authorized Representative for approval prior to the start of work. Work on the irrigation system may not commence until product data submittal is received and approved. Submittals shall be marked up to show proper sizes, flows, etc.

E. Record Irrigation Drawings: The Contractor shall maintain complete Record Drawings showing all deviations from the contract documents made during construction affecting the sleeves, main line pipe, controller locations, isolation valves, remote control valves, quick coupler locations, and other equipment indicated on the drawings. All wire routing, wire size, and splices shall be indicated. These Record Drawings shall be kept on a clean set of prints of the contract documents and will be reviewed by the Owner's representative throughout construction to verify that changes are being recorded. Main line pipe and wire route shall have two (2) distinctly different graphic symbols (line types). These record drawings shall be submitted to the Owner's representative before the time of the Systems Inspection/Substantial Completion Inspection. The Substantial Completion Certificate Date will not be issued until the Owner's representative receives the Record Irrigation Drawings.

F. Maintenance Data and Operating Instructions: Submit (1) three ring, hard cover binder and one PDF(Electronic File) titled MAINTENANCE AND OPERATING INSTRUCTIONS FOR THE [Project Name] to the Owner's representatives office prior to application for acceptance and final payment. After review and approval, the copies will be forwarded to the Owner. Included in the Maintenance and Operating Manual shall be:
1. Table of Contents
2. Written description of Central Control System.
3. System drawings:
   a. One (1) copy of the original plan.
   b. One (1) copy of the Record Drawing.
4. Listing of Manufacturers.
5. Manufacturers' data where multiple model, type and size listings are included, clearly and conspicuously indicating those that are pertinent to this installation.
   a. "APPROVED" submittals of all irrigation equipment.
   b. Instructions of Operation
   c. Maintenance: including complete troubleshooting charts.
   d. Parts list.
   e. Names, addresses and telephone numbers of recommended repair and service companies.
6. Winterization and spring start-up procedures.

7. Guarantee data.

G. Control Zone map: Upon completion of system, place in each controller, a color-coded copy of the area that controller services; indicating zone number, type of plant material and location on project that zone services. Laminate map with heat shrink clear plastic. **Copy of Control Zone Map shall also be included in Operation and Maintenance Manual.**

H. Controller Wiring Map: Each separate run of two-wire control wiring is to be a different color wire or marked with colored tape at all splices. The color of each separate two-wire run shall be indicated on the Control Wiring Map. The contractor shall also record amperage (mA) of each two-wire run from the farthest point on each run back to the controller and note amperage reading on the Controller Wiring Map. Controller Wiring Map shall be laminated with heat shrink clear plastic and placed in the controller(s). **Copy of Controller Wiring Map shall also be included in Operation and Maintenance Manual.**

1.12 DELIVERY, STORAGE AND HANDLING

A. Store and handle all materials in compliance with manufacturer instructions and recommendations. Protect from all possible damage. Minimize on-site storage.

1.13 GUARANTEE

A. The Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law.

B. In addition to the manufacturer’s guarantees the Contractor shall warrant the entire irrigation system, both parts and labor for a period of one (1) year from the date of acceptance by the Owner.

C. As part of the one-year warranty the Contractor shall perform the first year-end winterization and spring start-up for the irrigation system in the presence of the Owner’s designated maintenance personnel. The Contractor shall operate, maintain until acceptance, and guarantee the new system until all lawn and plants planted on this project have become established and have been approved by the Owner’s Representative.

D. The Contractor shall correct any deficiencies when notified during the guarantee period, and additionally correct, to the satisfaction of the Owner, any damage to buildings or grounds caused by deficient work at no cost to the Owner.

E. All guarantees shall be in writing and submitted to the Owner’s representative for review and approval on or before the date of Substantial Completion.

1.14 SUBSTANTIAL COMPLETION

A. The date of Substantial Completion for the irrigation system will be when the Maintenance and Operating Manual has been approved, the As-Built Record Drawings have been submitted, and the irrigation system is working as intended. This will be determined by observation by the Landscape Architect and Owner’s Representative.

1.15 COORDINATION

A. The Contractor shall at all times coordinate his work closely with the Owner's Representative to avoid misunderstandings and to efficiently bring the project to completion. The Owner's Representative shall be notified as to the start of work, progression and completion, as well as any changes to the drawings before the change is made. The Contractor shall also coordinate his work with that of his sub-contractors.

B. The Contractor shall be held responsible for and shall pay for all damage to other work caused by his work, workmen or sub-contractors. Repairing of such damage shall be done by the Contractor who installed the work, as directed by the Owner's Representative.

1.16 MAINTENANCE AND OPERATING INSTRUCTIONS

A. Contractor shall include in their Bid an allowance for four (4) hours of instruction of Owner and/or Owner's personnel upon completion of check/test/start-up/adjust operations by a competent operator (The Owner's Representative shall be notified at least one (1) week in advance of check/-test/start-up/adjust operations).

1.17 PROCEDURE

A. Notify all city departments and/or public utility owners concerned, of the time and location of any work that may affect them. Cooperate and coordinate with them in the protection and/or repairs of any utilities.

B. Provide temporary support, adequate protection and maintenance of all structures, drains, sewers, and other obstructions encountered. Where grade or alignment is obstructed, the obstruction shall be permanently supported, relocated, removed or reconstructed as directed by the Owner's Representative.

C. SUBSTITUTION OF MATERIALS: Any proposed product substitutions shall be in accordance with the General Conditions; shall meet or exceed specified warranty; shall be equivalent in specific features and qualities such as performance, standard and optional operational features, operation, size, and durability, shall be compatible with the rest of the work; and shall not require any changes or revisions to the Construction Documents.

D. SYSTEM PRESSURE The irrigation system is designed for a minimum static pressure as noted on the drawings unless otherwise specified and is schematic only, with the intent to convey full head-to-head coverage of the lawns and planting areas affected. The system must also provide the manufacturer's recommended minimum operating pressure or greater to every head while maintaining sufficient pressure to overcome the losses due to friction in the piping, fittings, and all other equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of the system. All material overages at the completion of the installation are the property of the Contractor and shall be removed from the site.

B. No material substitutions from the irrigation products described in these specifications and shown on the drawings shall be made without prior approval and acceptance from the Owner's Representative. For the existing sprinkler irrigation system on the site, the Contractor shall remove any lines being abandoned, and cap or plug the ends of lines remaining in service with proper fittings and thrust blocks. The contractor shall remove or relocate existing heads and/or connect new lines to existing lines, as indicated on the plans.

C. Any existing head, valve, valve marker, valve box, or other existing equipment located where there will be a grade or surface material change, shall be adjusted up or down to its proper position in relation to the new finished grade, at no additional cost to the owner, unless the plans show it to be relocated.

2.2 IRRIGATION PIPE

A. All HDPE Main Line shall be compound 4710 SDR 11 rating (see plans for sizes and locations)

B. All HDPE Laterals pipes shall be compound 4710 SDR 11 rating (see plans for sizes and locations)

C. All Main Line Pipe 4" or larger shall be PVC Class 200 O-ring pipe conforming to ASTM D1785-83 and ASTM D-1684 with ratings printed on pipe.

D. All Main Line or Lateral Line Pipe 3" or smaller shall be Schedule 40 PVC plastic pipe ASTM D 1785 (see plans for sizes and locations) with ratings printed on pipe.

E. All main and lateral line pipe 2 ½" or smaller shall have PVC plastic socket fittings ASTM D 2464 & 2467.

F. Flex swing pipe shall be THICK-WALLED POLY PIPE as manufactured by TORO or RAIN BIRD. This pipe is to be used only between spray heads and lateral lines and shall not exceed a distance of 2 ft. and shall only be used on heads of 7 GPM or less.

2.3 IRRIGATION FITTINGS

A. Fittings for mainline pipe sizes 3" or larger shall be Harco or approved equal joint restraint or M.J.or equal fittings with transition gaskets at all changes of direction tees, ells, caps, etc. M.J. fittings to be greased, wrapped, and 'megalugged'. An exception for automatic valves: Fitting transition from main line pipe may be Harco ductile iron fitting.

B. HDPE Pipe Fittings
1. HDPE fittings shall be 4710 DR11 rated butt fusion or electrofusion only. No socket fusion fittings will be permitted.
2. HDPE connections shall be HARCO HDPE flanged or HARCO HDPE Transition Fitting (or approved equal)
3. All HDPE Flange bolts shall be grade 8 zinc-coated bolts for sizes 10" thru 12" or grade 5 zinc-coated bolts for 4" thru 8".
4. Nipples: shall be Harco butt fusion x threaded transition nipples, or approved equal.

C. Fittings for pipe 2 ½"" or smaller shall be:
1. PVC Mainlines – SCH 80 for all solvent weld fittings
2. PVC Lateral Lines – SCH 40 for all solvent weld fittings
3. Use Weld-on, IPS P-70 Primer and Weld-on IPS PVC 711 plastic pipe cement. Products are to be applied per manufacturer's specifications. All connections on main lines must be allowed to set for twenty-four hours prior to pressurization.

D. All tees coming out of main lines or valves and other fixtures (with the exception of Harco or approved equal swivel tees), shall be horizontal so that no weight or pressure may be exerted through the fixture on the top or bottom of the main line. Depending on main line type, and size, tees shall be Harco or approved equal Ductile Iron fittings, HDPE butt or electrofusion fittings, or PVC Sch. 80 SXSXS with SXT Sch. 80 bushing of the appropriate size to the valves and Sch. 40 SXT tees for the head or heads. See detailed drawings.

E. All tees coming out of the lateral lines for heads and other fixtures, shall be horizontal so that no direct weight or pressure may be exerted through the head to the top or bottom of the lateral line. Tees on lateral lines shall also be HDPE butt or electrofusion, or PVC SXSXT to the head swing joints, depending on lateral pipe material indicated on the drawings.

F. No bends other than very gradual in pipe shall be permitted. The Contractor shall use elbow fittings of 90 and 45 degrees as the situations demand. The use of 22.5 degree or smaller angle fittings shall only be used as approved by Salt Lake County.

G. Flex Swing Piping – Schedule 80 threaded 1/2” or 3/4” x “barbed insert” elbows.

H. Quick Coupler– as detailed

I. Pop-Up Rotor Irrigation Heads – SCH 80 Double Swing Joint – see detail

J. All solvent welded joints shall be made with IPS Weld-on-Line, P-70 Primer, and No. 711 cement.

K. Lateral lines shall be connected by either HDPE butt or electrofusion, or PVC solvent-welded or threaded connections, depending on the lateral pipe material indicated on the drawings. Use IPS Weld-on-Line, P-70 Primer, and No. 711 cement for solvent-welded connections and Teflon tape for PVC threaded connections.

2.4 SLEEVES

A. Sleeves shall be installed for all irrigation pipe and wire under non-soil areas and where indicated on the Drawings. Sleeve size shall be twice the nominal size of the pipe, and a minimum of 4 inches. PVC Sch. 40 water pipe shall be used except where noted.

2.5 WIRE CONDUIT

A. Conduit for wiring to controllers shall be schedule 80 PVC, size as indicated on chart.

Number of Wires	Minimum Conduit Size
1-7	1”
8-11	1 1/2"
12-22	2”
23-31	2 1/2"
32-36	3”

B. Two-Wire Control Wire: Conduit for two-wire path, master valve wiring, or communication cable shall be 1" HDPE 100 PSI Poly Pipe. Install a standard size valve box as a 'Pull Box' at minimum of every 150'.

2.6 STOP AND WASTE VALVES

A. Stop and Waste type valves shall be solid bronze meeting Federal Specification WW-V-54, CLASS A, Type 1. Size shall be the same as the mainline of the sprinkler system which it is installed on. This valve must be installed at the same depth as the water source, the stop and waste will be installed in a curb box as herein specified. Valve shall be key operated, and of Meuller and/or Ford Type Valves.

2.7 BACKFLOW PREVENTERS

A. Provide Backflow Preventer as specified on the drawings.

2.8 BACKFLOW PREVENTER ENCLOSURES

A. Backflow Enclosure shall be a Strong Box Stainless Steel Enclosure, or approved equal with locking kit, and Insulated Blanket. Enclosure shall be sized to fit specified backflow preventer assembly as detailed and meeting all state and local codes.

2.9 FILTERS

A. Filter shall be as specified on the drawings.

B. Filter enclosure shall be as indicated on the drawings and details.

2.10 DUAL WATER SOURCE PHYSICAL DISCONNECT ASSEMBLY

A. Provide Physical Disconnect Assembly as detailed on the drawings.

2.11 HYDROMETERS, FLOW SENSORS, AND MASTER VALVES

A. All Hydrometers, Master Valves and Flow Sensors shall be of the size and type as specified on the drawings and installed as detailed and in accordance with manufacturer's installation instructions. Unless otherwise indicated on the drawings, hydrometers, master valves, and flow sensors shall be installed in their own separate valve box.

2.12 ELECTRONIC CONTROL VALVES

A. All electric remote control valves shall be of the size and type as specified on the Drawings.

2.13 DRIP CONTROL VALVE ASSEMBLIES

A. All drip control valve assemblies shall include valve, filter and pressure regulator. Size and type as specified on the Drawings.

2.14 VALVE BOXES

A. Valve boxes for control valves shall be rectangular valve box with bolt down cover as manufactured by Carson or approved equal. Valve boxes shall be sized to provide ample room for access and repair. No valve box shall rest directly upon the valve or any fixture associated with it. Each valve box shall be centered on the valve it covers. Each valve box shall have 6 inches of pea gravel placed in the bottom underneath the valve and lines to reduce the potential of mud and standing water therein.

B. Valve boxes for quick coupling valves, isolation valves, and manual drain valves shall be 10” round valve box as manufactured by Rainbird or approved equal.

C. Valve box extensions shall be provided as required for proper box depth.

D. Valve boxes and lids shall be **green** in all lawn areas and **tan** to match the mulch specified in all plant beds. The contractor shall verify availability from suppliers and state the color used in the submittals. It is the contractor’s responsibility to order custom colors well in advance.

E. Valve box for electric control valves, isolation valve, hydrometers, and quick coupling valves shall be a rectangular valve box and bolt down cover as manufactured by Rainbird, or approved equal and shall be of size required to fit all necessary equipment while allowing adequate space for servicing of equipment.

F. Valve boxes for approved wire splices, drain valves, resilient wedge isolation valves, shall be 10” round valve box as manufactured by Rainbird, or approved equal.

G. Valve box extensions shall be provided as required for proper box depth.

2.15 AUTOMATIC CONTROLLER

A. Automatic Controller and enclosure as specified on the drawings

2.16 WIRE

A. Standard Control Wire: All valve control and common wire shall be minimum #14 single strand, solid copper, 600v, direct burial PE insulated type cable, and shall meet all state and local codes for this service. Individual wires must be used for each zone valve. Common wire shall be white in color, control wire shall be red in color, and spare wires, installed where indicated on the drawings shall be blue. White color shall be used for common wire only.

B. In ground wire connections shall be UL listed, manufactured by 3M, model DBY-6 splice kits. All wire splices shall be made in valve boxes, at controller, or at valves.

C. Wire type and method of installation shall be in accordance with local codes for NEC Class II circuits of 30-volt A.C. or less.

D. Splices in electric control wires shall be soldered first and then fitted with a 3M DBY Direct Bury Splice Kit. No exceptions. All splices shall be contained in a valve box.

E. Provide two spare control wires along each leg or section of mainline from the valve(s) farthest from controller(s) back to the associated controller. Loop spare control wires back through each valve box back to the controller(s).

2.17 TWO-WIRE CONTROLLER WIRE

A. Shall be as indicated in the Supplemental Two Wire Notes included on the drawings and shall be run from the controller to each decoder.

B. All two-wire cable to be installed in 1" HDPE conduit. In areas where two-wire conduit span between valve boxes is greater than 150, Contractor shall install standard size valve box as conduit pull box every 150' and install extra cable length as noted.

C. For trouble shooting purposes, a star configuration is to be used as opposed to a looped configuration.

D. An electric decoder cable fuse devise (DCFD) to be installed at all splits in the 2-wire path where more than two runs of Maxi Cable come together. Install DCFD and extra cable in standard size valve box.

E. Each two-wire branch is to be either a different color of wire, or marked with colored tape at all splices for troubleshooting purposes and recorded on the Controller Wiring Map.

F. An extra 36" of cable shall be installed on both the incoming and outgoing runs of two-wire cable at each control valve to allow maintenance personnel to lift control valves out of box for maintenance and servicing.

G. 36" of extra cable length to be installed at all splices and conduit pull boxes, and valve boxes.

H. Contractor shall clearly indicate on As-Builts and Controller Wiring Map the two-wire path routing, with each color of wire, and record the amperage of each two-wire run from the farthest point on each run back to the controller on the As-Builts and Controller Wiring Map.

2.18 TWO WIRE DECODERS

A. Two-Wire Decoders shall be as indicated in the Supplemental Two Wire Notes included on the drawings. Only one decoder to one valve shall be used with no exceptions.

B. Contractor to install decoders as per manufacturer's installation instructions. New decoder to be numbered in sequence with current system.

C. Decoders are to be pre-addressed from the manufacturer.

2.19 LINE SURGE PROTECTION ALONG TWO-WIRE PATH

A. Two-wire surge protection shall be provided in accordance with manufacturer's installation instructions and requirements and as indicated in the Supplementary Two Wire notes on the drawings.

B. Grounding is to be installed at each line surge protection installed as per decoder grounding details and shall meet manufacturer's minimum grounding requirements as necessary to maintain product warranty. All grounding shall allow for 10 OHMS of resistance or less.

2.20 COMMUNICATION CABLE – Not Required. Flow sensors are to be connected via senor decoder.

2.21 ISOLATION VALVES

A. Mainline Isolation Valves shall be resilient Wedge Gate Valves - conforming to AWWA specification C 509. They shall be of Class 200 cast iron body. Resilient-seated Gate Valve and shall have a non-rising stem with rubber "0" rings and square operating nut. Stems shall be of cold rolled, solid bronze, high tensile strength. Valve shall be high strength cast iron, fully encapsulated urethane rubber wedge. Gate valves shall be hydrostatically pressure tested for 400 P.S.I. and shall be designated for a working pressure of 200 P.S.I. Valve shall be American made.

B. Control Valve Manifold Isolation Valves
1. Isolation Valve shall be a gate valve or ball valve as detailed on the drawings and as specified.
2. Gate Valves: Milwaukee brand or approved American made brass gate valve with non-rising stem. Size shall be the same size as the main line on which it is installed.
3. Ball Valves: shall be solid bronze meeting Federal Specification WW-V-54, CLASS A, TYPE. Size shall be the same size as the main line on which it is installed.
4. Manifold Isolation Valve shall be installed on the up-stream side of the electric remote control valve, as detailed. Install one (1) isolation valve per control valve cluster. For control valve clusters larger than three (3), provide one (1) isolation valve per three (3) control valves.

2.22 QUICK COUPLER

A. Quick coupling valves shall be as specified on the drawings.

2.23 MANUAL DRAIN VALVES

A. All drain valves shall be 3/4" Mueller &/or Ford ball type and installed as per details on the drawings. Drain valves are to be installed on mainlines only.

B. The location of each manual drain shall be shown on the "as built" drawing with dimensions from the nearest permanent fixture, such as a building corner, etc....

C. Each manual drain valve will be accessed by a 2-inch P.V.C. Schedule 40 pipe sleeve, capped by a Weathermatic 906L locking valve cap with a RLK-1 key, no approved equals, enclosed within a 10" round Brooks Bolt down box - top of drain sleeve to be 3" - 6" below lids of Brooks Box.

D. Each manual drain shall empty into a gravel sump, a minimum of 18 inches by 18 inches by 12 inches deep. The gravel shall be washed 3/4-inch rock. No pea gravel will be allowed.

2.24 CRUSHED STONE

A. Crushed stone shall be as specified on the Drawings. Crushed stone shall be used under valve boxes.

2.25 IRRIGATION HEADS

A. Pop-up spray and rotors as specified on the drawings.

2.26 PREFABRICATED SWING JOINTS

A. Prefabricated swing joint with brass threaded inserts shall be as manufactured by Spears or Dura.

2.27 DRIP TUBING AND COMPONENTS

A. Drip Tubing & Fittings: Drip tubing shall be as specified on the Drawings and Details.

B. Drip Emitters: Shall be as specified on the drawngs and details.

C. Line Flushing Valves: shall be as specified on drawings.

D. Drip Indicators: Shall be as specified on drawings.

2.28 THRUST BLOCKS AND JOINT RESTRAINTS

A. Provide joint restraints as per manufacturer's installation requirements and as detailed wherever the main line pipe:
1. Changes any direction at tees, angles, and crosses vertical and horizontal.
2. Changes size at reducers.
3. Stops at a dead-end.
4. Valves at which thrust develops when closed.
5. Thrust blocks are only acceptable at Backflow Preventer Assembly, as detailed.

B. The size and type of thrust block depends on pressure, pipe size, kind of soil, and type of fitting. As a general rule, one cubic foot (minimum) of class AA(AE) Type II concrete is required for each thrust block.

C. Thrust blocks shall rest against undisturbed original earth in the direction of thrust.

D. Upward Thrusts at Fittings: Where a fitting is used to make a vertical bend, use a bar to anchor the fitting to a thrust block braced against undisturbed soil. The thrust block should have enough resistance to withstand upward and outward thrusts at the fitting.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine all contract documents applying to this Section noting any discrepancies and bringing the same to the attention of the Owner's Representative for timely resolution.

B. Make all field measurements necessary for the work noting the relationship of the irrigation work to the other trades. Coordinate with other trades (landscaping and other site work trades). Project shall be laid out essentially as indicated on the Irrigation Plans, making minor adjustments for variations in the planting arrangement. Major changes shall be reviewed with the Owner's Representative prior to proceeding.

C. Irrigation component locations are shown on the drawings diagrammatically. It shall be the contractor's responsibility to determine the exact location of each valve and quick coupler to accommodate the conditions as found on the site. Avoid installing valves in areas where curbs and sidewalks come together or at any intersection of two or more walkways. All deviations from the drawings will be noted on the "As-Built" drawings.

D. At all times, protect existing irrigation, landscaping, paving, structures, walls, footings, etc. from damage. Any inadvertent damage to the work of another trade shall be reported at once.

E. The points of reference shall be the existing walks, buildings, and curbs. The staking shall be approved by the Owner's Representative prior to commencing installation operations. Any changes in the system which appear necessary, due to field conditions, must be called to the attention of the Owner's Representative and approved at the time.

F. Excavation work shall be as deep and as wide as will be required to safely perform the work, such as making mainline connections or forming vaults. Trenches shall be deep and wide enough to provide working space and to provide 18 to 30 inches of cover over the top of all pipe and fittings on main lines (lines which maintain a constant water pressure) and 12"-16" of cover over all lateral line piping. All trench bottoms shall be sloped so that the pipe will gravity drain back to the nearest manual drain. If the existing main line is deeper than 30 inches, the Contractor shall install a riser to a depth of 18 to 30 inches and then install the new line at the required 18-30" depth. At no time will the mainline be installed deeper than 30" unless prior approval by Owner's Representative. Each pipe laying in a mainline or lateral line trench shall not touch any other pipe. Maintain a pipe separation distance of 6" between each pipe.

G. Irrigation heads, valves and quick coupler locations are shown on the drawings diagrammatically. It shall be the contractor's responsibility to determine the exact location of each irrigation head, valve and quick coupler to accommodate the conditions as found on the site in order to provide complete head-to-head coverage of all areas. Avoid installing valves in areas where curbs and sidewalks come together or at any intersection of two or more walkways. Do NOT exceed the manufacturer's recommended spacing or as shown on the drawings for the irrigation heads. Minor adjustments in the system will be permitted to clear existing fixed obstructions subject to the approval of the Owner's Representative. All deviations from the drawings will be noted on the "As-Built" drawings.

H. All irrigation heads will be set perpendicular to the finished grade unless otherwise designated on the drawings and specifications.

I. POP-UP HEADS: Trenches for lines supplying pop-up heads shall be deep enough to maintain a minimum of 12-16 inches of cover over the top of all pipe and fittings. Trenches for these lines shall be a minimum of 6 inches away from any walks and curbs, and of sufficient width to accommodate tees coming out sideways (horizontally) from the laterals.

3.2 PIPE AND FITTINGS INSTALLATION

A. Using proper width trencher chain, excavate a straight and true trench to the depth required to provide specified cover over piping.

B. Loam encountered within the limits of trench excavation for irrigation mains and branch lines shall be carefully removed to the lines and depths as shown on the Drawings and stockpiled for subsequent replacement in the upper 6 inches of the trench from which it is excavated. Such removal and replacement of the quantities of loam shall be considered incidental to the irrigation system and no additional compensation will be allowed therefore.

C. Back filling shall be accomplished as follows: the first 10-inch of backfill material shall contain no foreign matter and no rock larger than 1 inch in diameter. Carefully place material around pipe and wire and tamp in place. Remainder of backfill shall be laid-up in 6-inch (maximum) lifts and tamped to compaction with mechanical equipment matching adjacent undisturbed area. Frozen material shall not be used for backfill.

D. All threaded fittings shall be installed using Teflon tape.

E. HDPE Pipe Installation:
1. All HDPE pipes shall be installed in accordance with the manufacturer's installation guide and recommendations.
2. With HDPE pipe systems thrust blocks are at the discretion of the contractor. Christy's polyethylene filling wrap .008 fitting wrap non-perforated for wrapping of ductile iron fittings before pouring concrete thrust blocking.
3. All HDPE fittings shall be installed using the butt or electrofusion method. Socket fusion will not be permitted.
4. When tapping/hole sawing into HDPE pipe for service tees, valves or sprinklers; utilize ONLY a MIYANAGA Poly-Clic Composite Core Bit Hole Saw. **NO EXCEPTIONS!**
5. Prior to installing hardware utilize a shop vac with a fabricated 1"x1" flex hose on the end of the intake hose and vacuum out any debris that may have fallen into the pipe.
6. Additional tapping/hole sawing methods and equipment may be requested for approval by the Designer and/or Owner
7. On-site fabrication of fittings is not allowed.
8. HDPE Service connection to the lateral pipe shall be with HARCO or approved equal service saddle.

F. PVC Pipe Installation:
1. Make all solvent-weld joints in strict accordance with manufacturer's recommendations, making certain not to apply an excess of primer or solvent, and wiping off excess solvent from each connection. Allow connections to set minimum 24 hours before pulling or pressure is applied to the system. Provide for expansion and contraction as recommended. Wire shall be laid in same trench as the main line and at pipe invert (see Wire Installation). All pipe joints shall be solvent welded together using IPS 70 Primer and IPS 711 cement.
2. Cut plastic pipe with handsaw or pipe-cutting tool, removing all burrs at cut ends. All pipe cuts are to be square and true. Bevel cut end as required to conform to Manufacturer's Specifications.
3. All PVC threaded pipe joints shall be installed with teflon tape.

G. Mainline pipe shall have minimum 18 inches of cover (excavate as required by pipe size). Lateral pipe shall have minimum 12 inches of cover (excavate as required by pipe size).

H. Cut plastic pipe with handsaw or pipe-cutting tool, removing all burrs at cut ends. All pipe cuts are to be square and true. Bevel cut end as required to conform to Manufacturer's Specifications.

I. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. At times, when installation of the piping is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. All piping, which cannot temporarily be joined, shall be sealed to make as watertight as possible. This provision shall apply during the lunch hour as well as overnight. Pipe not to be installed that day shall not be laid out. Should water enter the trench during or after installation of the piping, no additional piping may be installed or back filled until all water is removed from the trench. Pipe shall not be installed when water is in the trench, when precipitation is occurring, or when the ambient temperature is at 35 degrees F or below. PVC pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.

3.3 ELECTRICAL WIRE CONDUIT INSTALLATION

A. Electrical conduit shall be installed through controller base as detailed. Conduit shall be sized appropriately to accommodate all irrigation control wires and power supply.

3.4 BACKFLOW PREVENTER INSTALLATION

A. Install specified backflow preventer as detailed and in compliance with state and local codes.

3.5 BACKFLOW PREVENTER ENCLOSURE INSTALLATION

A. Install enclosure and insulation blanket according to manufacturer's installation instructions and in compliance with state and local codes.

3.6 MAINLINE FILTER AND FILTER ENCLOSURE

A. Install specified filter as detailed in specified enclosure in location shown on the plans. Exact location of filter assembly installation shall be approved by Landscape Architect and Owner's Authorized Representative.

3.7 DUAL WATER SOURCE PHYSICAL DISCONNECT

A. Install physical disconnect as detailed in location shown on the plans.

3.8 HYDROMETERS, FLOW SENSORS, & MASTER VALVE INSTALLATION

A. Install Hydrometers, Master Valves, and Flow Sensors as detailed and in accordance with manufacturer installation recommendations. Unless otherwise indicated on the drawings, hydrometers, master valves, and flow sensors shall be installed in their own separate valve box. of size and type required to provide adequate space to work on and service the equipment. Flow Sensor and Master Valve location shall be approved by Owner.

3.9 PIPE SLEEVING INSTALLATION

A. Sleeving shall be installed wherever piping is going under a non-soil area, generally where indicated on the Drawings. Minimum cover over all sleeving pipe shall be the depth as necessary to match lines (18"-30" for mainlines and 12"-16" for lateral lines) as shown on the detail except where noted otherwise.

3.10 ISOLATION VALVE INSTALLATION

A. Install Mainline Isolation Valves as detailed in locations shown on the drawings.

B. Install one (1) manifold isolation valve on mainline before each valve cluster. For clusters larger than three (3) control valves install one (1) isolation manifold isolation valve for three (3) control valves. Install isolation valve on a level crushed stone base so that they can be easily opened or closed. Install specified valve box over isolation valve.

3.11 QUICK COUPLER VALVE INSTALLATION

A. Install Quick Coupler Valves as detailed and in the locations shown on the drawings.

3.12 VALVE BOX INSTALLATION

A. Furnish and install valve boxes as detailed for electric control valves, quick coupling valve, isolation valve, manual drain valves, and wire splices.

B. Valve access boxes shall be installed on a minimum 6-inch crushed stone base. Finish elevation of all boxes shall be at grade except where noted on the Drawings. A 2" clearance must be maintained between the base of the valve and the crushed stone base. All crushed stone shall be supplied by the Contractor and installed before valve box is installed. Crushed stone shall not be poured into previously installed valve boxes.

3.13 CONTROL VALVE AND DRIP CONTROL VALVE ASSEMBLY INSTALLATION

A. Install valve assemblies as detailed. Control valves shall be installed on a level crushed stone base. Grade of base shall be consistent throughout. Valves shall be set plumb with adjusting handle and all bolts, screws and wiring accessible through the valve box opening.

B. Adjust zone valve operation after installation using flow control device on valve.

C. Do not install valves in areas where curbs and sidewalk come together or at any intersection of two or more walkways.

3.14 ELECTRICAL CONTROL WIRE INSTALLATION

A. Standard Control wiring shall only be used for wiring of valve to decoder and wiring of master valve as specified. Wiring shall be installed in the same trench as the main line wherever possible.

B. Wire type and method of installation shall be in accordance with local codes for NEC Class II circuits of 30-volt A.C. or less.

C. All connections made inside the box to connect wires to the valve shall be made inside a 3M-DBR/Y connector. Each connector shall be completely sealed and waterproof with a minimum 24" wire loop.

D. All wires shall be direct runs with no splices. Wires cannot be spliced without approval of Owner's representative or Project Manager.

E. Splices in electric control wires shall be fitted with a 3M DBR/Y Direct Bury Splice Kit. No exceptions. All splices shall be contained in a valve box with extra length equal to 24" above the top of the valve box.

F. Wire shall be pulled into controller with 12" minimum tail, and properly labeled. Any wire that comes from the ground to the controller must be housed in PVC conduit or flex conduit.

G. It is important that the splice is absolutely waterproof so that there is no chance for leakage of water and corrosion build-up on the connection. All wiring shall be accomplished with as few splices as possible. Splice locations shall be shown on the Record Drawings.

H. An expansion curl shall be provided within 6 inches of each wire connection to a solenoid and at least every 100 feet of wire length on runs more than 100 feet in length. Expansion curls can be formed by wrapping five (5) turns of wire around a 1-inch diameter or larger pipe and then withdrawing the pipe.

I. Contractor shall provide a complete wiring diagram showing wire routing for the connections between the controller and valves. See section one for the inclusion of wiring diagram in operation and maintenance manuals.

3.15 TWO-WIRE CONTROL WIRE INSTALLATION

A. Two-Wire Control Wire - shall be installed in the same trench as the main line wherever possible. All conduit shall be installed in trenches 6 inches to either side of the pipes so that the conduit is protected from damage during backfilling and maintenance operations. See detailed drawing showing the wire located in those positions. Conduit not placed in the trenches by the sides or under the pipes, shall be buried 18 inches or deeper and marked on the "as built" drawings.

B. All two-wire cable connections shall be made with watertight wire splice connectors as indicated in the Supplementary Two Wire Notes included on the drawings.

C. All connections made inside the box to connect wires to the valve shall be made inside a 3M-DBR/Y connector. Each connector shall be completely sealed and waterproof with a minimum 36” wire loop.

D. Two-wire conduit is to terminate inside valve box. Install a standard size valve box as a ‘Pull Box’ at minimum of every 150’.

E. Install all with a minimum 3 feet expansion loop for both incoming and outgoing wiring on two wire path for ease of maintenance.

3.16 DECODERS

A. Install decoders as per manufacturer’s recommendations. Contractor to lay out decoders as required by system. No two valves are to share the same address. Appropriate sensor decoders shall be used for the flow sensor and master valves.

B. All two wire decoders shall be installed inside valve box of control valve(s) in accordance with all manufacturers’ installation recommendations.

C. Grounding and line surge protection to be installed as per decoder grounding detail and per manufacturer’s installation recommendations. Grounding wire shall be connected to grounding rods/plates with cadweld connection.

3.17 COMMUNICATION CABLE INSTALLATION

A. All communication cable shall be direct runs with no splices.

B. All connections or splices in communication cable shall be made with a 3M SLiC Connector.

3.18 CONTROLLER INSTALLATION

A. Contractor shall install controller(s) according to manufacturer’s installation instructions and as detailed on Drawings. Locations of controller are to be as indicated on the drawings. Coordinate exact controller location with Owner’s Authorized Representative. Contractor shall wire valves into controller and set proper program.

B. Controller requires 120-volt electrical supply.

3.19 IRRIGATION HEAD INSTALLATION

A. All irrigation heads will be set perpendicular to the finished grade unless otherwise designated on the drawings and specifications.

B. All pop-up spray heads shall be installed on Flex swing pipe with 1/2” spiral barbed ells and one street ell as detailed.

C. All pop-up rotor heads in turf areas or planting beds shall be installed on a pre-manufactured swing joint as detailed. All pop-up rotor heads in native seed areas shall be installed above ground on a schedule 80 riser as detailed. Above ground installations shall be staked as detailed.

3.20 DRIP TUBING AND COMPONENTS

A. Install emitters as detailed in locations shown on drawings and details.

B. Fittings: All connections shall be per details.

C. Line Flushing Valves: Install as detailed in locations shown on the drawings and as needed to allow proper flushing of all sections of inline emitter drip tubing.

D. Drip Indicators: Install as detailed in locations indicated on the drawings. Contractor to ensure drip indicators are placed in each planter and at the ends of the drip zone (farthest point away from the valve).

3.21 JOINT RESTRAINT INSTALLATION

A. Install ductile Iron Joint Restraints in accordance with manufacturer’s installation instructions at each change of direction on all irrigation lines 3” or larger.

3.22 CHECK / TEST / START-UP / ADJUST

A. Before any pipes are covered, the Owner’s Representative or a representative of the owner shall inspect the system for compliance with specifications and drawings. Any required changes will be made at this time at no expense to the owner.

B. Flushing: After all piping, and valves are in place and connected, flush piping under a full head of water.

C. Testing:
1. Leakage test: test all lines for leaks under operating pressure. Repair all leaks and re-test.
2. Coverage test: perform a coverage test in the presence of the Owner's Representative (notify Owner’s Representative at least seven (7) days in advance of scheduled coverage test). Representative will determine if the water coverage is complete and adequate. Readjust heads and/or head locations as necessary or directed to achieve proper coverage.
3. All testing shall be at the expense of the Contractor.
4. Substantial completion will not be issued until all testing and required adjustments are completed.

3.23 CLEANING AND ADJUSTING

A. At the completion of the work, all parts of the installation shall be thoroughly cleaned. All equipment, pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge that may have accumulated by the operation of the system for testing.

B. Adjust valve boxes to grade as required.

C. Each control zone shall be operated for a minimum of 15 minutes and checked for consistency of delivering water. Valves, timing devices or other mechanical or electrical components, which fail to meet manufacture's standards, shall be rejected, replaced and tested until they meet the manufacturer's standards.

3.24 CONTROLLER AND CENTRAL CONTROL SYSTEM COMMISSIONING, PROGRAMMING, AND TRAINING

A. Contractor shall coordinate with irrigation controller suppliers and owner for controller and central control commissioning, programming, & training by the **controller manufacturer's certified service representative.** This commissioning, programming, & training **must be conducted by manufacturer's certified service provider (Sprinkler Supply Company, contact Brady Pitcher, 801.592.6490)** & shall include communication setup and verification, web interface setup and verification, weather data setup and verification, controller station value recording/programming, flow sensing set up and testing, and controller/web interface training for owner's maintenance personnel.

B. Commissioning shall occur after installation is complete, wiring is terminated, and all components are operational and labeled.

C. Any reprogramming required due to contractor error or changes in field wiring shall be performed at the contractor's expense.

3.25 ACCEPTANCE AND OPERATION BY OWNER

A. Upon completion of the work and acceptance by the Owner, the Contractor shall be responsible for the training of the Owner's Representative(s) in the operation of the system (provide minimum 48 hours written notice in advance of test). The Contractor shall furnish, in addition to the Record Drawings and operational manuals, copies of all available specification sheets and catalog sheets to the Owner's personnel responsible for the operation of the irrigation system. The Contractor shall guarantee all parts and labor for a minimum period of one (1) year from date of acceptance.

B. During the one (1) year warranty period, it will be the responsibility of the Contractor to work with the designated IHC Maintenance personnel to drain and winterize the system in the fall. It will also be their responsibility to help activate system in the spring and make sure there are no problems.

3.26 GUARANTEE

A. All work shall be guaranteed for compliance with the drawings and specifications for a period of one year after the date of substantial completion. The contractor shall correct any deficiencies when notified during the warrantee period and correct in satisfactory condition any damage to the buildings or grounds, without cost to the owner. All guarantees shall be in writing and approved by the Owner's Representative before submitting to the owner.

B. AS-BUILT DRAWINGS shall be furnished to the Owner's Representative at the time of the Systems Inspection **before any Substantial Completion Date will be issued.**

3.27 CLEAN UP

A. Upon completion of all installation work, Contractor shall remove all leftover materials and equipment from the site in a safe and legal manner.

END OF SECTION

SECTION 329000 - EXTERIOR PLANTING AND LANDSCAPING

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. Trees
2. Shrubs
3. Ground cover
4. Plants
5. Bulbs
6. Mulch
7. Concrete Mow Curb

B. Related Sections include the following:

1. Section 328400 – Irrigation
2. Section 329119 – Fine Grading and Soil Preparation
3. Section 329223 – Sodding
4. Section 321313 – Concrete Paving

1.3 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.

C. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

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

E. Planting Soil Mix: Soil produced by homogeneously blending existing on site or imported topsoil, organic compost, and Utelite fines as specified and mixed with necessary soil amendments as determined by required soil tests.

F. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

G. Substantial Completion: The point in time when the Work is sufficiently complete, in accordance with the Contract Documents, that the owner can occupy or use the Work for its intended purpose.

1.4 SUBMITTALS

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

B. Samples for Verification: For each of the following:
1. Bark Mulch – 1 gallon zip lock bag minimum sample size of bark mulch, identifying source, including name and telephone number of supplier.
2. Crushed Stone– 1 gallon zip lock bag minimum sample size of crushed stone, identifying source, including name and telephone number of supplier.
3. Weed Control Fabric: 18” x18” sample identifying source, including name and telephone number of supplier. Provide product specification information with sample.
4. Landscape Boulders – Provide sample of landscape boulder identifying source, including name and telephone number of supplier.

C. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
1. Manufacturer's certified analysis for standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

D. Qualification Data: For landscape installer.

E. Planting Schedule: Prepare a proposed planting schedule. Schedule the dates for each type of landscape work during the normal seasons for such work in the area of the site. Correlate work with specified maintenance periods to provide maintenance throughout the specified time period. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before the expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer with a minimum of 5 years of experience whose work has resulted in the successful establishment of exterior plants.
1. Installer's Field Supervision: Require the Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.
2. Qualification of Arborist: All work of pruning shall be performed by an arborist certified by the International Society of Arboriculture.

B. All plants shall comply with Federal and State Laws requiring inspection for plant disease and infestations. Any inspection certificates required by law shall accompany each delivery of plants, and such certificates shall be filed with the Owner’s Authorized Representative.

C. All Plants shall conform to the size, age, and condition as specified in the plant list shown on the drawings. Undersized plant material will not be approved. No additional compensation shall be due the contractor if larger than specified plant material is provided.

D. In all cases, the contractor shall be held responsible for all plant materials indicated on the plans unless otherwise directed in writing by the Landscape Architect.

E. Each bidder shall investigate sources of supply and satisfy himself that he can supply all of the plants mentioned in the planting lists in size, variety, and quantity noted and specified before his bid is submitted. Failure to take this precaution will not relieve the successful bidder from his responsibility as contractor to furnish and install all plant material in strict accordance with the contract requirements without additional expense to the owner.

F. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

G. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

H. Representative Plant photographs: The contractor shall provide actual photographs (one photograph minimum per plant species, variety, and/or cultivar), obtained from the plant source for each plant listed in the plant schedule to show representative standards of quality and compliance with the contract requirements. Plants shall be photographed with a person or some type of measuring device included in the photo to provide scale. Approval of the photographed plant materials does not constitute final acceptance. Plant material will be observed and inspected at the job site.

I. Plant Observation: After approval of plant photographs, Landscape Architect shall observe trees and shrubs, and other plant material at job site for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Trees with cut central leaders, split leaders, or crooked trunks will be rejected. Remove rejected plant materials immediately from Project site. Cost of replacements and project delays shall be borne by the Contractor. All trees approved for the project will be individually tagged with the Landscape Architect’s seals at the job site, and no trees shall be planted without such seals.

J. Selection: Contractor shall locate plant material sources and ensure plants are shipped in timely fashion for installation.
   1. Unauthorized substitutions will not be accepted. If proof is submitted that specific plants or plant sizes are unobtainable, written substitution requests will be considered for the nearest equivalent plant or size. All substitution requests must be made in writing.

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

L. Boulder Wall Mockups:

   1. Build 20 lineal feet of Boulder Wall to verify selections made under sample submittals and to demonstrate workmanship, aesthetic effects, and set quality standards for materials and execution. Do not proceed with complete installation of Boulder Walls until mockup is approved by the Landscape Architect.

   2. If the Landscape Architect determines the mockups do not comply with requirements, readjust until mockups are approved.

   3. Mockups maintained in an undisturbed condition may be incorporated into the completed work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Notify Landscape Architect 3 working days prior to the proposed arrival of plant material on site.

B. Plant materials shall be examined by Landscape Architect at time of delivery on site. This inspection does not constitute final acceptance of plants. All plants will be inspected again at time of final inspection and once again at the end of the warranty period. Any plant found to be unacceptable at any of these inspections shall be immediately removed and replaced.

C. Do not prune trees and shrubs before delivery, except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

D. Handle planting stock by root ball.

E. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set nursery stock on ground and cover roots with mulch.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of exterior plants stored on-site as often as necessary to maintain root systems in a moist condition.

1.7 COORDINATION

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

1. April 15 to October 15.

B. Weather Limitations: Planting shall not take place when ground is snow covered or frozen.

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Landscape Architect.

1.8 JOB CONDITIONS

A. Examine the finish grades, verify that elevations vary no more than 1/2" in 10 feet from the required line and grade set forth in the drawings, taking into account the elevation allowance needed to accommodate mulch depths. Observe the conditions under which work is to be performed, and notify the Landscape Architect of unsatisfactory conditions.
1.
2. Excavation:When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the Landscape Architect for direction prior to planting.

B. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.

C. The Contractor shall be fully responsible for any damage to existing trees. No pruning, thinning, or cutting will be allowed unless written permission is given by the Landscape Architect. The Contractor shall replace with like kind and size any trees or existing shrubs damaged by him or his sub-contractors.

1.9 ESTABLISHMENT AND MAINTENANCE

A. Maintenance During Construction: During construction of this Work, the Contractor shall be responsible for performing all landscape maintenance activities described in Division 32 – Exterior Improvements, including Section 329000, for the entire existing park, including all Phase 1 landscape and irrigation improvements. The Contractor shall ensure that the existing irrigation system remains fully operational at all times and shall perform all required maintenance operations in accordance with the Specifications for the duration of construction.

B. Maintenance Following Substantial Completion: Upon Substantial Completion of this Work, the Contractor shall perform the maintenance requirements described in this Section for the entire park, including both Phase 1 and Phase 2 areas, for a period of one (1) year.

C. The Contractor shall be fully responsible for maintenance of all newly installed lawn, groundcover, and planter areas for a period of **one (1) year from the date of Substantial Completion**..
   1. Maintenance shall include watering, mowing, edging, fertilizing, cultivating, pruning, weeding, pest and disease control, and all other work necessary to ensure healthy, vigorous growth and a neat appearance.
   2. Contractor shall perform all lawn mowing and edging **once per week during the active growing season** (April 15 to October 15) and as needed during dormant months to maintain a uniform, healthy condition.
   3. Fertilize lawns and planters at intervals recommended by the manufacturer to sustain uniform color and vigor.
   4. Keep all planting beds free of weeds and debris at all times.

D. Irrigation System Maintenance:
   1. Contractor shall be responsible for maintaining, monitoring, and adjusting the irrigation system during the one-year maintenance period to ensure proper coverage and efficient operation.
   2. Contractor shall repair or replace irrigation components that fail due to improper installation, material defects, or damage caused by the Contractor's operations.
   3. Contractor shall not be responsible for repairs required as a result of vandalism, damage by others, or circumstances beyond the Contractor's control.
   4. Any irrigation repairs outside the Contractor's responsibility shall be reported to the Owner in writing within 48 hours of discovery, including a description of the damage and photographs documenting the cause.

E. Reporting: Contractor shall notify the Owner in writing within 24 hours of completing any major maintenance or plant replacement work.

F. Replacement: Any plant that dies or becomes unhealthy during the maintenance period shall be replaced immediately at no cost to the Owner, and the replacement shall be warranted for a new full one-year period from the date of replanting.

G. Neglect: Failure to perform required maintenance shall be considered neglect of contract obligations and may result in withholding of retainage until maintenance is satisfactorily completed.

1.10 WARRANTY/GUARANTEE PERIOD

A. Warranty Limitations – Phase 1 Improvements: The warranty requirements described in this Section apply only to new Work completed under the Phase 2 contract. Existing Phase 1 improvements shall be maintained during construction and throughout the one-year maintenance period as specified, but Phase 1 landscape and irrigation elements are not subject to warranty replacement.

B. Warranty / Guarantee the exterior plants for period indicated below, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.
   1. Warranty Period for Trees and Shrubs and other plants: One year from date of the Notice of Substantial Completion.
   2. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
   3. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period and at time of substantial completion.
   4. At the conclusion of the guarantee period and prior to final inspection by the Landscape Architect, the contractor shall be responsible for the removal of all tree stakes and tree guys.
   5. Any Replacement plants shall also be warranted for 1 year from the date of replacement planting.
   6. Contractor shall provide specific maintenance instructions to be followed by the owner, including frequency and amount of water to be applied, any special care instructions, etc. These instructions shall be submitted to and reviewed by the Landscape Architect. If the contractor does not provide specific care information, owner will maintain plantings to their best practice and standards and this will be deemed acceptable compliance for any warranty claim.

1.11 SUBSTANTIAL COMPLETION

A. Within 10 days of the end of the establishment period or when the Work is sufficiently complete in accordance with the Contract Documents, written notice requesting a Substantial Completion inspection shall be submitted to the Project Manager by the Contractor. Three days shall be allowed for notification to those persons invited to attend prior to the inspection date. All plantings shall be warranty and guaranteed as stated in Sections 1.9 and 1.10.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required.

C. Size and Planting Condition: As indicated on Drawings.

D. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

2.2 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

B. Small Ornamental Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as indicated on Drawings.

C. Multi-stem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as indicated on Drawings.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

2.6 PERENNIALS

A. Form and Size: Provide healthy, field-grown plants from a commercial nursery, of container size, species and variety shown or listed and complying with requirements of ANSI Z60.1.

2.7 GROUND COVER PLANTS

A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.8 TOPSOILS AND PLANTING SOIL MIX

A. Provide topsoil and planting soil mixes as specified in section 329119 – Fine Grading and Soil Preparation.

2.9 FERTILIZER

A. Planting Tablets: Fertilizer planting tablets shall be tightly compressed commercial grade planting tablets having a 20-15-5 formula, weighing 21 grams each, as “Blue Chip,” “Grow-Power” planting tablets or “approved equal.” The planting tablets shall be delivered to the site in the original, unopened containers, bearing the manufacturer’s guaranteed analysis. Any damaged tablet will not be accepted.

2.10 LANDSCAPE EDGING

A. Concrete Mow Curb: As detailed on Drawings.

B. Metal Edging: As detailed on the Drawings.

2.11 BARK MULCH

A. Bark Mulch: Clean, medium coarseness, shredded bark mulch. Submit sample for approval prior to placement.

2.12 CRUSHED STONE MULCH

A. Stone mulch color and size as specified on the drawings. Crushed stone to be hard, durable, washed free of loam, sand, clay and other foreign substance. Submit samples of a range of colors for color selection and approval to be approved of Landscape Architect. Submit sample for approval of size and color prior to delivery to the site.

2.13 WEED CONTROL FABRIC

A. Weed Control Fabric shall be a roll type polypropylene or polyester fabric and shall be woven, needle punched or non-woven and treated for protection against deterioration due to ultraviolet radiation. Fabric shall be minimum 99 percent opaque to prevent photosynthesis and seed germination from occurring yet allowing air, water, and nutrients to pass thru. Minimum weight shall be 5 ounces per square yard with a minimum thickness of 20 mils with a 20 year guarantee.

2.14 LANDSCAPE BOULDERS

A. New Boulders: New boulders as required on the drawings shall be hard, durable rock materials in sizes as noted on the drawings and details. If sizes are not called out on drawings or details provide boulders in sizes as follows: 3-foot diameter (30%), 4 foot diameter (50%), and 5 foot diameter (20%). Color shall match or compliment stone mulch specified on site. Landscape boulders shall be provided in quantities, and general shapes as indicated on drawings. Representative samples shall be submitted at the site for approval of color, shape, and size. Approval of sample does not constitute final acceptance. All boulders shall be approved on site by Owner’s Authorized Representative upon delivery to verify compliance with the sample and shape and size.

2.15 LANDSCAPE BOULDER WALL INSTALLATION

A. Install boulder walls as detailed in locations shown on the drawings. See grading plans for elevations of top and bottom of wall. Layout and location of boulder walls shall be reviewed on-site by Landscape Architect prior to installation.

B. Install mock-up wall and obtain approval prior to completing entire landscape boulder wall installation as per section 1.5 Quality Assurance.

2.16 STAKES AND GUYS

A. Tree stakes shall be two-inch (2”) diameter, by eight-foot (8’) minimum long straight grained pine and driven to a minimum depth of eighteen inches (18”) into firm soil beneath plant pit excavation. Height of stakes shall be below tree branching.

B. Tree ties shall be VIT Cinch Tie attached to stake with 1- ¼” galvanized threaded nails. Field sample shall be approved by the Owner’s Representative

C. Guy wires and anchors on all evergreens and trees 4” caliper or larger shall be duckbill tree support system model # 68 DTS including anchors, galvanized steel, vinyl-coated cable, turnbuckles, tree collars and cable clamps, all pre-assembled. Install per manufacturer’s specifications.

D. Safety flagging for all diagonal guy wires shall consist of one half-inch (1/2”) PVC sleeves.

2.17 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Herbicide:
1. Provide selective post emergent herbicide for use in weed control. Provide Round-up or approved equal.
Provide pre-emergent herbicide for use in planter beds for weed control. Provide Treflan or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Locate all underground utilities prior to digging. Do not place plants on or near utility lines. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Herbicide Treatment: All planting beds shall be weed free prior to commencing soil placement, fine grading, and planting. Treat areas with a non-selective herbicide as necessary a minimum of ten (10) days prior to commencement of any planting or irrigation work to ensure weed free planting areas. Herbicide applications shall be applied in accordance with manufacturer's recommendations and in accordance with section 3.16 Herbicide Application and Weed Control. The poisoned vegetation shall be allowed to completely die back, including the roots, before proceeding with the work. Dead vegetation shall then be removed from the site and disposed of in a legal manner.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before planting. Make adjustments as required by Landscape Architect.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

3.3 PLANTING BED ESTABLISHMENT

A. Prepare subgrade of planting beds and spread Planting Soil Mix in accordance with specification section 329119 - Fine Grading and Soil Preparation.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture and in accordance with specification section 329119 – Fine Grading and Soil Preparation. Roll and rake, remove ridges, and fill depressions to meet finish grades prior to adding mulch.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

D. Install Landscape Edging as detailed in all location shown on the drawings.

3.4 TREE AND SHRUB EXCAVATION

A. Pits and Trenches: Excavate circular pits with sides sloped inward. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

B. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

C. Prior to planting, fill excavated tree/shrub pit with water and allow to percolate out. If after 24 hours, the water has not percolated out of the pit, notify the Owner's Authorized Representative. Do not plant until the problem has been corrected.

3.5 TREE AND SHRUB PLANTING

A. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball 1"-2" above adjacent finish grades.
   1. Remove burlap, wire baskets, twine, and wrappings from root balls, taking care not to disturb root balls. Do not use planting stock if root ball is cracked or broken before or during planting operation.

2. Place planting soil mix around root ball in 12 inch lifts, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

B. Set container-grown stock plumb and in center of pit or trench with top of root ball flush with adjacent finish grades.
1. Carefully remove root ball from container without damaging root ball or plant.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Add fertilizer plant tablets to planting pit. Fertilizer tablets shall be placed no deeper than eight inches (8”) from finished grade and two inches (2’) from the root ball. Add the required number of tablets as specified below.
1. One (1) tablet per one (1) gallon container.
2. Two (2) tablets per five (5) gallon container.
3. Three (3) tablets per ten (15) gallon container.
4. Four (4) tablets per two-inch (2”) caliper tree.
5. Six (6) tablets per three-inch (3”) caliper tree.
6. Eight (8) tablets per four-inch (4”) caliper tree.

D. Prepare a watering basin around the trunk as indicated on Drawings.

E. Mulching: Apply specified thickness of mulch extending to edge of planting pit or trench. Do not place mulch within 4 inches of trunks or stems.

3.6 TREE AND SHRUB PRUNING

A. Pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches. All cuts, scars and bruises shall be properly treated according to the directions of the Landscape Architect. Proper pruning techniques shall be used. Do not leave stubs and do not cut the leader branch. Improper pruning shall be cause for rejection of plant material.

3.7 GUYING AND STAKING

A. Trees should not be staked except in rare cases. Stake and guy trees only when required by site conditions to ensure viability of the tree and approved by Landscape Architect.

B. Upright Staking and Tying: As detailed, trees shall be firmly staked, as shown on the Drawings. Stakes shall be of even height and neat in appearance, and shall not injure the root balls.

C. Guying and Staking: As detailed, trees shall be firmly anchored and guyed as shown on the Drawings.

3.8 GROUND COVER AND PERENNIAL PLANTING

A. Set out and space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING BED MULCHING

A. Mulch backfilled surfaces of tree wells, planting beds and other areas indicated on drawings.

1. Mulch: Apply bark or stone mulch to the depths and locations indicated on the drawings. Do not place mulch against plant stems.

3.10 WEED CONTROL FABRIC INSTALLATION

A. Remove all vegetation, including roots, from within the areas specified to receive Crushed Stone Mulch. Completely cover areas with the specified weed control fabric prior to placement of crushed stone. Overlap cut edges a minimum of twelve (12) inches and secure to subgrade according to manufacturer's recommendations. **Weed control fabric installation shall be inspected by Owner's Authorized Representative prior to covering.**

3.11 LANDSCAPE BOULDERS

A. Install landscape boulders as detailed and in locations shown on the drawings. Boulders shall be installed in locations as generally shown on the plans as approved by the Landscape Architect.

3.12 LANDSCAPE BOULDER WALL INSTALLATION

A. Install boulder walls as detailed in locations shown on the drawings. See grading plans for elevations of top and bottom of wall. Layout and location of boulder walls shall be reviewed on-site by Landscape Architect prior to installation.

B. Install mock-up wall and obtain approval prior to completing entire landscape boulder wall installation as per section 1.5 Quality Assurance.

3.13 LANDSCAPE EDGING INSTALLATION

A. Concrete Mow Curb: Install concrete edging materials as detailed in locations shown on the drawings.

B. Steel and Metal Edging: Install as detailed and in accordance with manufacturer's installation instructions in locations shown on the drawings.

3.14 WATERING

A. All plants shall be thoroughly watered immediately after planting; this shall mean full and thorough saturation of all backfill in the pits and beds during the same day of planting. Water shall be applied only by open end hose at very low pressure to avoid air pockets, injury or washing. When planted, watered, and fully settled the plants shall be vertical and the stand shall be slightly below the stand in the nursery.

3.15 SUPPLEMENTAL WATERING

A. **The Contractor shall hand water newly planted trees, twice a week for eight weeks**.

B. A minimum of five (5) gallons per tree per watering is required. Amount may vary pending seasonal rainfall.

C. Lightweight pickup truck with 55-gallon drum may be used to water trees. Any other method must be approved by Landscape Architect.

D. The Contractor must locate and stake any sprinkling head or valve box within 10' feet of proposed tree location, and must establish direction of lateral or main sprinkling line that serves the staked sprinkler head or valve box. (This procedure will help eliminate hitting underground sprinkling system.)

E. The Contractor shall take extra care to watch for sprinkling heads and valve boxes in lawn area. Any broken sprinkling heads or valve boxes, etc., shall be replaced by Contractor at no expense to owner.

3.16 HERBICIDE APPLICATION AND WEED CONTROL

A. Application of pre-emergent herbicide is required. The contractor shall maintain the site weed free until the end of the establishment period.

B. Apply herbicides so no damage to protected vegetation occurs whether inside or outside the project site. Damage to protected vegetation or vegetation outside the project site will be reimbursed to the owner or replaced by the Contractor in a manner satisfactory to the Owner's Authorized Representative, and according to the International Society of Arboriculture Method of "Valuation for Landscape Trees, Shrubs, and Other Plants," latest edition.

C. Post Emergent Herbicide:
1. Mix and apply post-emergent herbicide according to manufacturer's recommendations indicated in the "Weeds Controlled" section of the label, and apply to undesired, actively growing vegetation.
2. Apply the spray mixture so that all undesired vegetation is uniformly covered, but avoid causing over-spray and drift. Spray target vegetation so that it is wet, but short of run-off.
3. Prune all suckers at the base of any trees to the soil level prior to application.
4. Do not apply post-emergent herbicide in any of these conditions: When rainfall is expected within six hours; when there is growth stress as a result of drought, insects, disease, or plant damage, or when there is heavy dust on plants.
5. Do not walk or permit other traffic on treated areas when they are wet from application. Shoes and equipment may track spray solution to areas where vegetation is not to be treated.
6. Repeat application, as necessary to completely eradicate undesired vegetation.

D. Pre-emergent Herbicide:
1. Mix and apply pre-emergent herbicide according to manufacturer's recommendations and information on the side panel, and the following: Use granular applicators designed to apply herbicide at Manufacturer's suggested highest rate.
2. Calibrate the applicator according to the manufacturer's directions prior to use and check frequently during application to be sure the equipment is working properly and distributing the granules uniformly. Do not apply more than the recommended amount.
3. Apply granular herbicide according to manufacturer's recommendations and on-site conditions and soil preparation requirements or restrictions appropriate to the herbicide used.

4. The pre-emergent application must be followed within 8 hours with overhead watering or rainfall equivalent to 1/2".

E. License: Use a state licensed applicator to apply herbicide.

F. Mechanical Control:
1. Mechanically control the weeds by pulling, cutting, hoeing, or by any other directed means approved by the Owner's Authorized Representative.
2. Weeds in a dormant stage or other condition which cannot be effectively controlled with post-emergent herbicide shall be removed from the site by mechanical methods.

3.17 ESTABLISHMENT AND MAINTENANCE

A. Begin Maintenance immediately after planting.

B. Maintain plants for the specified time frame previously indicated above and throughout the Establishment Period.

C. Maintain plants by watering, pruning, cultivating and weeding as required for healthy growth. Restore planting saucers. Treat as required to keep plant materials free of insects and disease.

D. The Contractor shall provide the owner with an approved irrigation schedule.

E. The Contractor shall provide on-site maintenance instructions to the Owner's Authorized Representative and maintenance personnel prior to turning the project over to the Owner.

3.18 CLEAN-UP AND PROTECTION

A. During exterior planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.19 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property. If approved by Owner, excess soils may be wasted on site.

END OF SECTION 329000

FINE GRADING AND SOIL PREPARATION - SECTION 329119

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. Related Sections include the following:

1. Section 329000 – Planting
2. Section 329219 – Seeding

1.3 SUBMITTALS

A. At least 30 days prior to ordering materials, the Contractor shall submit to the Landscape Architect representative samples, certifications, manufacturer's literature and certified test results for all materials as specified below. No materials shall be ordered or delivered until the required submittals have been reviewed and stamped approved by the Landscape Architect. Delivered materials shall match the approved samples.

B. Approval shall not constitute final acceptance. The Landscape Architect reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

C. List of submittals required.

1. Sample of manufactured Planting Soil Mix and soil analysis testing results.
2. Sample of imported topsoil (component of the Planting Soil Mix) and soil analysis testing results.
3. Sample of organic compost (component of the Planting Soil Mix) and sieve analysis.
4. Sample UteLite (component of the Planting Soil Mix) and product data.

1.4 QUALITY ASSURANCE

A. The following standards apply to the work of this Section:

1. AOAC: Association of Official Agricultural Chemists.
2. ASA: Methods of Soils Analysis, American Society of Agronomy, Soil Science Society of America, Inc., Madison Wisconsin, latest edition.
3. American Society for Testing and Materials (ASTM).
4. All applicable local codes and regulations.

B. It is the intent of this specification that all materials herein specified and shown on the drawings shall be of the highest quality available and meeting the requirements specified.

C. The work of this Section shall be performed by a Contracting firm that has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five (5) years experience.

D. All work shall be performed in accordance with the best standards of practice relating to the trade and under the continuous supervision of a competent foreman capable of interpreting the Drawing and Specifications.

E. Soil shall not be worked when moisture content is so great that excessive compaction occurs, nor when it is so dry, that dust will form in air or that clods will not break readily. Water shall be applied, if necessary, to provide ideal moisture content for tilling and for planting.

F. All accumulated debris and rubbish shall be cleaned up and removed from the site before commencing work. Clear and grub all dead vegetative matter. The site shall be weed free prior to proceeding with any work.

G. 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.

H. Topsoil Analysis: Furnish a soil analysis for any stockpiled and imported topsoil proposed for use as specified in this section 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 satisfactory topsoil.

I. Compost Testing Laboratory Qualifications: An independent, with the experience and capability to conduct testing indicated following U.S. Composting Council Seal of Testing Assurance procedures, or equivalent.

J. Compost Analysis: Provide documentation from supplier that compost has reached monitored temperature of 140 degrees Fahrenheit for at least one week.

1. Test representative sample(s) of compost for the following parameters: pH, soluble salts, percent moisture, percent organic matter, particle size, and nutrient content, including: Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), and Magnesium (Mg).

2. Test compost for maturity. Provide Carbon-Nitrogen ratio.

1.5 JOB CONDITIONS

A. Examine the subgrade, verify the elevations to be no more than plus or minus 2” above or below subgrade elevation which should allow for the depths required for topsoil and mulch throughout the planted areas. Observe the conditions under which work is to be performed, and notify the Landscape Architect of unsatisfactory conditions.

PART 2 - PRODUCTS

2.1 PLANTING SOIL MIX

A. Planting Soil Mix: Shall consist of a ratio by volume of 50 percent topsoil, 25 percent organic compost, and 25 percent Utelite fines.

1. The Contractor shall provide Planting Soil Mix at locations and depths indicated on the Drawings to complete all planting areas, as specified in this Section and as directed by the Landscape Architect. Planting Soil Mix shall be produced by homogeneously blending the specified components prior to placement.
2. Do not commence with mixing Planting Soil Mix until the review and approval of soil test results, organic compost certification submittal, and Utelite fines submittal.

2.2 TOPSOIL

A. Native or Imported topsoil used for native seed areas as a component of the Planting Soil Mix for turf areas, plant beds, and tree planting pits. Submit soil test results certifying that any imported topsoil meets the texture and analysis outlined below.

1. Source: Topsoil will be obtained from the following sources:
   a. Existing Topsoil Stockpiled on site **(topsoil samples indicate that adequate on-site topsoil is available to meet project needs)**, or
   b. Imported from naturally well-drained areas with a history of satisfactory vegetative growth that has not been stripped before.

B. Imported Topsoil shall be “fine sandy loam” or “sandy loam” determined by mechanical analysis (ASTM D-22) and based on the “USDA Classification System.”

C. Imported Topsoil shall not contain less than four percent (4%) or more than eight percent (8%) organic matter as determined by the loss on ignition of oven-dried samples.

D. The acidity range of the topsoil shall be pH 5.5 to 7.5.

E. All Topsoil shall be free of stones 1 inch or larger in any dimension, with stone fragments (gravel or any soil particles greater than 2mm) <5% by volume, and free of all other extraneous materials harmful to plant growth. Soluble salts <2 (dS/m or mmho/cm) and sodium absorption ration (SAR) <3. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be equal to or less than 1.0 millimhos/cm. (Test minus sieve Number 10 material).

F. No imported topsoil shall be delivered to the site or placed in planting areas until topsoil test results and recommendations have been reviewed and approved by the Landscape Architect. Such approval shall not constitute final acceptance. The Landscape Architect shall reject any material delivered to the site, which, after on-site, post-delivery testing, does not meet these specifications.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 6 to 8; moisture content 25 to 35 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of <5 dS/m or mmho/cm; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. Compost shall conform as follows:

1. Tested at minimum, every six months for noxious weeds.
2. Organic matter source (feedstock): Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
3. Organic Matter Content: 60 to 80 percent of dry weight as determined by ash method.
4. Free of refuse (less than 1 percent by dry weight), plastics, contaminants or any material toxic to plant growth.
5. Processed to meet U.S. Composting Council's Seal of Testing Assurance Program, or equivalent.
6. Carbon to Nitrogen Ratio: 40 to 1 or lower.
7. Composted for a minimum of 9 months and reach a monitored temperature of 140 degrees Fahrenheit for at least one week.

Toxic Elements	Maximum Concentration (mg/kg dry weight)
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Molybdenum	75
Nickel	420
Selenium	36
Zinc	2800

B. Peat: No Peat shall be used in this project.

C. Organic Compost available from Miller Companies LC, Hyrum Utah (telephone: 435-245-3157) has generally met the specification requirements listed above.

2.4 UTELITE FINES

A. Expanded shale lightweight aggregate. Available from Utelite Corporation, (801) 243-9348.

PART 3 - EXECUTION

3.1 PREPARATION

A. Planting Soil Mix and topsoil placement shall not commence until rough grades have been approved by the Landscape Architect.

B. Planting Soil Mix shall be placed in all turf and shrub/groundcover plant beds to depths specified and in all tree planting pits as specified in this section and as directed by the Landscape Architect. Topsoil shall be placed in all native seed areas to depths specified on the drawings

C. Undisturbed areas shall remain intact whenever possible.

D. All landscape areas shall be weed free prior to commencing soil placement, fine grading, and planting. Treat areas with a non-selective herbicide as necessary to insure weed free planting areas. Herbicide applications shall be applied in accordance with manufacturer's recommendations and in accordance with section 3.4 Herbicide Application and Weed Control in section 329000-Planting.

E. Planting Soil Mix Placement

1. Immediately prior to placing and spreading the Planting Soil Mix or topsoil, loosen the subgrade of planting beds to a minimum depth of four inches (4”). Remove all stones greater than 3/4" in diameter and all weeds, sticks, debris, or rubbish. Such material shall be removed from the site and legally disposed.
2. Spread Planting Soil Mix or topsoil over loosened subgrade to the depth indicated on the drawings. Do not spread Planting Soil Mix or topsoil if subgrade is frozen, muddy, or excessively wet.

F. Planting Soil Mix and Topsoil shall be backfilled in lifts of no more than six inches (6”). Compact each lift to 85% prior to placing next layer of backfill.

G. Add recommended soil amendments at rates specified in soil analysis recommendations identified in the soil test results and as directed by the Landscape Architect. Rototill amendments into the top 6 inches of soil to achieve a uniform mixture.

1. Following the incorporation of soil amendments, the surface shall be re-compacted to meet the requirements of this section.

3.2 FINE GRADING

A. When rough grading, weeding, soil preparation and soil amending have been completed, and soil has been thoroughly water settled, all planting areas should be smoothly graded, ready for placement of plant materials.

B. Fine grading shall be done when soil is at optimum moisture content.

C. Finish grades shall be smooth, even and on a uniform plane with no abrupt changes of surface. The finish grade shall not vary more than one half inch (1/2”) in ten feet (10’) from the required line, and grade set forth in the Drawings. Adjustments of finish grades shall be made at direction of Landscape Architect as required.

D. Finish grade of mulch in shrub and groundcover areas shall be flush with paved surfaces, after top-dressed with depth of bark or stone mulch as specified on the drawings. Finish grade of soil in all seeded areas shall be one inch (1”) below all paved surfaces prior to seeding.

E. The Contractor shall maintain a minimum of two (2) percent drainage away from all buildings, structures, and walls. Finished grades shall be smoothed to eliminate puddling or standing water.

F. All finished grades shall be a minimum of two (2) percent unless otherwise indicated on the plans or approved by the Owner’s Authorized Representative prior to installation of any plant materials.

END OF SECTION 329119

SECTION 329223 - SODDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Furnish and install sodded lawn as described in Contract Documents, for all lawn areas.

B. Related Sections include the following:

1. Section 328400 – Irrigation
2. Section 329300 – Exterior Planting
3. Section 329119 – Fine Grading and Soil Preparation

1.3 QUALITY ASSURANCE

A. The work of this Section shall be performed by a Contracting firm, which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five (5) years' experience. The Contractor must supply three references for work of this type and size with their bid including names and phone numbers of contact person(s).

B. All work shall be performed in accordance with the best standards of practice relating to the trade and under the continuous supervision of a competent foreman capable of interpreting the Drawings and Specifications.

C. All accumulated debris and rubbish shall be cleaned up and removed from the site before commencing work. Clear and grub all dead vegetative matter. The site shall be weed free prior to proceeding with any work.

D. Pre-Installation Meetings

1. Participate in pre-installation meetings.

1.4 STANDARDS AND DEFINITIONS

A. The following standards and definitions shall apply to the work of this Section.

1. AOAC: Association of Official Agricultural Chemists
2. ASPA: American Sod Producers Specifications for Turfgrass Sod Materials and Transplanting/ Installing.
3. ASTM: American Society for Testing and Materials

1.5 SAMPLES AND SUBMITTALS

A. At least thirty (30) days prior to intended use, the Contractor shall provide the following samples and submittals for approval. Do not order materials until Landscape Architect's approval of samples, certifications, or test results has been obtained. Delivered materials shall closely match the approved samples.

1. Sod: Submit a supplier's certificate showing sod composition by grass species conforms to the Specification requirements. Certification shall identify the source and include the name and telephone number of the supplier.

B. Maintenance Instructions: At the time of Acceptance, the Contractor shall submit complete lawn care maintenance instructions for the Owner's use. The instructions shall be reviewed for approval by the Landscape Architect as a pre-condition for Acceptance.

C. Installer Qualifications: Submit installer’s qualifications.

1.6 DELIVERY, STORAGE, & HANDLING

A. Harvest, deliver, store, and handle sod in accordance with requirements of "American Sod Producers (ASPA) Specifications for Turfgrass Sod Materials and Transplanting/ Installing."

B. During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.

1. During dry weather, protect sod from drying. Water as necessary to insure vitality and to prevent excess loss of soil in handling.
2. Sod which dries out will be rejected.

1.7 COORDINATION

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

1. April 15 to October 15.

1.8 LAWN MAINTENANCE AND ESTABLISHMENT PERIOD

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

1. Sodded Lawns: No less than four (4) growing months or 60 days from date of Substantial Completion.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas with new sod to produce a uniformly smooth lawn.

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 2 inches for the first two weeks after planting. Water at the rate given in the turfgrass vendor’s written recommendations thereafter during the maintenance period.

1. Schedule watering to prevent wilting, puddling, and erosion. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. The Contractor shall instruct the Owner as to the watering requirements and shall monitor such operations at all times. The Contractor shall be held responsible for failure to monitor the watering requirements and shall be held responsible to replace any or all turf that is lost due to improper application of water.

D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 30 percent of grass height. Remove no more than 30 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 2-3 inches high.

E. Lawn Post-fertilization: Apply fertilizer after second mowing and when grass is dry and every three weeks thereafter throughout maintenance period. It shall be the responsibility of contractor to notify Owner's Authorized representative and University Grounds 48 hours prior to fertilizing.

1. Use commercial-grade complete fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on containers. Apply at a rate of 2 pounds per 1000 square feet.

1.9 SUBSTANTIAL COMPLETION

A. The date of Substantial Completion for the new landscape will be when the Maintenance and Operating Manual has been approved, all required submittals have been received and approved, and the planting is installed as intended as demonstrated during final inspection. This will be determined by observation by the Landscape Architect and Owner's Representative.

PART 2 - PRODUCTS

2.1 COOL SEASON TURFGRASS SOD

A. Cool Season Turf Grass Sod shall be:
1. New Turf and Turf Replacement/Repair Area Sod: shall be 18 month old Kentucky Bluegrass mix developed for disease resistance and drought tolerance. Submit supplier's certification and seed mix information for approval prior to delivery to the site.
   a. Only sod that has been grown on a commercial sod farm shall be used.
   b. Sod shall be a viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
   c. Superior sod grown from certified, high quality, seed of known origin or from plantings of certified grass seedlings or stolons.
   d. Assure over-all high quality and freedom from noxious weeds or an excessive amount of other crop and weedy plants at time of harvest.
   e. Sod shall be machine cut at a uniform soil thickness of three-quarters inch (3/4") at the time of cutting. Measurement for thickness shall exclude top growth and thatch. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be five percent 5%). Sod strips that are broken or have torn or uneven ends will not be acceptable. Sod shall be at least one year old from time of original seeding.

f. Sod shall be harvested, delivered and installed within a period of 24 hours. Sod strip soil shall be kept moist at all times.
g. Stakes: Stakes for pegging the sod shall be sound hardwood approximately one inch by two inches (1" x 2") and of sufficient length to penetrate the sod strip and subsoil to a minimum depth of two inches (2") of subsoil. Stakes shall be free from insects and fungi and capable of remaining in the ground at least two years

2.2 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on the containers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection

1. Take care in preparation work to avoid conditions which will create hazards. Post signs or barriers as required.
2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.
3. Keep site well drained and landscape excavations dry.

B. Surface Preparation – Newly Graded Subgrades

1. Limit lawn subgrade preparation to areas to be planted.
2. Seven days maximum prior to sodding:
   a. Prepare subgrade and spread Topsoil in accordance to specification section 329119 – Fine Grading and Soil Preparation.
   b. Reduce elevation of planting soil to allow for soil thickness of sod.
3. After lawn areas have been prepared, take no heavy objects over them except lawn rollers.
4. After preparation of lawn areas and with Topsoil in semi-dry condition, roll lawn planting areas in two directions at approximately right angles with water ballast roller weighing 100 to 300 lbs. according to soil type.
5. Rake or scarify and cut or fill irregularities that develop as required until area is true and uniform, free from lumps, depressions, and irregularities.

C. Surface Preparation – Unchanged Subgrades

1. Limit lawn subgrade preparation to areas to be planted.
2. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
3. Loosen surface soil to a depth of at least 4 inches. Till soil to a homogeneous mixture of fine texture and break up all clods and lumps.
4. Remove stones larger than 3/4 inch in any dimension and clods, weeds, sticks, roots, and other extraneous matter and legally dispose them off of the Owner’s property.

D. Finish Grading

1. Finish grades shall be in accordance with specification section 329119 – Fine Grading and Soil Preparation. Adjustments of finish grades shall be made at the direction of the Landscape Architect as required. 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.
2. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
3. Restore areas if eroded or otherwise disturbed after finish grading and before planting.
4. Final grade of soil in all turf areas shall be 1” below top of adjacent hardscape of any kind before laying sod.

3.2 INSTALLATION

A. Laying of Sod

1. Prior to laying sod, apply 16-16-8 fertilizer to the entire surface to receive sod at the rate of 4 pounds per 1,000 square feet.
2. Lay sod during growing season. Sodding during dry summer period, at freezing temperatures, or over frozen soil is not acceptable.
3. Lay sod within 24 hours of harvesting.
4. 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. Cut out irregular or thin sections with a sharp knife. 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.
5. Lay sod flush with adjoining existing sodded surfaces.
6. Lay sod at sloping areas with the long dimension of individual sod strips laid parallel with the contours of the slope.
7. Anchor sod on slopes exceeding 6:1 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
8. Do not sod slopes steeper than 3:1.

B. After Sodding Is Complete

1. Roll horizontal surface areas in two directions perpendicular to each other.
2. Repair and re-roll areas with depressions, lumps, or other irregularities. Heavy rolling to correct irregularities in grade will not be permitted.
3. Saturate sod with fine water spray within two hours of planting to obtain moisture penetration through sod into top 2” of topsoil.
4. During first two weeks, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 2 inches.

3.3 FIELD QUALITY CONTROL

A. Inspection

1. Sodded areas will be accepted at final inspection if -
   a. Sodded areas are properly established.
   b. Sod is healthy, well rooted, even-colored, free of bare and dead spots and without weeds.
   c. No surface soil is visible when grass has been cut to height of 2".

d. Sodded areas have been mowed a minimum of twice.

2. Areas sodded after the end of the growing season (approx. October 31) will be accepted the following spring (May 1st) approximately one month after start of growing season if specified conditions have been met.
3. Reestablish lawns that do not comply with requirements and continue maintenance at not additional cost to the Owner until lawns are satisfactory.

3.4 SOD GUARANTEE

A. Protect, water, and replace any damaged sod until acceptance by Owner. Guarantee shall include filling any voids between sod pieces, repairing any eroded areas, and maintaining sod by watering, mowing, and controlling insects, as well as advising Owner of any maintenance or watering procedures necessary to care for and promote plant life. All sod must be in satisfactory condition at the time of the substantial completion inspection.

3.5 CLEANING

A. Immediately clean up any soil or debris spilled onto pavement and dispose of all deleterious materials.

3.6 PROTECTION

A. Protect sodded areas against traffic or other use immediately after sodding is completed by placing adequate warning signs and barricades.

B. Provide adequate protection of sodded areas against trespassing, erosion, and damage of any kind. Remove this protection after sodded areas have been accepted by Owner’s Authorized Representative.

END OF SECTION 329223

DIVISION 33 – Utilities

TABLE OF CONTENTS

G.BROWN:DESIGN INC
SITE AND LANDSCAPE ARCHITECTS

678 East Vine Street, Ste 10
Murray, Utah 84107
p. 801.575.6066 f. 801.575.6166
www.gbrowndesign.com