PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Mortar and grout.
   3. Steel reinforcing bars.
   4. Masonry joint reinforcement.
   5. Miscellaneous masonry accessories.

B. Related Sections:
   1. Section 051200 "Structural Steel Framing" for furnishing anchor rods, embedded plates, and bearing plates for unit masonry.

1.03 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Unit Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PERFORMANCE REQUIREMENTS

A. Provide reinforced unit masonry that develops indicated net-area compressive strengths at 28 days, as indicated on drawings.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 602/ACI 530.1/ASCE 6.

1.05 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Contractor will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense. Materials tested shall be the same in every way to the materials used to construct this project and shall be from the same lots or batches used for constructing this project.
   1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
   2. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.06 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:
   1. Reinforcing Steel: Detail bending and placement of reinforced unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls. Drawings shall include:
      a) 1/4” scale elevations of all beams, columns and walls with all openings and reinforcing shown.
      b) Top and bottom elevations of walls and bearing elevations of all elements supported.
      c) Size and location of all openings, pockets, embedments, and anchor bolts.
      d) Bar sizes, location and quantities of reinforcing steel.
      e) Location and arrangement of supporting and spacing devices.
      f) Bending and cutting schedules.
      g) All control joints, expansion joints and horizontal relief joints.
      h) All other framing and/or special conditions affecting the work.

1.07 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a) Include material test reports substantiating compliance with requirements.
      b) Include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Grout: Submit grout strength test data. Data shall be in conformance with the requirements for concrete mix designs per Division 3 section “Cast-in-place concrete”
      a) Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
      b) For self consolidating grout, include test reports for slump flow and visual stability index (VSI) as determined by ASTM C1611

C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in TMS 602/ACI 530.1/ASCE 6.

1.08 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 latest edition unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as required to meet the specified prism strength, but in no case shall units be less than 1900 psi.
   2. Density Classification: Lightweight unless otherwise indicated.

2.02 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure prefabricated lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

G. Additives: None permitted, except as specified herein. Specifically do not lower freezing point of mortar or grout by use of calcium chloride or other antifreeze agents.

2.04 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Interior Walls: Hot-dip galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon Stainless steel.
   3. Wire Size for Side Rods: As indicated on drawings
   4. Wire Size for Cross Rods: 0.148-inch diameter.
   5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry: Provide one of the following:

1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches wide, plus 1 side rod at each wythe of masonry 4 inches wide or less.
2. Tab type, ladder design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.05 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with ASTM F1554 grade 36, or ASTM A307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.06 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. For reinforced masonry, use portland cement-lime mortar.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Reinforced Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type S.
   2. For reinforced masonry, use Type S.
   3. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Unless acceptable, do not hand mix mortar. Maintain workability of mortar by remixing or retempering. Discard mortar which has begun to stiffen or is not used within 2-½ hours after initial mixing.

D. Grout for Reinforced Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 7 in TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Grout shall attain a minimum compressive strength of 2000 psi at 28 days when tested in accordance with C1019.
   3. Except for self-consolidating grout, mix and proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated.
   4. Provide grout with a slump of 8 to 11 inches for grout heights less than 5 feet 4 inches, or 10 to 11 inches for grout lift heights greater than 5 feet 4 inches as measured according to ASTM C 143/C 143M, unless self-consolidating grout is used.

5. Self consolidating grout, if used, shall comply with the material requirements of ASTM C476; have a slump flow of 24 to 30 in as determined by ASTM C1611/C1611M; and has a Visual Stability Index (VSI) less than or equal to 1 as determined in accordance with ASTM C1611/C1611M, Appendix X.1.
6. Proportioning of self-consolidating grout at the project site is not permitted. Do not add water at the project site except in accordance with the self-consolidating grout manufacturer's recommendations.
7. Do not use admixtures unless acceptable. Field additional of admixtures is not permitted in self-consolidating grout.

PART 3 - EXECUTION

3.01 LAYING MASONRY WALLS

A. Bond Pattern: Unless otherwise indicated, lay exposed masonry in running bond do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

B. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

C. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.02 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar each side of grouted cells.

3.03 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.04 CONTROL AND EXPANSION JOINTS

A. General: Install control joint materials in reinforced unit masonry as masonry progresses, as indicated on drawings.

3.05 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

3.06 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6, latest edition.
   1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances.
   2. Completely embed reinforcing bars in grout.
   3. Maintain clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least 1/4 inch for fine grout and 1/2 inch for coarse grout, except where cross webs of hollow units are used as supports for horizontal reinforcement.
   4. Place reinforcing bars maintaining the following minimum cover:
      a) Masonry face exposed to earth or weather: 2 inches for bars larger than No. 5 ; 1½ inches for No. 5 bars or smaller.
      b) Masonry not exposed to earth or weather: 1½ inches .
   5. Maintain minimum clear distance between parallel bars of the nominal bar size or 1 inch , whichever is greater.
   6. In columns and pilasters, maintain minimum clear distance between vertical bars of one and one-half times the nominal bar size or 1½ inches , whichever is greater.
   7. Splice only where indicated on the Project Drawings, unless otherwise acceptable.
   8. Unless accepted by the Architect/Engineer, do not bend reinforcement after it is embedded in grout or mortar.
   9. Noncontact lap splices: Position bars spliced by noncontact lap splice no farther apart transversely than one-fifth the specified length of lap nor more than 8 inches
   10. Joint reinforcement
      a) Place joint reinforcement so that longitudinal wires are embedded in mortar with a minimum cover of 1/2 inch when not exposed to weather or earth; or 5/8 inch when exposed to weather or earth.
      b) Provide minimum 6 inch lap splices for joint reinforcement.
      c) Ensure that all ends of longitudinal wires of joint reinforcement at laps are embedded in mortar or grout.
   11. Placement Tolerances
      a) Place reinforcing bars in walls and flexural elements within a tolerance of 1/2 inch.
      b) Place vertical bars within:
         1) 2 inches of the required location along the length of the wall when the wall segment length exceeds 24 inches .
         2) 1 inch of the required location along the length of the wall when the wall segment length does not exceed 24 inches
      c) If it is necessary to move bars more than one bar diameter or a distance exceeding the tolerance stated above to avoid interference with other reinforcing steel, conduits,

or embedded items, notify the Architect/Engineer for acceptance of the resulting arrangement of bars.

d) Foundation dowels that interfere with unit webs are permitted to be bent to a maximum of 1 inch horizontally for every 6 inches of vertical height.

C. Cleanouts: Provide cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 5 feet 4 inches .

1. Construct cleanouts so that the space to be grouted can be cleaned and inspected. In solid grouted masonry, space cleanouts horizontally a maximum of 32 inches on center.
2. Construct cleanouts with an opening of sufficient size to permit removal of debris. The minimum opening dimension shall be 3 inches .
3. After cleaning, close cleanouts with closures braced to resist grout pressure.

D. Grout Placement

1. Placing time: Place grout within 1-1/2 hours from introducing water in the mixture and prior to initial set.
   a) Discard site-mixed grout that does not meet the specified slump without adding water after initial mixing.
   b) For ready-mixed grout:
      1) Addition of water is permitted at the time of discharge to adjust slump.
      2) Discard ready-mixed grout that does not meet the specified slump without adding water, other than the water that was added at the time of discharge. The time limitation is waived as long as the ready-mixed grout meets the specified slump.
2. Confinement: Confine grout to the areas indicated on the Project Drawings. Use material to confine grout that permits bond between masonry units and mortar.
3. Grout pour height:
   a) Definition: The total height of masonry to be grouted prior to erection of additional masonry. A grout pour consists of one or more grout lifts.
   b) Do not exceed the maximum grout pour height given in TMS 602/ACI 530.1/ASCE 6, Table 7.
4. Grout lift height:
   a) Definition: An increment of grout height within a total grout pour. A grout pour consists of one or more grout lifts.
   b) For grout except self-consolidating grout:
      1) Where the following conditions are met, place grout in lifts not exceeding 12 feet 8 inches .
         a) The masonry has cured for at least 4 hours.
         b) The grout slump is maintained between 10 and 11 inches .
         c) No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
      2) When there are intermediate bond beams within the grout pour, limit the grout lift height to the bottom of the lowest bond beam that is more than 5 feet 4 inches (1.63 m) above the bottom of the lift, but do not exceed a grout lift height of 12 feet 8 inches .
      3) When the conditions above are not met, place grout in lifts not exceeding 5 feet 4 inches .
5. For self-consolidating grout:
   a) When placed in masonry that has cured for at least 4 hours, place in lifts not exceeding the grout pour height.

b) When placed in masonry that has not cured for at least 4 hours, place in lifts not exceeding 5 feet 4 inches

E. Consolidation
1. Consolidate grout at the time of placement.
a) Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling.
b) Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.
c) Consolidation or reconsolidation is not required for self-consolidating grout.

F. Grout key: When grouting, form grout keys between grout pours. Form grout keys between grout lifts when the first lift is permitted to set prior to placement of the subsequent lift
1. Form a grout key by terminating the grout a minimum of 1½ inches below a mortar joint.
2. Do not form grout keys within beams.
3. At beams or lintels laid with closed bottom units, terminate the grout pour at the bottom of the beam or lintel without forming a grout key.

3.07 FIELD QUALITY CONTROL

A. As indicated on drawings.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

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

1.2 SCOPE OF WORK

A. Work of this Section includes all labor, materials, equipment, and services necessary to supply and fabricate each type of stone to the dimensions, shapes of design, approved color ranges, and approved shop drawing details, in patterns and under conditions as shown on the Contract Drawings, specified herein and as required for the Project including, but not limited to, the following:

1. Stone Runnel
2. Stone Basins
3. Stone Veneer Seatwall

B. Refer to Section 04 43 13.13 – Anchored Stone Masonry Veneer for installation requirements.

1.3 RELATED SECTIONS

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. Other specifications sections which directly relate to the work of this Section include, but are not limited to, the following:

1.	Section 01 33 00	Submittal Procedures.
2.	Section 03 30 05	Cast-in-Place Concrete – Site
3.	Section 04 43 13.13	Anchored Stone Masonry Veneer
4.	Section 31 20 00	Earthwork
5.	Section 32 13 13.13	Exposed Aggregate Concrete Paving
6.	Section 32 14 40	Stone Paving
7.	Section 32 16 13.43	Stone Curbs
8.	Section 33 46 10	Landscape Underdrainage

1.4 SUBMITTALS

A. General: Refer to and comply with Section 01 33 00 – Submittal Procedures for procedures and additional submittal criteria.

B. Statement of Qualifications: Submit to identify and exhibit Landscape Stonework installer(s) and supplier(s) qualifications as specified in Article 1.5 "Quality Assurance." Submittal shall be in addition to and as confirmation of requested information submitted with Bid Proposal.

C. Product Data:

1. For Stone Materials:
   (a) Submit complete data on quarry facilities for stone types specified. Include information of location, production capabilities, and the nature and character of stone material that can be selected and supplied.
   (b) Material properties data for each stone material type shall be submitted by the stone suppliers and certified as representative of the properties of stone material that can be supplied for the Project.
   (c) Submit an affidavit from respective quarry attesting that stone materials of type required for the Project have been quarried and obtained from one quarry, is of top grade of material specified and conforms to additional requirements in Article "Quality Assurance" herein for Source Limitations for Stone.
2. For Setting/Installation Materials:
   (a) Submit for mortar mix material of color to be used in installation of Landscape Stonework. Include material certification and analysis reports.
   (b) Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
   (c) Submit product information for Stainless Steel Pins.
3. For Cleaning Landscape Stonework: Submit product information and description of method(s) for cleaning stone materials during work and at completion.
4. Other Materials:
   (a) Erosion Control Fabric: Product data verifying compliance with specified properties.

D. Samples: Prior to ordering the below listed materials, submit representative samples to Landscape Architect for selection and approval as follows. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate samples of each type listed below showing full range of color variation, finish and texture that can be expected in the permanent work. The samples shall include but not be limited to:

1. Stone Sample: For each type, color grade, finish, and variety of stone required. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate samples of each sample showing full range of color variation, finish, and texture that can be expected in the permanent work.
2. For all stones provide sample with specified finish adequately sized to represent the qualities and characteristics of the specified stone. Label each sample with job name, supplier, color and finish.
   (a) For stone with variation in coloration, submit sample for each color in the group.

E. Colored Mortar Samples for Verification: For each stone required.

F. Photographs: Concurrent with submitting stone samples listed herein, provide photographs of each type of stone showing groupings of stones that are expected to be used in the final work. Show variations in size (provide scale element), color, and finish.

G. Shop Drawings: Provide Shop Drawings that show all details including sizes, materials, patterns, quantities and manner of assembling the various members, properly coordinated with the related work. Shop Drawings shall show true profiles, methods of anchoring hardware, if any, and all other necessary information. Take accurate field measurements before preparation of shop drawings:

1. Anchored Stone Veneer Assemblies: Shop drawings showing full details for anchoring and attaching stone veneer. Include calculations from a Structural Engineer Registered in the State of Arkansas.
   (a) Shop drawings shall be coordinated and submitted concurrently with shop drawings for reinforced concrete walls.
   (b) Shop drawings shall indicate setting beds, blocking and/or shelves beneath veneer assemblies.
2. Stone Setting Drawings: Submit setting drawings showing the relationship to adjoining construction and, after final selection, indicating the location of each stone boulder unit with a number designation corresponding to number marked on each stone unit and as indicated on Contract Drawings.
3. Coordination Drawings: Include coordination details for related, supporting, and adjoining work; as well as erection/installation diagrams. Show relative layout for all adjacent pavements, walls, foundation materials, etc. all correctly dimensioned.

H. Mock-ups: Upon approval of all materials, the Contractor shall construct sample panels and mock ups on site in the minimum size indicated below. Each sample panel and mock-ups shall be large enough to display typical characteristics of each item and type of work. Construct sample panels and mock ups concurrently with other required samples to aid in review of all materials. The Landscape Architect must approve the visual characteristics, quality of workmanship, and installation methods before final work is started. If the original sample and mock-ups are not approved, the Contractor shall provide additional samples and mock ups, as required, at no cost to the Owner until an approved sample and mock-ups are obtained. The approved samples shall become the standard for the entire job. Sample panel/mock-up shall not be constructed on a location becoming part of the final work, unless otherwise noted, and shall remain undisturbed until all work is completed. Sample panels shall be constructed at the same time and erected in a location approved by the Landscape Architect and Owner. Contractor shall completely remove any panels not set in place as part of the final work from the site upon final acceptance of work. The Landscape Architect reserves the right to adjust the size of the sample panels/mock-up as needed to show full condition. Mockup requirements:

1. Stone Veneer:
   (a) Stone Veneer Retaining Wall: Approximately 25 square feet including stone mortared to concrete wall backing and drainage system to demonstrate the full size, color range, patterning and jointing of stone in

multiple courses. Include cordner conditions. If approved by Landscape Architect, mockup may be used in permanent installation.

(b) Water Basin Veneer: Approximately 15 square feet, including stone mortared to concrete wall backing to demonstrate the full size, color range, patterning and jointing of stone in multiple courses. If approved by Landscape Architect, mockup may be used in permanent installation.

(c) Stone Veneer Seatwall: Approximately 15 square feet, including stone mortared to concrete wall backing to demonstrate the full size, color range, patterning and jointing of stone in multiple courses. Include corner conditions. If approved by Landscape Architect, mockup may be used in permanent installation.

I. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, sources of supply, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Landscape Architect and approved in writing.

1.5 QUALITY ASSURANCE

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

1. ACI: American Concrete Institute
2. ANSI: American National Standards Institute
3. ASTM: American Society for Testing and Materials
4. BSI: Building Stone Institute
5. FS: Federal Specifications
6. PCA: Portland Cement Association

B. Installer Qualifications: Installer shall be experienced to perform work of this type and shall have specialized in the installation of work similar to that required for this project. Installer shall employ experienced stone masons and stone fitters who are skilled in installing stone assemblies similar in material, design, complexity, and extent to those indicated for this Project and whose projects have a record of successful in-service performance.

1. Use adequate numbers of skilled workmen equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with specific requirements

C. Supplier Qualifications: Stone supplier shall be by a firm or firms that have successfully supplied natural stonework of each material type and condition, similar to the quality specified, and in the quantity shown for a period of not less than 10 years. Stone shall be obtained from quarries or suppliers capable of furnishing quantity, sizes and character of the stone required. Contractor will be held responsible for any delay in the

completion of the Work due to his failure to supply satisfactory stone in ample quantities and proper sequence.

D. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specifications.

E. Stone Material Selection and Examination: Comply with requirements of Part 2 Article "Stone Materials" for examination and selection confirmation of Stone Boulders at quarry by Owner, Construction Manager, and Landscape Architect. Source Limitations for Mortar Materials: Obtain ingredients of a uniform quality for each mortar component from a single manufacturer and each aggregate from one source or producer.

F. Source Limitations for Mortar Materials: Obtain ingredients of a uniform quality for each mortar component from a single manufacturer and each aggregate from one source or producer.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1. Contractor, together with Construction Manager, shall schedule a meeting with the stonework fabricator and installer and the Landscape Architect at a time sufficiently in advance of stone installations to permit coordination. In addition, include in appropriate sequence, representatives of other related work.

2. At the meeting, review stone system quality control requirements including details of construction, outstanding submittals, contract Drawings and Specifications, and on-site conditions affecting or which may affect installations.

H. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Landscape Architect's approval for layout and grades.

1. The Contractor shall stake out the work (horizontal and vertical) in sufficient detail for evaluation by the Landscape Architect.

2. The Landscape Architect shall be permitted to make reasonable adjustments to layout and grading without further compensation to the Contractor.

I. Grade Control: Establish and maintain required lines and elevations. Review grades and lines with Landscape Architect prior to starting work and as work progresses.

J. Stain Protection: Immediately remove and clean off residue of mortar and soil to prevent staining of stone.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling and Unloading: Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.

B. Protect stone and other system components during storage and construction against moisture, soiling, staining, and physical damage.

C. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Allow air to circulate around stone.

D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. The Contractor shall fully inform himself or herself of existing conditions of the site before submitting his bid, and shall be fully responsible for carrying out all site 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.

B. Environmental Requirements:

1. Hot-Weather Requirements: Protect stone installation materials when temperature and humidity conditions produce excessive evaporation of water from mortar setting beds. Do not apply setting mortar or joint grout to substrates with heat index temperatures of 100 degrees F. (38 deg C.) and above.
   (a) Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen sub-grade or setting beds. Comply with cold weather limitations and requirements specified herein:
   (a) Protect stone installation material and components against freezing when atmospheric temperature is 40 degrees F. (4 degrees C.) and falling. When conditions require, heat materials to provide mortar temperatures between 40 and 120 degrees F. (4 and 49 degrees C.).
   (b) Provide the following protection for completed portions of work for 24 hours after installation when the mean dialing air temperature ins as indicated: below 25 deg F, cover with insulating blankets; below 20 deg F, provide enclosure and temporary heat to maintain temperature above 32 deg F.
   (c) Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F. (4 degrees C.) and above.

C. Prevent wind or rain disturbance of setting materials, protect from sheet flow from adjacent areas, and generally maintain optimum installation conditions.

D. Protection of Stone Veneer Assemblies: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone veneer assemblies when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

1.8 SEQUENCING AND SCHEDULING

A. Stone Masonry shall be installed prior to installation of surrounding pavements, curbs, and concrete base slabs.

B. Stone Masonry work shall be installed after preparation of subgrades and in coordination with adjacent subsurface drainage, electric and water services, and structural soils.

PART 2 PRODUCTS

2.1 SUBBASE AND BASE MATERIALS

A. Compacted aggregate subbase shall be used as a base course material under pavements only as indicated on the Drawings. Refer to Section 31 20 00 – Earthwork.

B. Concrete Base shall be used as base course material under stone masonry as indicated on the Drawings. Concrete base shall be reinforced concrete to the thickness and reinforcing indicated on the Drawings.

2.2 CAST-IN-PLACE CONCRETE FOUNDATIONS

A. Refer to Section 03 30 05 – Cast-in-Place Concrete for concrete footings, foundations and base slabs.

2.3 STONE FABRICATION

A. General: Fabricate stone paving in sizes and shapes required to comply with requirements indicated, including details on Contract Documents.

B. Stone shall be cut to sizes, shapes, dimensions, and details shown on the Contract Drawings and to fit stone pattern as indicated.

C. Exposed surfaces and edges of stone units shall be free from cracks, broken corners, chipped edges, scratches, or defects affecting appearances. No patching or hiding of defects will be permitted.

D. Stone Finishing: Finish shall be as indicated on the Drawings or specified herein.

2.4 STONE – GENERAL

A. Characteristics and Quality:

1. All stone shall be carefully selected from sound stock and shall be free from defects impairing strength, durability, or function, such as cracks, holes, flaws or imperfections which have been patched or filled.

2. Unless otherwise approved or directed by the Landscape Architect, provide matched blocks from a single quarry / supplier.

3. Stone Shapes and Sizes: Provide stone of types, shapes, and sizes as indicated on the Drawings or as otherwise specified herein.

4. Stone shall exhibit the full range of color, value, graining texture, and other features to the extent inherent in each stone type.

   (a) Color and value variations shall be within ranges established by approved samples.

   (b) Graining and texture variations, whether highly figured or uniform, shall be consistent in all material supplied.

B. Contractor's bid shall account for the total volume (cubic feet) and tonnage noted in the Stone Schedule(s) on the Drawings. The Landscape Architect reserves the right to alter the quantity and size of stone shown in the Stone Schedule so long as the total tonnage is not exceeded.

C. Provisions for Examinations at the Quarry: The Landscape Architect shall "tag" stone at the source. If so requested, the Contractor shall accompany the Landscape Architect and assist in the tagging procedure. Contractor shall provide removable marking paint. Contractor shall coordinate and facilitate all stone tagging trips with quarries including arrangement for equipment to be present to move stockpiled stone.

D. Visual Criteria for Stone: All examinations, selections, and approvals shall be for the purpose of achieving a final appearance of stone with greatest possible uniformity, or uniformity shown on the Drawings, and will be based upon the following criteria.

1. All stone shall be of sound stock and uniform texture, and shall be free from holes, seams, chips, cracks, shakes, clay pockets, spalls, stains, starts, and other defects that are not natural to the stone specified and that would impair the strength, durability and appearance of the work, as determined by the Landscape Architect.

2. Inherent variations characteristic of the stone and the quarry from which the stone is to be obtained shall be brought to the attention of the Landscape Architect at the time the samples are submitted for approval, and shall be subject to approval of the Landscape Architect.

3. Stone shall be selected for background color, veining, marking and matching, shall run in even shades, and shall be set accordingly.

E. Stone Shapes and Sizes: Provide stone of types, shapes, and sizes as indicated by Contract Documents matching grain, and colors of representative stones as selected by Landscape Architect at stone material source. Stone shall have a natural fractured face finish without tool or drill marks, unless otherwise indicated.

2.5 STONE VENEER

A. Stone shall be roughly angular solid sandstone with finishes as indicated on the Drawings and specified herein.

B. Suppliers: Acceptable suppliers include the following:

1. Bluebird Stone

PO Box 125 Lathum Road
Shady Point, OK 74956
Phone: 918.647.7161
www.bluebirdstone.com

2. Ibison Stone Supply
10520 Hwy 10 W
Hackett, AR 72937
Tel: 479.638.8678
www.ibisonstonesupply.com

3. Green Country Stone
10727 State Hwy 120
Cameron, OK 74932
Phone: 918.654.3627
www.greencountrystone.com

C. Sizes: Varies (as indicated in the Drawings).

D. Color: Tawny-Beige (refer to Drawings for colors/locations).

E. Stone Finishes: Refer to Drawings for stone finishes.

2.6 MISCELLANEOUS MATERIALS

A. Portland Cement Mortar Materials:

1. Portland Cement: Comply with ASTM C150, Type I or II. For joint filler, provide Portland cement mortar with color added conforming to ASTM C-150, and sand conforming to ASTM C-33. Color shall be as selected by the Landscape Architect. Cement shall in no case contain more than .03% by weight of soluble alkali (calculated as Na20). Submit mill certificates of cement and certified analysis from an approved testing laboratory.

2. Hydrated Lime: Comply with ASTM C207, Type S.

3. Aggregate: Comply with ASTM C144, except graded with 100% passing No. 16 sieve, non-staining or otherwise graded to comply with latex-additive manufacturer's requirements.

(a) Colored Aggregate: Ground marble, granite, limestone or other sound stone; selected to produce required grout color.

4. Colored Mortar Pigments: Provide natural and synthetic iron and chromium oxides, compounded for use in joint mortar mixes. Use only pigments that have proved through testing and experience to be satisfactory for use in Portland cement mixes with latex admixtures. Provide integral, non-fading colorant made by Davis Colors, 7101 Muirkirk Road, Baltimore, MD 20705, Phone: 800.638.4444. Web: www.daviscolors.com, Scoffield, or approved equal; color selected by the Landscape Architect.

5. Water: Potable, clear and free of deleterious materials which would impair the quality of the mortar/grout.

6. Grout: High strength non-shrinking grout that is free of metallic aggregate, oxidizing catalysts, and accelerators; factory packaged; requiring only addition of water; Masterflow #173 Grout by Master Builders or 5-Star Grout Corp. or approved equivalent.

7. Pins: Stainless Steel Series 316, ½" diameter. Size shown on the approved Shop Drawings.

B. Mortar Mixes:

1. Mixing, General:
   (a) Setting Mortar: Conform to ASTM C270, Type M or N, Portland cement/lime mortar.
   (b) Mix cementitious materials, admixtures, and aggregate with the proper amount of water consistency which will result in a homogeneous, still and plastic mix.
   (c) Mix mortar in small batches by approved mechanical mixes. Monitor volume of materials per batch carefully.
   (d) Retempering of mortar will not be permitted, and mortar that has been allowed to stand more than one or two hours shall not be used. Mortar shall be mixed and kept tempered so that it will, at all times, contain as much water as it is able to carry.

2. The mortar shall meet the following physical requirements:
   (a) Compressive strength: 3,000 psi min.
   (b) Water absorption: 4.0% max.
   (c) Bond strength: 500 psi min.

C. MASONRY CLEANERS

1. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry-measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry-measure laundry detergent dissolved in 1 gal. (4 L) of water.

2. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by stone producer.
   (a) Diedrich Technologies, Inc.; 202 New Masonry Detergent.
   (b) Dominion Restoration, Inc.; DR-60 Stone and Masonry Cleaner.
   (c) Hydrochemical Techniques, Inc.; Hydroclean Brick, Granite, Sandstone and Terra Cotta Cleaner (HT-626).
   (d) ProSoCo, Inc.; Sure Klean No. 600 Detergent.
   (e) ProSoCo, Inc.; Sure Klean Restoration Cleaner.

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Contractor Construction Manager in writing of

all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

3.2 PREPARATION

A. Advise installers of other work about specific requirements for placement of reinforcement, bond breaker, flashing, and similar items to be built into stone and unit masonry veneer assemblies.

B. Prior to installation, examine surfaces to receive stonework and do not proceed until any defects detrimental to the finished work are corrected.

C. Verify all measurements and dimensions and coordinate the installation of supporting construction for natural stone boulders.

D. Layout of Work: Accurately lay out Site Stone Masonry work to patterns and to fit conditions as indicated and encountered on site. Comply with set out control points and coordinate with other work of Project. Provide additional control points and stakeouts as required to effect correct alignments and grade elevations. Advise Construction Manager of any discrepancies or on-site conditions detrimental to critical layouts and obtain approved correction.

1. Also refer to Section 017123 –Field Engineering.

E. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SUBBASE PREPARATION AND COMPACTED AGGREGATE SUBBASE

A. Compacted aggregate subbase shall conform to Section 31 20 00 – Earthwork.

B. Prepare and install compacted subgrade, compacted aggregate subbase and CIP Concrete base in accordance with Section 033005 – Cast-in-Place Concrete-Site.

3.4 STONE PREPARATION

A. Block Stone:

1. Provide stone units as indicated by Contract Drawings of solid block unit(s) of sizes indicated with natural finish appearance.

2. All corners and exposed faces shall be rubbed or shaped to remove any sharp edges in a manner approved by the Landscape Architect and that will not show drill, grinding, or other tool marks.

3.5 INSTALLATION - GENERAL

A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

B. The Contractor shall assign a qualified person to assist the Landscape Architect with the layout of the stone and to advise on the structural integrity of stone arrangements as they are being placed. The Landscape Architect will be the sole arbiter of the aesthetic stone arrangement and distribution but the Landscape Architect shall not be held liable for problems arising out of structural recommendations made by the Contractor.

C. The Landscape Architect reserves the right to redistribute stone from one area to another and shall work with the Contractor to determine this distribution before work commences in an area.

D. The Contractor shall keep track of stone quantities as they are being delivered to the site and shall keep a tally on the tonnage of stone being used throughout the project. The Contractor shall inform the Landscape Architect and Construction Manager when 50% and 75% of the stone has been delivered and/or placed.

E. The Contractor shall work with the Construction Manager to locate a stone staging area for separating and sorting stone. The Contractor shall display the stone in such a manner as to facilitate selection of stone during the placement period.

3.6 STONE UNITS ON CONCRETE BASE

A. Before commencing work, thoroughly clean stone of all dust, dirt and foreign matter.

B. Lay stone in a full bed of mortar at the proper level as indicated on the approved Shop Drawings. Cure mortar bed for at least three (3) days. Do not smear mortar on adjoining surfaces.

C. After initial set of setting bed, tool joints with a 1/4" diameter non-staining wood jointer to produce a slightly concave joint, free of drying cracks.

D. Cure joints for at least seven (7) days after installation by covering with curing paper or other non-staining material.

3.7 STONE VENEER

A. Refer to Section 04 43 13.13 – Anchored Stone Masonry Veneer for installation of stone veneer on reinforced concrete backup.

3.8 PROTECTION

A. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction. Work-in-progress shall be protected at all times during construction by use of a suitable strong, impervious film or fabric securely held in place. Immediately remove mortar, grout or other detrimental materials from exposed surfaces of stone or adjoining construction.

B. After installation, protect stone units from damage during subsequent construction activities.

C. Provide additional protection for exposed edges, corners, and all other stone liable to physical injury or staining.

D. After installation, protect stone units from damage during subsequent construction activities. Suitable protection shall be required wherever necessary, but no lumber that may stain or deface the work shall be used. All fastenings and nails used in conjunction with protecting devices shall be non-staining.

E. At Substantial Completion or as directed by Construction Manager, remove all temporary protection installed as part of this Section.

3.9 ADJUSTING, CLEANING, AND REPAIRING

A. Examine all work and repair all damage. Clean soiled or stained surfaces. In the event damage is irreparable, or soiled or stained surface cannot be cleaned, then remove and replace such items at no additional cost to Owner.

B. Remove and replace stone blocks that are defective, broken, chipped, stained, or otherwise damaged.

1. Replace in a manner that results in Site Stone Masonry matching approved samples and mockups.

C. In-Progress Cleaning: Clean stonework as work progresses. Remove grout/mortar fins and smears before tooling joints.

D. Final Cleaning:

1. After completion of any repair work, clean exposed surfaces of all stone surfaces and units installed as work of this Section with clean water and stiff fiber brushes until all dirt, stains, efflorescence grout/mortar, and other defacements are removed. Use cleaner and procedures recommended by stone quarry and approved by Landscape Architect. Do not use wire brushes, metal scrapers or acids. Protect adjacent surfaces from damage during cleaning operations.

2. Test cleaning methods on mockup; temporarily leave adjacent stone unit un-cleaned for comparison purposes. Obtain Landscape Architect's approval of sample cleaning before proceeding with cleaning of stones.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stone masonry anchorage to concrete backup.

B. Related Requirements:
   1. Section 033005 – Cast-in-Place Concrete – Site
   2. Section 044310 – Site Stone Masonry

1.2 ACTION SUBMITTALS

A. Product Data: For each stone anchorage accessory and manufactured product.

B. Refer to Section 044310 – Site Stone Masonry for additional required submittals, including but not limited to qualifications, samples, shop drawings, coordination drawings and mock-ups.

PART 2 - PRODUCTS

2.1 STONE AND MISCELLANEOUS MATERIALS

A. Refer to Section 044310 – Site Stone Masonry

2.2 VENEER ANCHORS

B. Materials:
   1. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304, Z-type anchors
   2. Fabricate sheet metal anchor sections and other sheet metal parts in thicknesses indicated on the drawings of stainless steel.

C. Manufacturers:
   1. Hohmann & Barnard, Inc.
   2. Wire-Bond

2.3 MISCELLANEOUS MASONRY ACCESSORIES

D. Cavity Drainage System (non-submerged conditions): High-performance, high-strength drainage composite consisting of a three-dimensional, high-impact polystyrene core and a high- strength non-woven filter fabric.
   1. Products: Subject to compliance with requirements, provide the following:

a. Carlisle Coatings & Waterproofing; CCW-MiraDRAIN 6000XL.

2. Provide the following configuration:
   a. Sheets or strips full depth of cavity and installed to full height of cavity.
   b. Install vents, weeps and wicks at top and base of drainage system per manufacturer's recommendations to accommodate the maximum flow capacity of the drainage system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Accurately locate and mark stone coursing elevations and stone veneer anchor locations on face of concrete before beginning stone veneer anchorage installation.

B. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
   1. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.2 INSTALLATION OF ANCHORED STONE MASONRY

A. Anchorage Condition #1: Stone masonry wythe is of uniform thickness and exposed faces of units generally align in a vertical plane. Anchor stone masonry to concrete with stone veneer anchors as indicated on the Drawings. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.

B. Embed veneer anchors in mortar joints of stone masonry for a distance equal to two-thirds of the thickness of the wythe. Vertical leg or legs of stone veneer anchor shall project into kerf cut in unit for depth equal to one third of the course height.

C. Provide anchors at 24" O.C., min (2) per stone.

D. Build anchors into mortar joints as stone is set.

E. Fill space between back of stone masonry and drainage system with mortar or grout as stone is set.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this Section and are hereby made a part of this Section.

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

1.2 SCOPE OF WORK

A. Work of this Section includes all labor, materials, equipment, and services necessary to provide selected natural stone materials in patterns and under conditions as shown on the Contract Drawings and/or specified herein, including but not limited to, the following:

1. Sourcing, supply, selective fabrication, delivery to the site and installation of natural stone boulders and blocks in specified sizes as indicated on the Drawings or as required for Project:
   (a) Monolithic Stone Bench
   (b) Monolithic Stone Bench w/Underlight
   (c) Tail Stone
   (d) Roof Retaining Boulders
   (e) Scramble Stair
2. Field measurements of adjacent and/or supporting construction and verification of existing conditions.
3. Drilling, fitting and cutting of stonework as required for the proper completion of the work.
4. Installation of natural stone boulders and blocks in presence of Landscape Architect, including field adjustment of each boulder for aesthetic effect.
5. Protection of stone during transit, storage, erection and after installation.
6. Setting beds, mortars, grouting/pointing mortars, and related setting accessories for complete installation.
7. Coordination and provisions for and interfacing with adjoining construction.
8. Cleaning of stonework installed as part of the work of this Section, after installation and prior to acceptance.

1.3 RELATED SECTIONS

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. Other specifications sections which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 01 33 00 Submittal Procedures.

2. Section 12 93 00 Site Furnishings
3. Section 31 20 00 Earthwork
4. Section 32 13 13.13 Exposed Aggregate Concrete Paving
5. Section 32 14 40 Stone Paving
6. Section 32 16 13.43 Stone Curbs
7. Section 32 91 00 Planting Soil System
8. Section 32 92 00 Lawns
9. Section 32 93 00 Planting and Fine Grading
10. Section 33 46 10 Landscape Underdrainage

1.4 SUBMITTALS

A. General: Refer to and comply with Section 013 3 00 – Submittal Procedures for procedures and additional submittal criteria.

B. Statement of Qualifications: Submit to identify and exhibit Landscape Stonework installer(s) and supplier(s) qualifications as specified in Article "Quality Assurance" herein. Submittal shall be in addition to and as confirmation of requested information submitted with Bid Proposal.

C. Product Data:

1. For Stone Materials:
   (a) Submit complete data on quarry facilities for stone types specified. Include information of location, production capabilities, and the nature and character of stone material that can be selected and supplied.
   (b) Material properties data for each stone material type shall be submitted by the stone suppliers and certified as representative of the properties of stone material that can be supplied for the Project.
   (c) Submit an affidavit from respective quarry attesting that stone materials of type required for the Project have been quarried and obtained from one quarry, is of top grade of material specified and conforms to additional requirements in Article "Quality Assurance" herein for Source Limitations for Stone.
2. For Setting/Installation Materials:
   (a) Submit for mortar mix material of color to be used in installation of Landscape Stonework. Include material certification and analysis reports.
   (b) Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
   (c) Submit product information for Stainless Steel Pins.
3. For Cleaning Landscape Stonework: Submit product information and description of method(s) for cleaning stone materials during work and at completion.
4. Other Materials:
   (a) Erosion Control (Geotextile) Fabric: Product data verifying compliance with specified properties.

D. Photographs: Concurrent with submitting stone samples listed herein; provide photographs of each type of stone showing groupings of stones that are expected to be used in the final work. Show variations in size (provide scale element), color, and finish.

E. Shop Drawings: Submit Shop Drawings for the items indicated below. Shop Drawings shall include materials, profiles, plans, elevations, sections, details, method of assembly, connections, and installation. Shop Drawings shall show true profiles, methods of anchoring hardware, if any, and all other necessary information. Take accurate field measurements before preparation of shop drawings and specifications

1. Monolithic Stone Bench
2. Monolithic Stone Bench w/Underlight

F. Setting Drawings: Submit setting drawings showing the relationship to adjoining construction and, after final selection, indicating the location of each stone boulder unit with a number designation corresponding to number marked on each stone unit and as indicated on Contract Drawings.

1. Monolithic Stone Bench(s): For stone benches show location layouts and patterns coordinated with Contract Drawings and related to survey control points and dimensions to confirm alignment with adjacent conditions. Establish and verify dimensions with concrete work of on-site walls and base slabs, layouts and patterns of other work, and other like conditions. Include details to confirm how boulder stone units will be installed, including single unit placements, stacked unit placements and any modification/deviations from conditions indicated by Contract Documents.

G. Coordination Drawings:

1. Include coordination details for related, supporting, and adjoining work; as well as erection/installation diagrams. Show relative layout for all adjacent pavements, walls, foundation materials, etc. all correctly dimensioned.

H. Mock-ups: Submit layout and detail shop drawing(s) for material and installation of stone elements to locate and confirm mock-up requirements as specified in Article 1.5 “Quality Assurance” herein.

1. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers’ product names, sources of supply, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

I. Samples: Prior to ordering the below listed materials, submit representative samples to Landscape Architect for selection and approval as follows. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate samples of each type listed below showing full range of color variation, finish and texture that can be expected in the permanent work. The samples shall include but not be limited to:

1. Stone Sample: For each type, color grade, finish, and variety of stone required. Do not order materials until Landscape Architect’s approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate

samples of each sample showing full range of color variation, finish, and texture that can be expected in the permanent work.

2. For all stones provide sample with specified finish adequately sized to represent the qualities and characteristics of the specified stone. Label each sample with job name, supplier, color and finish.

   (a) For stone with variation in coloration, submit sample for each color in the group.

J. Colored Mortar Samples for Verification: For each stone required.

K. Samples for Verification:

1. For Monolithic Stone Benches: Submit one (1) set of samples for each type, at a minimum size of 14" high x 24" long x 18" depth in quantity necessary to indicate the full range of material characteristics, color, and texture specified including both natural cleft and sawn finishes.

2. Tail Stone: Submit one (1) set of samples for each type, at a minimum size of 3" high x 24" long x 18" depth in quantity necessary to indicate the full range of material characteristics, color, and texture specified

3. Roof Retaining Boulders: Submit one (1) set of samples for each type, at a minimum size of 14" high x 14" long x 14" depth in quantity necessary to indicate the full range of material characteristics, color, and texture specified

4. For Scramble Stair: Submit one (1) set of samples for each type, at a minimum size of 6" high x 24" long x 18" depth in quantity necessary to indicate the full range of material characteristics, color, and texture specified

5. Mortar color sample.

1.5 QUALITY ASSURANCE

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

1. ACI: American Concrete Institute

2. ANSI: American National Standards Institute

3. ASTM: American Society for Testing and Materials

4. BSI: Building Stone Institute

5. FS: Federal Specifications

6. PCA: Portland Cement Association

B. Supplier Qualifications: Landscape Stonework supplier shall be by a firm or firms that have successfully supplied natural stonework of each material type and condition, similar to the quality specified, and in the quantity shown for a period of not less than 10 years. Stone shall be obtained from quarries or suppliers capable of furnishing quantity, sizes and character of the stone required. Contractor will be held responsible for any delay in the completion of the Work due to his failure to supply satisfactory stone in ample quantities and proper sequence.

C. Installer Qualifications: An installer who is and employs experienced stone masons and stone fitters who have a minimum of 5 years experience and who are skilled in installing

landscape stonework in material, design, complexity, and extent to those indicated for this Project and whose projects have a record of successful in-service performance.

1. Stonework Foreman: Contractor installing Landscape Boulders on this Project shall have on staff a Supervising Foreman assigned full time to this Project, from time of mock-up installations through completion, who shall have at least ten (10) years total stonework installation experience and with at least five (5) years experience in stone installations of equivalent or more extensive type and scope to this Project. Submit detailed resume of past experience with dates, duration and scope identification, project name and location, and work function on previous projects.
2. Use adequate numbers of skilled workmen equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with specific requirements and methods needed for performance of the work in this Section.

D. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry or source, unless otherwise approved in writing by the Landscape Architect with resources to provide materials of consistent quality in appearance and physical properties.

E. Stone Material Selection and Examination: Comply with requirements of Part 2 Article "Stone Materials" for examination and selection confirmation of Stone Boulders at quarry by Owner, Construction Manager, and Landscape Architect. Source Limitations for Mortar Materials: Obtain ingredients of a uniform quality for each mortar component from a single manufacturer and each aggregate from one source or producer.

F. Field Samples/Mock-Ups: Construct at earliest possible time and at ~~an~~ approved locations before proceeding with respective work and after the Landscape Architect's approval of samples for verification. Construct to demonstrate aesthetic effects with full range of stone and qualities of materials and execution.

1. General:
   (a) Notify Construction Manager at least seven days in advance of dates and times when field sample/mockup will be constructed.
   (b) Construct to comply with the requirements specified herein, using materials indicated for the completed work, including same base construction, special features for expansion joints, and contiguous work as indicated.
2. Monolithic Stone Benches (with and without lighting element):
   (a) Construct representative stone bench mockup in a location as approved by the Construction Manager. Install a minimum of (2) stone benches including stacked units in multiple courses, complete with aggregate base, setting and mortar bed(s). Mockup may be used as part of completed work if installation is approved by Landscape Architect.
3. Tail Stone:
   (a) Construct representative Tail Stone mockup in a location as approved by the Construction Manager. Install a minimum of (3) stone courses complete with aggregate base. Mockup may be used as part of completed work if installation is approved by Landscape Architect.

4. Roof Retaining Boulders and Scramble Stair:

(a) Construct representative Roof Retaining Boulders and Scramble Stair mockup in a location as approved by the Construction Manager. Install a minimum of (5) stone risers complete with adjacent retaining boulders and required aggregate bases. Mockup may be used as part of completed work if installation is approved by Landscape Architect.

G. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Landscape Architect's approval for layout and grades.

1. The Contractor shall stake out the work (horizontal and vertical) in sufficient detail for evaluation by the Landscape Architect.

2. The Landscape Architect shall be permitted to make reasonable adjustments to layout and grading without further compensation to the Contractor.

H. Grade Control: Establish and maintain required lines and elevations. Review grades and lines with Landscape Architect prior to starting work and as work progresses.

I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination".

1. Contractor, together with Construction Manager, shall schedule a meeting with the stonework fabricator and installer and the Landscape Architect at a time sufficiently in advance of stone installations to permit coordination. In addition, include in appropriate sequence, representatives of other related work.

2. At the meeting, review stone system quality control requirements including details of construction, outstanding submittals, contract Drawings and Specifications, and on site conditions affecting or which may affect installations.

J. Stain Protection: Immediately remove and clean off residue of mortar and soil to prevent staining of stone.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling and Unloading: Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.

B. Storage and Protection:

1. Protect stone and other system components during storage and construction against moisture, soiling, staining, and physical damage.

2. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Allow air to circulate around stone.

3. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

4. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:

1. Hot-Weather Requirements: Protect stone installation materials when temperature and humidity conditions produce excessive evaporation of water from mortar setting beds. Do not apply setting mortar or joint grout to substrates with heat index temperatures of 100 degrees F. (38 deg C.) and above.

   (a) Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

2. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen sub-grade or setting beds. Comply with cold weather limitations and requirements specified herein:

   (a) Protect stone installation material and components against freezing when atmospheric temperature is 40 degrees F. (4 degrees C.) and falling. When conditions require, heat materials to provide mortar temperatures between 40 and 120 degrees F. (4 and 49 degrees C.).

   (b) Provide the following protection for completed portions of work for 24 hours after installation when the mean dialing air temperature ins as indicated: below 25 deg F, cover with insulating blankets; below 20 deg F, provide enclosure and temporary heat to maintain temperature above 32 deg F.

3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F. (4 degrees C.) and above.

B. Prevent wind or rain disturbance of setting materials, protect from sheet flow from adjacent areas, and generally maintain optimum installation conditions.

C. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone veneer assemblies.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone veneer assemblies.

D. Grade Control: Establish and maintain required lines and elevations. Review grades and lines with Landscape Architect prior to starting work and as work progresses.

1.8 SEQUENCING AND SCHEDULING

A. Landscape Stonework shall be installed prior to installation of surrounding pavements, curbs, and concrete base slabs.

B. Landscape Stonework shall be installed after preparation of subgrades and in coordination with adjacent subsurface drainage, electric and water services, and structural soils.

PART 2 PRODUCTS

2.1 SUBBASE AND BASE MATERIALS

A. Compacted aggregate subbase shall be used as a base course material as indicated on the Drawings. Refer to Section 31 20 00 – Earthwork.

2.2 STONE – GENERAL

A. Characteristics and Quality:

1. All stone shall be carefully selected from sound stock and shall be free from defects impairing strength, durability, or function, such as cracks, holes, flaws or imperfections which have been patched or filled.

2. Unless otherwise approved or directed by the Landscape Architect, provide matched blocks from a single quarry / supplier. Landscape boulders shall be from a single location within the quarry especially reserved for Project, unless stones from randomly selected blocks are acceptable to the Landscape Architect and Owner for aesthetic effect.

3. Stone Shapes, Sizes and Finishes: Provide stone of types, shapes, sizes and finishes as indicated on the Drawings or as otherwise specified herein.

4. Stone shall exhibit the full range of color, value, graining texture, and other features to the extent inherent in each stone type.
   (a) Color and value variations shall be within ranges established by approved samples.
   (b) Graining and texture variations, whether highly figured or uniform, shall be consistent in all material supplied.

B. Provisions for Examinations at the Quarry: The Landscape Architect shall "tag" stone at the source. If so requested, the Contractor shall accompany the Landscape Architect and assist in the tagging procedure. Contractor shall provide removable marking paint. Contractor shall coordinate and facilitate all stone tagging trips with quarries including arrangement for equipment to be present to move stockpiled stone.

C. Visual Criteria for Stone: All examinations, selections, and approvals shall be for the purpose of achieving a final appearance of stone with greatest possible uniformity, or uniformity shown on the Drawings, and will be based upon the following criteria:

1. All stone shall be of sound stock and uniform texture, and shall be free from holes, seams, chips, cracks, shakes, clay pockets, spalls, stains, starts, and other defects that are not natural to the stone specified and that would impair the strength, durability and appearance of the work, as determined by the Landscape Architect.

2. Inherent variations characteristic of the stone and the quarry from which the stone is to be obtained shall be brought to the attention of the Landscape Architect at the time the samples are submitted for approval, and shall be subject to approval of the Landscape Architect.

3. Stone shall be selected for background color, veining, marking and matching, shall run in even shades, and shall be set accordingly.

2.3 STONE BENCH

A. The block stone shall be roughly angular solid cap block sandstone of rectangular to square form with a natural finish and with no sharp edges.

B. Suppliers: Acceptable suppliers include the following:

1. Bluebird Stone
   PO Box 125 Lathum Road
   Shady Point, OK 74956
   Tel: 918.647.7161
   www.bluebirdstone.com

2. Green Country Stone
   10727 State Hwy 120
   Cameron, OK 74932
   Tel: 918.654.3627
   www.greencountrystone.com

3. Ibison Stone Supply
   10520 Hwy 10 W
   Hackett, AR 72937
   Tel: 479.638.8678
   www.ibisonstonesupply.com

4. Or approved equal.

C. Sizes: As indicated in the Drawings.

D. Color: Tawny-Beige and Brown.

E. Finish: As indicated on Drawings

F. Project Locations include but are not limited to: Alle, Teaching Garden, Healing Garden, Tail, Café Plaza, Project Bluff, Winter Terrace and Wetland Terraces.

G. Fabrication: All corners and exposed faces shall be rubbed or shaped to remove any sharp edges in a manner approved by the Landscape Architect and that will not show drill, grinding, or other tool marks.

2.4 STONE INSTALLATION MATERIALS

A. Boulder Fragment Infill:

1. Aggregate: Comply with ASTM C144, except graded with 100% passing No. 16 sieve, non-staining or otherwise graded to comply with latex-additive manufacturer's requirements.
   (a) Colored Aggregate: Ground marble, granite, or other sound stone; selected to produce required grout color.

2. Colored Mortar Pigments: Provide natural and synthetic iron and chromium oxides, compounded for use in joint mortar mixes. Use only pigments that have

proved through testing and experience to be satisfactory for use in Portland cement mixes with latex admixtures. Provide integral, non-fading colorant made by Davis Colors, Scoffield, or approved equal; color selected by the Landscape Architect.

3. Water: Potable, clear and free of deleterious materials which would impair the quality of the mortar/grout.

B. Contractor shall provide a total of 1/2" x 6"L Type 316L Stainless Steel Pins as needed for boulders requiring anchoring as per approved shop drawings.

C. Masonry Cleaners

1. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry-measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry-measure laundry detergent dissolved in 1 gal. (4 L) of water.

2. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by stone producer.
   (a) Diedrich Technologies, Inc.; 202 New Masonry Detergent.
   (b) Dominion Restoration, Inc.; DR-60 Stone and Masonry Cleaner.
   (c) Hydrochemical Techniques, Inc.; Hydroclean Brick, Granite, Sandstone and Terra Cotta Cleaner (HT-626).
   (d) ProSoCo, Inc.; Sure Klean No. 600 Detergent.
   (e) ProSoCo, Inc.; Sure Klean Restoration Cleaner.

2.5 MORTAR MIXES

A. Mixing, General:

1. Setting Mortar: Conform to ASTM C270, Type M or N, Portland cement/lime mortar.

2. Mix cementitious materials, admixtures, and aggregate with the proper amount of water consistency which will result in a homogeneous, still and plastic mix.

3. Mix mortar in small batches by approved mechanical mixes. Monitor volume of materials per batch carefully.

4. Retempering of mortar will not be permitted, and mortar that has been allowed to stand more than one or two hours shall not be used. Mortar shall be mixed and kept tempered so that it will, at all times, contain as much water as it is able to carry.

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Contractor Construction Manager in writing of all deficiencies and conditions detrimental to the proper completion of this work.

Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

3.2 PREPARATION

A. Advise installers of other work about specific requirements for placement of reinforcement, bond breaker, flashing, and similar items to be built into stone and unit masonry veneer assemblies.

B. Prior to installation, examine surfaces to receive stonework and do not proceed until any defects detrimental to the finished work are corrected.

C. Verify all measurements and dimensions and coordinate the installation of supporting construction for natural stone boulders.

D. Layout of Work: Accurately lay out Landscape Stonework to patterns and to fit conditions as indicated and encountered on site. Comply with set out control points and coordinate with other work of Project. Provide additional control points and stakeouts as required to effect correct alignments and grade elevations. Advise Construction Manager of any discrepancies or on-site conditions detrimental to critical layouts and obtain approved correction.

1. Also refer to Section 01 71 23 –Field Engineering.

E. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SUBBASE PREPARATION AND COMPACTED AGGREGATE SUBBASE

A. Compacted aggregate subbase shall conform to Section 31 20 00 – Earthwork.

B. Prepare and install compacted subgrade, compacted aggregate subbase and CIP Concrete base in accordance with Section 03 30 05 – Cast-in-Place Concrete-Site.

3.4 INSTALLATION

A. General:

1. The Landscape Architect shall review the arrangement of all of the stone in the field.. The Contractor shall give the Landscape Architect 14 days notice before the commencement of work. The Contractor shall confer with the Landscape Architect on the distribution of the stone sizes for each area.

2. The Contractor shall assign a qualified person to assist the Landscape Architect with the layout of the stone and to advise on the structural integrity of stone arrangements as they are being placed. The Landscape Architect will be the sole arbiter of the aesthetic stone arrangement and distribution but the Landscape Architect shall not be held liable for problems arising out of structural recommendations made by the Contractor.

3. The Landscape Architect reserves the right to redistribute stone from one area to another and shall work with the Contractor to determine this distribution before work commences in an area.

4. The Contractor shall keep track of stone quantities as they are being delivered to the site and shall keep a tally on the tonnage of stone being used throughout the project. The Contractor shall inform the Landscape Architect and Construction Manager when 50% and 75% of the stone has been delivered and/or placed.

5. The Contractor shall work with the Construction Manager to locate a stone staging area for separating and sorting stone. The Contractor shall display the stone in such a manner as to facilitate selection of stone during the placement period.

B. Setting Stone Units:

1. Place stone units as indicated on compacted crushed aggregate stone base course to be provided in accordance with Section 31 20 00 – Earthwork that shall also include the following.
   (a) Geotextile (filter) fabric below and behind stones as indicated on the Contract Drawings to prevent wash out of backfill material.
   (b) Back fill behind stones with compacted crushed stone as indicated on the Contract Drawings.

2. Allow for review and adjustment to placement of each stone by Landscape Architect at time of installation.

3. Stack block units as indicated on the Contract Drawings, approved Shop Drawings or as otherwise directed by Landscape Architect.

4. Fill gaps greater than 2” between stones with hand placed and mortared stone fragments as required to provide a solid stone face effect.

5. Joint and setting bed mortar shall be deep raked so that stones appear to be dry laid and shall be applied of color selected and approved by the Landscape Architect.

3.5 PROTECTION

A. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction. Immediately remove mortar, grout or other detrimental materials from exposed surfaces of stone or adjoining construction.

B. After installation, protect stone units from damage during subsequent construction activities.

1. Provide additional protection for exposed edges, corners, and all other stone liable to physical injury or staining.

C. At Substantial Completion of Project construction work or as directed by Construction Manager, remove all temporary protection installed as work of this Section.

3.6 ADJUSTING, CLEANING, AND REPAIRING

A. Examine all work and repair all damage. Clean soiled or stained surfaces. In the event damage is irreparable, or soiled or stained surface cannot be cleaned, then remove and replace such items at no additional cost to Owner.

B. Remove and replace stone blocks that are defective, broken, chipped, stained, or otherwise damaged.

1. Replace in a manner that results in Landscape Stonework matching approved samples and mockups.

C. In-Progress Cleaning: Clean stonework as work progresses. Remove grout/mortar fins and smears before tooling joints.

D. Final Cleaning:

1. After completion of any repair work, clean exposed surfaces of all stone surfaces and units installed as work of this Section with clean water and stiff fiber brushes until all dirt, stains, efflorescence grout/mortar, and other defacements are removed. Use cleaner and procedures recommended by stone quarry and approved by Landscape Architect. Do not use wire brushes, metal scrapers or acids. Protect adjacent surfaces from damage during cleaning operations.

2. Test cleaning methods on mockup; temporarily leave adjacent stone unit un-cleaned for comparison purposes. Obtain Landscape Architect's approval of sample cleaning before proceeding with cleaning of stones.

END OF SECTION