CITY OF BOULDER, COLORADO

Finance Department/Purchasing Division
1777 Broadway
P.O. BOX 791
Boulder, Colorado 80306

Telephone No.: **303- 441-3054**
Fax No.: **303- 441-4381**
Email: **greyc@bouldercolorado.gov**

BID NO. 16-2016

OPENING DATE: 2:00 PM, Wednesday, May 25, 2016

SPECIFICATIONS
PROPOSAL, CONTRACTS AND BONDS
FOR
GENERAL CONSTRUCTION AND PUBLIC WORKS
FOR
THE CITY OF BOULDER, COLORADO
FOR

Civic Area Park Development

FOR INFORMATION CALL:

Doug Godfrey
Project Manager
Parks & Recreation
GodfreyD@bouldercolorado.gov

CITY OF BOULDER, COLORADO
ADVERTISEMENT FOR BIDS
BID NO. 16-2016
CIVIC AREA PARK DEVELOPMENT

Sealed bids will be received by the City of Boulder, Colorado, at the office of the Purchasing Coordinator, 1777 Broadway, Boulder, Colorado 80302 until **2:00 P.M. May 25, 2016** for the project called the **Civic Area Park Development**.

Bids will be in a sealed envelope, plainly marked "**Bid No. 05-2016, City of Boulder, Civic Area Park Development**", and addressed to:

Calder Grey
City of Boulder - Purchasing Division
1777 Broadway
P.O. Box791
Boulder, CO 80306

Hand carried bids and all non-USPS deliveries will be delivered to the Purchasing Division, 1777 Broadway, Boulder, Colorado, 80302.

Only those firms/contractors who were pre-qualified under the Statement of Qualifications solicitation RFQ 05-2016 will be allowed to submit a bid. The Firms who have been pre-qualified are as follows:

ECI
Golden Triangle Construction
Mortenson Construction
PCL Construction

Proposals submitted in response to this Bid by any Contractor who is not listed above, shall be considered not responsive and automatically rejected by the City.

All bids shall be signed, enclosed in a sealed envelope, and filed as stated in this advertisement. No bidder shall submit more than one bid.

Bid documents will be issued electronically only. A copy of the bid and any related materials may be obtained from the City of Boulder's website at:

https://bouldercolorado.gov/purchasing/bid-opportunities-awards

The work for which the bids are requested consists of:

The project is roughly 6 acres of reconfigured park land at the Boulder Civic Area along Boulder Creek between Canyon Boulevard and Arapahoe, and Broadway and the Boulder Public Library.

Bidders shall submit prices on the base bid and all alternatives as provided for in the Bid Form.

The City is not required to take the lowest bid. Bid proposals will be evaluated on a combination of criteria including demonstrated ability to meet bidder qualification and cost.

Each bid shall be accompanied by a money order, certified check, or bid bond payable to the City of Boulder, Colorado, in the amount of not less than five percent (5%) of the total amount of the bid. No bid will be considered unless accompanied by such deposit. Such check or bid bond shall be forfeited to the City if the bid is accepted and the bidder fails to sign a contract within fifteen days of acceptance.

Each bid shall also be accompanied by the following information, in addition to the other requirements herein:

1. Project Approach (maximum one (1) page);
2. Project Schedule congruent with the Base Bid in a format of the bidder's choosing;
3. Project Logistics and Phasing Plan (number of pages at the Bidder's option);
4. Resume of the Project Manager and Project Superintendent (one (1) page each); and
5. Bid Clarifications and Assumptions (number of pages at the Bidder's option).

The above section of the Bidder's submittal shall not exceed twenty (20) pages single-sided or ten (10) pages double-sided. Six (6) of these pages may be 11x17 format, and the rest shall be 8 ½ x 11. Font shall be 10 point or greater on all pages.

Bids and Qualification Statements shall be prepared at the bidders expense and become a City record and therefore a public record.

The City reserves the right to reject any and all bids and to waive any informality or irregularities therein. The City reserves the right to evaluate the bids including the base bid and any bid alternatives in any combination deemed to be in the best interest of the City.

Bids not submitted by the required deadline are ineligible for consideration and will not be opened, but the City may change the deadline at any time.

Bidders may inspect the bids after they are opened in accordance with provisions of the Colorado Public Records Act. However, if the City determines that all bids should be rejected and a rebid may be necessary, the manager may hold the bid in confidence until the rebid has been completed.

Confidential data, if identified as such, will be held confidential upon request, if the request is made as part of the bid and if the City Attorney determines the data meets the requirements of the Colorado Public Records Act.

The City may reject any and all bids but otherwise shall, after satisfying itself it understands the submittals, accept the lowest bid satisfying the minimum bid requirements and qualification criteria prescribed below. If the City determines the lowest bidder does not meet the minimum bid requirements the bid may be rejected.

Responsibility criteria include the following:

- Whether the bidder maintains a permanent place of business

- Whether the bidder has adequate plant, equipment, and support services to perform the contract
- Whether the bidder has previously perform similar work satisfactorily
- Whether the bidder is likely to be engaged in work that may impair the ability to finance the work covered by the bid or provide equipment for its proper execution
  Whether the bidder proposed a reasonable approach to achieve the objectives of the project
- Whether there have been or are presently any claims raising a substantial question about the bidders ability to perform the contract.

Bidders/General Contractors (including all parties of a joint venture, each completing a separate Qualification Statement, but submitting all forms together) are required to submit evidence that they have a practical knowledge of and the financial resources to complete the Work by completing Form 2, Contractor Qualification Statement.

No bids may be withdrawn within a period of forty five (45) days after the date set for opening bids, but a bid may be withdrawn up to twenty four (24) hours prior to expiration of the deadline for submitting bids.

Technical irregularities in the bid requirements may be waived if the City determines that such a waiver does not compromise the integrity of the bidding process.

The bidder shall furnish the City a completed copy of the Proposed Subcontractors Form 20 with the bid proposal. The bidder shall furnish the City a completed copy of Proposed Manufacturers and Suppliers Form 21 with the bid proposal.

The bidder to whom a contract is awarded will be required to furnish a separate "Performance Bond" and "Labor and Material Bond" to the City of Boulder, Colorado. The Performance Bond and the Labor and Material Bond shall be furnished in the amount of one hundred percent (100%) of the Contract, in conformity with the requirements of the Contract Documents.

CITY OF BOULDER, COLORADO
A MUNICIPAL CORPORATION

By

_____
City Clerk

CITY OF BOULDER, COLORADO

CONSTRUCTION CONTRACT

GENERAL CONDITIONS
July 2006

GENERAL CONDITIONS

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ARTICLE I. DEFINITIONS AND INTRODUCTORY PROVISIONS

101. USE OF THIS DOCUMENT

These general contract conditions consist of requirements concerning the construction contracts of the city. They are applicable to all contracts of the city in which reference is made to "city of Boulder General Conditions."

102. CONTRACT

The "contract" is the entire agreement between the contractor and the city and includes, without limitation, these general conditions and other contract documents in their entirety. The term is used generally and does not refer to any particular document.

103. CONTRACT DOCUMENTS

The "contract documents" are all written documents which define the construction work and the obligations of the contractor in performing the work and the city in providing compensation for the work. The contract documents include the following:

A. General conditions (this document);

B. Special conditions;

C. Bid documents;

D. Contract agreement (Form 5);

E. Drawings and specifications;

F. Payment and performance bonds; and

G. Change orders, work directives, field orders, addenda and other documents which may be required or specified. When a form number is referenced herein, it refers to the forms provided in the Appendix to this document, these are the city's preferred forms, but similar forms may be used at the discretion of the project manager.

104. GENERAL CONDITIONS

The "general conditions" are the sections set forth in articles 1 through 10 herein.

105. SPECIAL CONDITIONS

The special conditions are additions and revisions to the general conditions which refer to aspects of particular contracts. In the event that there are inconsistencies between the general conditions and the special conditions of a particular contract, special conditions supersede general conditions.

106. BID DOCUMENTS

The "bid documents" include the bidding instructions, and inform contractors of the bidding procedures of a particular contract. The bid proposal is the document upon which the contractor submits a bid, the bid bond, and any addenda to any of the other contract documents which are effective prior to submission of the bid proposal and the advertisement for bids.

107. DRAWINGS AND SPECIFICATIONS

The "drawings and specifications" consist of all documents, excluding shop drawings, approved by the city for the purpose of describing the work to be performed under the contract. The city shall retain ownership of all drawings and specifications prepared or used in connection with the contract, whether prepared by or on behalf of the contractor or the city. Copies of the drawings and specifications may be obtained at the location specified in the advertisement for bids. The drawings show the character and the scope of the work to be performed. Figure dimensions shall in all cases be used in preference to scale dimensions. The specifications consist of written technical descriptions of materials, equipment, construction systems, processes, standards, and workmanship. If work is shown on drawings, but dimensions for such work are not indicated, then the contractor shall not execute such work unless the contractor is able to determine the unspecified dimensions from the dimensions which are specified. Whenever the contractor is unable to determine unspecified dimensions, the contractor shall proceed as provided in section 120.

108. OWNERSHIP OF UNIQUE DRAWINGS AND SPECIFICATIONS

The city may hire an artist, architect, or engineer to prepare drawings or specifications for a unique design, logo, or structure, as will be set forth in the special conditions. The city hereby reserves complete property rights to such drawings and specifications. This section is not intended to include common drawings or specifications or manufacturer's specifications which are commonly used in the construction industry, or which are used by the artist, architect, or engineer who prepared such drawings or specifications. The contractor and all subcontractors are prohibited from using such drawings or specifications or selling or otherwise transferring such drawings or specifications to any other person or entity, except as required for the work, unless the project manager waives this condition in writing.

109. PARTIES TO THE CONTRACT

There are only two parties to the contract: the city and the contractor.

110. THE CITY

The City of Boulder, Colorado, shall be referred to in these documents as the "city." As used herein, the city also refers to each city department, division or other agency, board or commission or project manager set forth in the contract documents as having some responsibility for supervising the implementation of the contract.

111. PROJECT MANAGER

The city shall designate a "project manager" to be responsible for supervising the implementation of the contract and to represent the city in all matters and questions arising under the contract. The project manager shall be the judge of the performance of the contract as it relates to compliance with drawings and specifications and other contract documents, quality of workmanship and materials and implementation of the contract according to its letter and intent. The project manager shall have full access to the work at all times. The project manager alone shall have the authority to issue change orders. All correspondence to the city relating to the contract shall be directed to the project manager. The project manager's duties are defined further in other sections of the general conditions. The project manager's decisions on all matters of the contract shall be final and conclusive, subject to contractor's right to dispute such decision.

112. PROJECT INSPECTOR

The "project inspector" is an employee of the city or of the A/E (defined below). The city has delegated its authority to the project inspector to make initial decisions regarding technical questions which may arise as to the quality or acceptability of materials furnished and work performed and as to the manner of performance and rate of progress of the work under the contract. The project inspector shall interpret the intent and meaning of the contract, including drawings and specifications, and make initial decisions with respect to quality, workmanship and materials and the contractor's fulfillment of the contract and the contractor's entitlement to compensation. The contractor shall consult with the project inspector in all matters relating to the contract where any questions arise regarding technical aspects of the contract. The project inspector's decisions are subject to review by the project manager.

113. THE ARCHITECT/ENGINEER

The city may contract for the services of an architect or engineer, referred to as an "A/E," to aid the project manager in administering the contract. The A/E will consult with the project manager concerning the performance and acceptance of the work. The A/E will participate in the preparation and approval of progress and final payment estimates, and participate in inspections while the work is in progress and prior to final acceptance by the city.

114. THE CONTRACTOR

The word "contractor" as used herein refers to the person, partnership, corporation or joint venture which has contracted with the city to perform the work specified by the contract documents. The term "contractor" shall also be deemed to include any subsidiaries which are at least 80% owned by the contractor. The contractor shall supervise and direct the work, using the contractor's best skill and attention. The contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the contract, and shall perform all the work in a workmanlike manner. The contractor shall be responsible to the city for all acts and omissions of the contractor's agents and employees, subcontractors and their agents and employees, and other persons performing any of the work under contract with the contractor or any of its agents, employees, or subcontractors. The contractor shall

not be relieved from any obligations under the contract documents by inspections, tests, or approvals required or performed pursuant to the contract by persons other than the contractor.

115. SUBCONTRACTORS

The contractor shall list on its bid proposal any proposed subcontractor or supplier (other than employees) whom the contractor plans to hire to perform the work on the bid proposal. By executing the contract with the contractor, the city agrees to approve such subcontractors and suppliers, unless the city has a reasonable objection to any such subcontractor or supplier, and so notifies the contractor in writing within a reasonable time of discovering such objection. If the city has a reasonable objection to any such proposed subcontractor or supplier, the contractor shall propose a substitute to whom the city has no reasonable objection. If the contractor plans to hire any subcontractor or supplier not listed on the bid proposal, the project manager must give written approval before such subcontractor or supplier may perform any work or supply any materials under the contract. No agreement between the contractor and a subcontractor or supplier shall in any way affect the contract between the city and the contractor. The contractor shall review the qualifications of all subcontractors and their supervisors and assure that all subcontractors satisfy all applicable insurance requirements set forth in article 3 herein. The contractor shall require each subcontractor to sign an agreement in which the subcontractor agrees to be bound by all applicable terms and conditions of the contract documents for the benefit of the city. The contractor shall be fully responsible for all acts and omissions of its subcontractors and of persons and organizations directly or indirectly employed by them and of persons and organizations for whose acts any of them may be liable to the same extent that the contractor is responsible for the acts and omissions of persons directly employed by the contractor. Nothing in the contract documents nor in the city's acceptance of a subcontractor shall create any contractual relationship between the city and any subcontractor or other person or organization having a direct contract with the contractor, nor shall it create any obligation on the part of the city to pay or to see to the payment of any moneys due any subcontractor or other person or organization.

116. THIRD PARTY BENEFICIARIES

The contract is not intended to create any right in or for the public or any member thereof, any subcontractor or supplier, nor any other third party, nor to authorize anyone not a party to the contract to maintain a suit to enforce its terms. The duties, obligations, and responsibilities of the parties to the contract, with respect to third parties, shall remain as imposed by law. This section shall not apply to any surety to the extent it is acting under any labor and materials bond or performance bond entered into by the contractor.

117. INTEGRATION

The contract documents represent the entire integrated agreement between the city and the contractor and supersede all prior negotiations, representations, or agreements, whether written or oral. No modification, amendment, waiver or novation shall be valid unless incorporated in a written amendment or change order signed by both the project manager and the contractor.

118. SEVERABILITY

To the extent that the performance of the parties' obligations may be accomplished within the intent of the contract, the terms of the contract are severable, and should any term or provision of the contract be declared invalid or become inoperative for any reason, such invalidity or failure shall not affect the validity of any other contract term or provision.

119. WAIVER

If the city fails to enforce any term of the contract for any period, this shall not act as a waiver. No waiver of any breach of any term hereof shall be effective unless set forth in a writing signed by both the project manager and the contractor. The waiver of any breach of a term hereof shall not be construed as waiver of any other term.

120. INCONSISTENCIES IN CONTRACT DOCUMENTS

The contract documents are complementary, and what is called for by one document is binding as if called for by all contract documents. If the contractor notices a conflict, error or discrepancy in the contract documents, the contractor shall notify the project manager in writing immediately. The contractor shall not proceed with any part of the work affected by such conflict, error or discrepancy until the project manager has authorized the contractor to proceed in writing. The city shall decide which of the provisions in the contract documents shall be followed in the event of a conflict, error or discrepancy. If the city selects an interpretation which costs more or less than a version on which the contractor reasonably relied in preparing its bid, the contract price shall be increased or decreased by an appropriate change order. The adjustment in the contract price shall be calculated according to the provisions of article 8 herein, except that increases shall be granted only to the extent that the project manager finds that the contractor's interpretation which formed the basis of its bid was reasonable. If the contractor disputes the contract price adjustment made by the project manager, the contractor may appeal pursuant to section 25. The contractor shall report to the project manager all errors the contractor discovers in the contract documents. The contractor shall not be liable for damages resulting from conflicts, errors, or discrepancies in the contract unless the contractor caused the conflict, error, or discrepancy or if the contractor knew in the exercise of reasonable diligence of the conflict, error or discrepancy and failed to call it to the city's attention.

121. COMPLIANCE WITH LAWS

At all times during the performance of the contract, the contractor shall strictly adhere to all applicable federal, state, county and city laws that have been or may hereafter be established. This shall include, without limitation, the United States Department of Health, Occupational Safety and Health Administration (OSHA) standards. As used in this section, and hereafter, the term "laws" shall include, without limitation, all federal, state and city codes, charters, ordinances, laws, standards, rules, regulations and permits.

122. CHOICE OF LAW

In all litigation arising out of the contract, the statutory and common law of the State of Colorado shall be controlling, unless federal funds are expended on the contract and governing federal

requirements specify that federal law must prevail. Unless federal law governs, venue shall be in the District Court in and for Boulder County, State of Colorado.

123. FEDERAL AID PROVISIONS

Whenever federal funds are used on the work, the special conditions shall set forth the federal funding provisions. In such event the rules and regulations promulgated by the federal department or agency disbursing the funds shall be among the terms and conditions of the contract and shall be observed by the contractor, and shall be taken into account by the contractor in preparing and submitting its bid proposal. In the event of an inconsistency between the contract documents and federal aid requirements, the latter shall govern. When the United States of America provides funds, it may assign inspectors to insure that the purposes for which the funds were provided are achieved. However, such activity by the United States does not make it a party to the contract and shall not modify the rights or obligations of either the city or the contractor hereunder.

124. PAYMENT OF INTEREST

In the event that any payment of interest is to be made pursuant to any provision of the contract, interest shall be paid at the average rate earned by the city on its invested funds during the quarterly fiscal period prior to the period during which the interest was accrued.

125. CONTRACT GRIEVANCE APPEAL PROCEDURE

If the contractor disputes any decision made by the project manager, the contractor may appeal such decision informally to the city manager. If the city manager denies such appeal, or does not respond to the appeal within fifteen (15) days after receiving it, the contractor shall be required to submit a formal notice of intent to claim pursuant to section 809.

126. CITY AFFIRMATIVE ACTION REQUIREMENTS

Pursuant to Section 2-l-10, B.R.C. 1981, the contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, sexual orientation, gender variance, marital status, religion, ancestry, mental or physical handicap, or age, except when sex or age or absence of mental or physical handicap is a bona fide occupational qualification, and, in the instance of a handicap, no reasonable accommodation can be made. The contractor shall take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to the above mentioned characteristics. Such action shall include, without limitation, the following: employment, upgrading, demotion, transfer, recruitment and recruitment advertising, lay-off and termination, rate of pay and other forms of compensation, and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places on the work site notices setting forth this non-discrimination clause. In the event of the contractor's non-compliance with the foregoing non-discrimination clause, this contract may be canceled, terminated, or suspended in whole or in part, and the contractor may be declared ineligible for future city contracts.

127. ATTORNEYS' FEES

If the City is reasonably required to engage an attorney to assist it in connection with any claim, dispute, or other disagreement with the contractor, including without limitation engagement in connection with any litigation or arbitration proceedings under this contract, and the city substantially prevails in such proceeding, the contractor shall reimburse the city for its reasonable attorneys' fees, costs, and other expenses including without limitation the expenses of consultants and other experts, incurred by the city in such proceedings. Reimbursement of attorneys' fees shall be at the prevailing rate within the city for services rendered by the city attorney and employees of the city who assist the office of the city attorney in such proceedings.

128. AUTHORITY

Contractor warrants that the individual executing this contract is property authorized to bind the contractor to the terms of this contract.

ARTICLE II. BIDDING INSTRUCTIONS

201. GENERAL INSTRUCTIONS

These bidding instructions are general in nature, and may be amended or supplemented by the city. Upon submitting a bid proposal, the bidder warrants that it is familiar with all provisions of the contract documents, and agrees to comply with them. Bidding procedures shall at all times conform to the requirements of Chapter 2-8, B.R.C. 1981, as amended.

202. ADVERTISEMENT FOR BIDS

The city manager shall publish a notice of call for bids at least once in a newspaper of general circulation in the city when required by Section 2-8-4, B.R.C. 1981, as amended. The city manager may notify any contractor deemed particularly well suited to perform the particular tasks in a proposed contract.

203. LEGAL QUALIFICATIONS OF BIDDERS

Each bidder shall sign the bid proposal and give the bidder's current business address. The legal status of the bidder shall be stated in the proposal. A corporation shall name the state in which it is incorporated, shall be qualified to do business in the State of Colorado, and shall so state. When a corporation submits a proposal, the proposal shall be signed in the name of the corporation by a duly authorized officer or agent of the corporation, who shall submit a personal address together with evidence that such person has legal authority to sign the proposal. A partnership shall give the full names and addresses of all partners and their interest and role in the partnership business. When a partnership submits a proposal, the proposal shall be signed in the name of the partnership by a duly authorized general partner or agent thereof, who shall submit a personal address together with evidence that such person has legal authority to sign the proposal. If the bidder signs a bid proposal using the designation "President," "Secretary," "Agent," or other designation without disclosing the name of a bidding contractor, the person signing the bid proposal may be held individually

responsible for the bid. If required, the bidder shall furnish the city with a completed copy of Form 2, Contractor/Subcontractor Qualification, at the time and place set forth in the bidding instructions.

204. LICENSES AND PERMITS

Neither the contractor nor any subcontractor shall commence work under this contract in the city until obtaining all required city licenses and permits. The following is a list of licenses and permits which may be required; (the regulations can be accessed via the city's website at www.bouldercolorado.gov). These requirements are subject to change without notice. This list should not be deemed to be exhaustive. In addition, the contractor is responsible for obtaining all required federal, state, and county licenses and permits. The city will pay the development excise tax and any plant investment fees applicable to the project.

License or Permit	B.R.C. 1981	Location
General Contractor's License	4-4-3	Planning and Development Services Phone:303-441-1880
Building Permit	10-5-2	Same
Solar Access Permit	9-8-7	Same
Plumbing Contractor's License	4-15-3	Same
Plumbing Permit	10-10-2	Same
Electrical Contractor's Registration	4-8-2	
Electrical Permit	10-6-2	Same
Mechanical Contractor's License	4-13-3	Same
Mechanical Permit	10-9-2	Same
Sound Level Variance	5-6-2	
Sign Contractor's License	4-21-2	Same
Sign Permit	10-11-4	Same

Moving or Wrecking Permit	10-5-2	Same
Fire Protection System Permit	10-8-2	Same
Fence Permit	10-5-2	Same
Public Right-of-Way License	4-6-2	Same
Public Right-of-way Excavation Permit	4-6-9	Same
Water Main Connection Permit	11-1-14	Same
Sewer Main Connection Permit	11-2-9	Same
Industrial Discharge Permit	4-20-31, 11-3-13	Water Quality Phone: 303-413-7350
Sales and Use Tax License	3-2-11	Sales & Use Tax Division Phone: 303-441-3050

205. LOCATION OF BIDDING DOCUMENTS/ADDENDA

Drawings, specifications and other contract documents and addenda are located at the office described in the advertisement for bids. As used herein, addenda include all written or graphic instruments issued by the city prior to the deadline for submission of bids which modify or interpret the contract documents, drawings or specifications by additions, deletions, clarifications, or corrections. Any potential bidder may request in writing to have copies of all addenda sent to the bidder's address. However, the city shall not be liable for any failure to send or to receive such addenda. No addenda shall be issued less than five (5) working days prior to the deadline for submission of bids. If necessary, the deadline for submission of bids shall be extended to comply with this section.

206. OMISSIONS IN DRAWINGS AND SPECIFICATIONS

Drawings and specifications are intended to be complementary, and must be interpreted in that sense. Anything shown or called for in one and omitted in another is binding as if called for or shown by both. The provisions of section 120 shall apply to any inconsistency between drawings, between specifications, and between drawings and specifications. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. The corrected total will be shown in the tabulation of bids. Special provisions and detail drawings are intended to modify and shall supersede more general drawings and specifications. If work is not described by the drawings and specifications, but is within the reasonable scope of the work, the bidder shall incorporate into the bid proposal such extra work. As used herein, work which is not specifically described in the drawings and specifications but which is within the reasonable scope of the work is work which is necessary for the successful performance of the contract, the necessity of which can be reasonably implied from the contract documents. Failure to notice or acknowledge such work shall not excuse the bidder nor allow a claim for extra payment or time extension in the event that the bidder is awarded the contract. The contractor shall have the burden to prove that such work could not have been reasonably implied from the contract documents.

The City will furnish the contractor, upon award of the contract for construction, five (5) sets of contract documents at no charge. Additional contract documents are available for the City's cost of reproduction.

Order of Precedence of Contract Documents:

A. To resolve conflicts resulting from errors or discrepancies in the contract documents, the order of precedence shall be as follows:

1. Change Orders
2. Addenda
3. The Contract Agreement
4. Permitting or Licensing Conditions as interpreted by the Permitting or Licensing Authority
5. Special Contract Conditions and Provisions
6. Drawings
7. Technical Specifications
8. General Contract Conditions
9. Referenced Standard Specifications
10. Instructions to Bidders
11. Advertisement for Bids
12. Contractor's Bid (Bid Proposal Form)

B. With reference to the Drawings, the order of precedence shall be as follows:

1. Figures govern over scaled dimensions
2. Detail drawings govern over general drawings

3. Addenda/change order drawings govern over Contract Drawings
4. Contract Drawings govern over standard drawings.

207. STANDARDS

Reference to standard specifications of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard code, specification, or tentative specification adopted and published at the deadline for the submission of bids, unless specifically stated otherwise. Wherever the following abbreviations are used, they are to be given the meaning which follows the abbreviation:

AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AI	Asphalt Institute
AGC	Associated General Contractors
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALS	American Lumber Standards
ANSI	American National Standards Institute (successor to USASI)
APA	American Plywood Association
APWA	American Public Works Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWI	American Woodworkers Institute
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
CDOT	Colorado Department of Highway
CDH	Colorado Division of Health
CLFMA	Chain Link Fence Manufacturers Association
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specification Institute
EPA	Environmental Protection Agency
FS	Federal Specifications
MUTCD	Manual on Uniform Traffic Control Devices
NACE	National Association of Corrosion Engineers
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFPA	National Fireman’s Protection Association

NRMCA	National Ready Mix Concrete Association
NWMA	National Wood Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
SDA	Steel Door Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UBC	Uniform Building Code
UL	Underwriter's Laboratory
UMC	Uniform Mechanical Code
UPL	Uniform Plumbing Code
WCLB	West Coast Lumber Inspection Bureau
WPCF	Water Pollution Control Federation
WWPA	Western Wood Products Association

208. ROYALTIES AND PATENTS

The contractor shall pay all license fees and royalties. The contractor shall include and shall be considered to have included in the bid proposal a sum sufficient to cover all fees, royalties, licenses and claims for any patent rights, trade secrets, copyrights, trademarks or other intellectual property which may be connected with the work. If the contractor uses any such intellectual property in the work, the contractor shall enter into a written agreement with the owner of the intellectual property to provide that there will be no future payments owed by the city. The contractor shall defend, indemnify, and hold harmless the city, its officers, agents and employees from all fees, royalties, licenses and claims or suits therefore in connection with any infringement or alleged infringement of any intellectual property right, unless the infringement or alleged infringement results from the negligence of the city or an A/E hired by the city in failing to ascertain that an infringement is or may be occurring, in which case the contractor shall defend any action against the city.

209. SITE INSPECTION

Before submitting a bid, each bidder shall:

A. Examine the contract documents thoroughly;

B. Visit the site to familiarize it with local conditions that may in any manner affect cost, progress, or performance of the work;

C. Become familiar with federal, state, and local laws, ordinances, rules, and regulations that may in any manner affect cost, progress or performance of the work;

D. Study and carefully correlate the bidder's observations with the contract documents; and

E. Notify the project manager of all conflicts, errors, omissions, ambiguities or discrepancies in or among the contract documents.

On request, the city will provide each bidder access to the site to conduct such investigations and tests as each bidder deems necessary for submission of a bid. It shall be the bidder's responsibility to make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (including without limitation, surface, subsurface and underground utilities) at or contiguous to the site or otherwise which may affect costs, progress or performance of the work and which the bidder deems necessary to determine its bid for performing the work in accordance with the time, price and other terms and conditions of the contract documents. Location of any excavation or boring made by bidder shall be subject to prior approval of the city and other applicable agencies. Bidder shall fill all holes, restore all pavements to match the existing structural section and shall clean up and restore the site to its former condition upon completion of such exploration. The city reserves the right to require the bidder to execute an access agreement with the city prior to accessing the site.

If a bidder discovers an apparent error or omission in the drawings and specification, or any other contract documents, the bidder shall immediately notify the project manager to enable the city to make any necessary revisions. The city may consider it to be detrimental to the city for a bidder to submit an obviously unbalanced unit bid price.

The lands upon which the work is performed, rights of way, and access thereto, and other lands designated for use by contractor in performing the work are identified on the drawings.

Information and data reflected in the contract documents with respect to underground utilities at or contiguous to the site are based upon information and data furnished to the city by the owners of such underground utilities or others, and the city does not assume responsibility for the accuracy or completeness thereof, unless it is expressly provided otherwise in the contract documents.

By submission of a bid, the bidder shall be conclusively presumed to represent that the bidder has complied with every requirement of these instructions to bidders and that the contract documents are not ambiguous and are sufficient in scope and detail to indicate and convey understanding of all terms and requirements of the contract documents. By failing to make an inspection, the bidder waives all rights to claim extra payment or time extensions due to unexpected conditions which could have been determined had the site been inspected, *see* Section 802. Bidders may not rely on oral or written representations made by the city, unless the city has guaranteed in writing that such representation is factually accurate; and by submitting a bid, each bidder waives all liability for any error in any representation made by the city to the bidder.

210. EVALUATION OF BIDS AND BIDDERS; REJECTION OF BIDS

The city reserves the right (1) to reject any and all bids, (2) to waive any and all informalities or irregularities, (3) to negotiate final terms with the successful bidders and (4) to disregard all nonconforming, nonresponsive or conditional bids.

The city may consider the qualifications and experience of subcontractors and other persons and organizations (including those who are to furnish the principal items of material or equipment) proposed for those portions of the work as to which the identity of subcontractors and other persons

and organizations must be submitted. Operating costs, maintenance considerations, performance data, and guarantees of materials and equipment may also be considered by the city.

The bidder shall furnish the city all information and data requested by the city to determine the ability of the bidder to perform the work. The city reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the city that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein.

The city may conduct such investigation as deemed necessary to assist in the evaluation of any bid and to establish the responsibility, qualifications and financial ability of the bidders, proposed subcontractors and other persons and organizations to do the work in accordance with the contract documents to the city's satisfaction within the contract time.

By submitting a bid, each bidder authorizes the city to perform such investigations of the bidder and, by its signature thereon, authorizes the city to obtain reference information concerning the bidder and releases the city and the party providing such information to the city from any and all liability to the bidder as a result of such reference information so provided.

If the contract is to be awarded, it will be awarded to the bidder who, by evaluation, the city determines will best meet the city's interests.

The city reserves the right to accept or reject the work contained in any of the bid schedules or alternates, either in whole or in part.

211. DETOURS AND TRAFFIC CONTROL

When a street, alley, bikelane, path, or sidewalk detour or temporary transportation device must be constructed or maintained as part of the work, including without limitation traffic control supervision, the contractor shall include such costs in the bid.

212. THE BID PROPOSAL

The bid shall be submitted upon the proposal form supplied by the city. The general conditions, special conditions, bidding instructions and proposal, contract agreement, and specifications are bound in one volume, and this shall be submitted intact. Each proposal must be enclosed in a sealed envelope addressed to the purchasing agent. The face of the envelope must show the name of the bidder, the project number, the descriptive title of the work, for which the bid is made, and the time and date of opening. The bid proposal shall include the furnishing of all materials, plans, equipment, tools, and all other facilities and the performing of all labor and services necessary or proper for the completion of the work, except as may be provided otherwise in the contract documents. The contractor, by submittal of this bid proposal accepts the constructions drawings as referenced in the bid package.

213. COMPLETING AND SIGNING THE PROPOSAL FORM

The bidder shall complete the proposal form by writing or printing, in a legible fashion, the entire bidder's prices offered for the work to be done. All blank spaces which require a response of the

bidder shall be properly filled in. If the words and figures on the proposal form do not agree, the written words will govern. Any alteration, interlineation, or erasure on the proposal form or other parts of the contract documents as originally issued to the bidder must be initialed by the signer of the bid. Proposals that are unbalanced so that each item does not reasonably carry its own proportion of cost and proposals which contain inadequate or unreasonable prices for any item also may be rejected. The bidder shall assume full responsibility for timely delivery at the location designated for the receipt of bids. Oral, telephonic, telegraphic, or telecopied bids are invalid and will not receive consideration.

214. DISCREPANCIES BETWEEN UNIT PRICES AND EXTENSIONS

In the event of discrepancies between the unit prices quoted in the proposal and the extensions thereof, the unit prices shall control. However, the city reserves the right to accept the extension price if that is deemed by the city to be a more accurate valuation for a particular bid item.

215. NO ORAL AGREEMENTS

No oral agreement or conversation with any officer, agent or employee of the city, either before or after the execution of the contract, shall affect or modify any of the terms, conditions, or other obligations set forth in any of the contract documents. All contract modifications must be in writing and signed by the authorized agent of the city who is in charge of the administration of this contract.

216. PREFERENCE FOR COLORADO MATERIALS

Except for federally funded contracts, preference is given to materials, supplies, and provisions produced, manufactured or grown in Colorado, quality being equal to articles offered by competitors outside the state of Colorado, pursuant to Section 8-18-101, C.R.S., as amended.

217. COLORADO LABOR REQUIREMENTS

Except for federally funded contracts, Colorado labor shall be employed for at least eighty percent (80%) of each class of skilled and common labor employed for all city public works projects. “Colorado labor” means any person who is a resident of the state of Colorado at the time of employment, without discrimination as to race, color, creed, sex, age, or religion except when sex or age is a bona fide occupational criterion. Section 8-17-101, C.R.S., as amended.

218. CITY SALES AND USE TAX

The contractor is deemed to be the consumer of the materials used in all construction projects in Boulder. Therefore, all tangible personal property used in the construction project is subject to the current city sales or use tax pursuant to Section 3-2-2, B.R.C. 1981. The city sales tax is imposed on all sales, rentals, leases and taxable services used in the construction project. The city’s construction use tax is imposed upon tangible personal property and taxable services purchased for construction use in the city whether purchased inside or outside of the city. Both non-residents and residents of the city engaged in a construction project in the city are liable to pay the city construction use tax. No credit will be given for taxes paid to another municipality. The General Contractor is liable for

the payment of the city's sales and use tax for the total project including tax due by its subcontractors. This tax must be included in the bid proposal.

219. STATE SALES AND USE TAX

Pursuant to Section 39-26-114, C.R.S., all materials to be incorporated into city projects are exempt from the RTD and State of Colorado sales and use taxes. Bids shall exclude these taxes.

220. CHANGES IN THE CITY SALES AND USE TAX RATE

If the city sales and use tax rate is increased or decreased effective after the deadline for the submission of bids, an adjustment shall be made in the contract by the project manager to take account of any additional or reduced tax liability.

221. BID SHALL IDENTIFY WORK TO BE SUBCONTRACTED

In the special conditions, the city may designate the amount of work which it will permit the contractor to subcontract. This will be determined by considering the various construction trades required to do the work, the market conditions in the construction industry, and how the work can be organized to promote the city's best interests. The bid proposal shall identify each element of the work to be subcontracted, estimate the percentage of the total work which that element represents, and provide the name and qualifications of each proposed subcontractor. However, the city recognizes that prior to bidding, the bidder may not have been able to negotiate for all work which the bidder proposes to subcontract. Therefore, the city will permit the successful bidder to propose additional subcontractors at any time during the contract period, as long as the limitation on subcontracting has not been exceeded. If any of the proposed subcontractors are rejected by the city after acceptance of the bid, the contractor shall replace them with substitute subcontractors acceptable to the city. If the city rejects a proposed subcontractor and the contractor, with the exercise of good faith and best efforts, is unable to employ an alternate acceptable subcontractor within the contract price, the contractor may request an increase in the contract price. If the contractor disputes the contract price increase granted by the city, the contractor may appeal pursuant to section 125.

222. PROPOSAL GUARANTEE

As a guarantee of good faith on the part of the bidder, each bid proposal shall be accompanied by an unconditional letter of credit, money order, certified check, or bid bond payable to the city in an amount not less than five percent (5%) of the total amount of the bid. The city shall only accept a bid bond if it is set forth on Form 1 from the bidder. No bid proposal will be considered unless accompanied by such a proposal guarantee. In case alternate bids are called for, providing for the use of several different classes of material or types of improvement for the same work, one bid bond in the amount of five percent (5%) of the total amount of the highest bid will be sufficient for all proposals.

223. RETURN OF PROPOSAL GUARANTEE

As soon as bid prices have been compared and determination of bidder responsibility has been made, the proposal guarantees of all except the three (3) lowest responsible bidders will be returned unless the city is considering the bids of more than three (3) bidders, in which case all such proposal guarantees may be retained. When the successful bidder executes and delivers the contract agreement and delivers to the city satisfactory performance and labor and material bonds and insurance documentation and all other contract documents, and satisfies all other conditions precedent to contract execution by the city, the proposal guarantees of these three (3) bidders shall be returned to them. In any event, the proposal guarantees of all bidders shall be returned within sixty-five (65) days of the bid opening, unless the city retains the proposal guarantee pursuant to section 224.

224. RETENTION OF PROPOSAL GUARANTEE

If the successful bidder fails to enter into a contract in accordance with an accepted bid proposal, or fails to furnish the required performance and labor and material bonds, insurance certificates, and other contract documents, within fifteen (15) days from the mailing of the notice of award, or if the bidder has engaged in collusion with other bidders in submitting the bid, the bidder's proposal guarantee shall be retained by the city as liquidated damages and not as a penalty. In the event only a portion of the bidder's bid is accepted or if the bidder refuses to accept an award of less than the combination of bids on two (2) or more designated portions of such bids, the city shall retain as liquidated damages a portion of the proposal guarantee equal to the proportion of the work which the bidder refused to perform bears to the total bid price of the contract accepted by the city. By submitting the proposal guarantee with the bid proposal, the bidder agrees to liquidated damages in the event the bidder fails to enter into the contract with the city. The city shall not have to prove actual damages suffered in order to retain the proposal guarantee as liquidated damages. The parties agree that liquidated damages are appropriate because the city's anticipated actual damages are uncertain in amount and difficult to forecast accurately. The parties agree that the amount of the proposal guarantee or the specified portion thereof is a reasonable estimate of damages and not disproportionate to the anticipated loss or injury.

225. ONLY ONE PROPOSAL ACCEPTED

More than one bid proposal from an individual, firm, partnership, or corporation under the same or different names will not be considered. Evidence that any bidder has an interest in more than one proposal for the same work will be cause for rejection of all such proposals. Evidence of collusion or other illegal activities between bidders will be considered sufficient cause for the rejection of all bids so affected. In addition to any other remedies the city may have, the city may retain as liquidated damages for the disruption of the bidding process the proposal guarantees of all bidders involved in collusion or other illegal activities. The parties agree that the amount of the proposal guarantee is a reasonable estimate of damages for collusion or other illegal or improper activities on the part of the bidder and is not disproportionate to the anticipated loss or injury. A person or entity which has quoted prices to a bidder is not thereby disqualified from quoting prices to other bidders or from submitting a direct bid on its own behalf.

226. ALTERNATE BIDS

Whenever alternate bids are called for, providing for use of more than one class of material or type of improvement for the same work, all bidders shall submit prices for each class of material or type of improvement specified, unless otherwise specified in the special conditions. The material to be used or the type of improvement to be adopted will be selected by the city after the bid proposals have been opened and read. The city has the right to accept alternate bids in any order or combination.

227. SUBSTITUTIONS

The materials, products, and equipment described in the bidding documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. No substitution will be considered prior to receipt of bids unless written request for approval has been received by the project manager at least ten (10) working days prior to the date for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cut sheets, performance, and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment, or other work that incorporation of the substitute would require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The project manager's decision of approval or disapproval of a proposed substitution shall be final. If the project manager approves any proposed substitution prior to receipt of bids, such approval will be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner. No substitutions will be considered after the contract award unless specifically provided in the contract documents.

228. WITHDRAWAL OF BID PROPOSALS

A bidder may withdraw a bid proposal at any time prior to the submission deadline. Any withdrawal request shall be signed in the same manner as and by the same person or persons who signed the bid proposal.

229. REJECTION OF BIDS

Upon request, bidders shall present satisfactory evidence that they are familiar with the type of work specified, and that they have the necessary capital, experienced personnel, tools, machinery, and other equipment necessary to conduct the work in a good and workmanlike manner. Upon request, bidders also shall satisfy the city that they can complete the work within the time specified in the special conditions and that they have conducted themselves in the past in a manner which assures their probity and trustworthiness. The city purchasing agent and the project manager will determine jointly the bid to be selected. The city, acting through its authorized representatives, retains the right to reject any and all bids and waive any informality or irregularity contained in the bids. Specifically, and without limiting the generality of the foregoing, the city may refuse to accept proposals from bidders or sureties in arrears to the city upon any tax debt or contract, or which are defaulters as surety or otherwise upon any obligation to the city. In the event that all bids are rejected or that a bid other than the lowest bid is selected, the bids received shall be referred to the

city manager. In addition, the city may bar or suspend all bidders who participate in illegal bidding activities from bidding on future projects.

230. BIDDING UNDER A DESIGN-BUILD OPTION

A design-build option is a project in which the contractor accomplishes both the design and the construction of a public facility. If a design-build option is used, the project manager shall conduct a design review evaluation to determine the bid to be selected. Each bidder shall be given equal opportunity to present a design-build offer. This evaluation shall be recorded and competing bidders shall not be allowed to attend another bidder's evaluation. The lowest cost bid for a design-build project need not be selected if the design of a higher cost bid is deemed sufficiently superior to warrant the higher cost.

231. THE BID OPENING

Bidders are invited to be present at the bid opening. All bid proposals will be made available for examination by interested parties immediately following the bid opening unless the bidder specifically requests confidential treatment of specific identified confidential commercial data five days prior to the bid opening date. Such request for confidentiality shall be in writing, and the commercial data for which confidentiality is requested and the basis for the request shall be clearly identified. The city will comply with a bidder's request for confidentiality of commercial data only if the data consist of a formula, patent, device, plan or compilation of information which is used by the bidder and which gives the bidder an advantage over the bidder's competitors who do not already know or use it. The final bid price and the unit prices are not confidential and may not be included in any request for confidentiality.

232. MISTAKES IN BIDDING INSTRUCTIONS

If the city makes a mistake in drafting the bidding instructions or any other contract documents, the city reserves the right to reject any or all bids, or to require that bidders submit an alternate bid proposal with adjustments made to correct the error(s). Such error(s) will be set forth in an addendum. If a contractor has already been selected and has started performing work under the contract, and the city then discovers a mistake in the contract documents for which the city is responsible, the city may opt to reform the contract. If the mistake causes the contractor to receive compensation for materials not used in the work or for labor which would not be required for the work, the contract payment price shall be decreased proportionally. If the mistake causes the contractor to fail to bid on work which must be performed in order properly to complete the contract, the city may increase the contract payment price to equal the proportionate increase in the cost of required materials and labor caused to the contractor. In the alternative, the city may solicit bids for such additional work, or the city may reassign such additional work to another contractor, as the city deems appropriate. Nothing in this provision shall apply to mistakes made by the contractor in completing the bid proposal or in performing the contract.

ARTICLE III. INSURANCE AND BONDING REQUIREMENTS

301. NOTICE OF AWARD

The bidder whose bid proposal has been accepted by the city will be sent a Notice of Award (Form 4) in writing signed by the purchasing agent within forty-five (45) days of the bid opening. The city's acceptance of the bid proposal shall bind the successful bidder to sign the contract agreement (Form 5) within ten (10) days of the date of mailing of the notice of award or to be responsible for liquidated damages as provided in section 224. The city's rights and obligations set forth in the contract agreement shall become effective only with the signatures of the city officials set forth in section 302 on behalf of the city.

302. SIGNING THE CONTRACT AGREEMENT

The notice of award informs the successful bidder that the city is ready to enter into a contract. Once the bidder has been selected, the purchasing agent then will complete the contract agreement (Form 5) for the project and transmit four (4) copies of the agreement to the successful bidder for signing. The successful bidder shall sign, and have notarized, all four (4) copies of the contract agreement and return them to the purchasing agent along with the appropriate performance bond, labor and material bond, insurance certificates, and power of attorney authorizations. The purchasing agent will transmit the four (4) copies of the signed contract agreement to the city attorney, the city manager, and the finance director. After each official has signed all four (4) copies they shall be returned to the purchasing agent. When the contract agreement has been signed by the purchasing agent, city attorney, city manager, and finance director, the purchasing agent will issue a purchase order, which is the official notice to proceed. Copies of the purchase order and the contract agreement will be transmitted to the contractor, project manager, purchasing agent, and finance director. A copy of the purchase order and the contract agreement will be filed in the city central files.

303. LEGAL ADDRESS OF CONTRACTING PARTIES

All notices required to be given to the parties to this contract shall be mailed to the addresses of the project manager and the contractor, or the contractor's superintendent, as designated in the contract agreement (Form 5, Part Eight). The parties so designated or their addresses may be modified upon receipt of a written request by the other party.

304. BOND REQUIREMENTS

Unless otherwise specified in the special conditions, a performance bond and a labor and material bond shall be required for all contracts. The successful bidder shall furnish the performance and labor and material bonds in the full amount of the contract price within fifteen (15) days after the city has issued the notice of award. Both bonds shall be in the form set forth as Form 6 (performance bond) and Form 7 (labor and material payment bond). The bonds must be issued by a surety authorized by the State of Colorado to do business in Colorado and admitted in the State of Colorado with an A.M. best rating of A-VI or better and be named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring

Companies" as published in circular 570 (amended) by the Audit Staff, Bureau of Accounts, U.S. Treasury Department. If at any time a surety which issues a performance bond or a labor and material bond becomes insolvent or the subject of bankruptcy proceedings or loses its right to do business in Colorado, another surety shall be required, which the contractor shall obtain within five (5) days after receipt of any form of notice of such event. In the event that there is a conflict between the city-approved bond form and any other contract entered into between the contractor and the surety on either the performance or the labor and material payment bond, the conditions stipulated in the city-approved bond form shall control. The contractor shall also notify the city immediately if the surety becomes insolvent or the subject of bankruptcy proceedings or loses its right to do business in Colorado pursuant to section 1005. In the event that the contract price is increased due to a change order, the city reserves the right to require the contractor to procure additional performance and labor and material payment bonds to cover the increase in the contract price. The city shall reimburse the contractor for the increased cost of such additional bonds, which will be added to the contract price by an executed change order.

305. PERFORMANCE BOND

The contractor shall procure and pay for a performance bond (Form 6) which, when executed by the contractor and the surety, shall be a guarantee for the faithful performance and completion of the work in strict accordance with the terms of the contract. The performance bond shall also be a guarantee for the repair or replacement of all work found by the city to be defective or otherwise unacceptable during the contract performance time and through the guarantee period. *See* article 7. With regard to design/build contracts, unless otherwise specified, the performance bond shall guarantee the faithful performance and completion of all design work as well as construction. The performance bond shall stay in effect during the guarantee period set forth in section 701. The performance bond shall be in an amount of one hundred percent (100%) of the dollar value of the contract. The surety which executes the performance bond waives any right to independent notice under the contract if the contractor receives such notice, and consents to any extension of time, modification, waiver, forbearance, or change which may be made in any of the terms and conditions of the contract by the parties or by their successors or assigns. In the event that the guarantee period for the contract is extended pursuant to section 717 past the original guarantee period, the contractor's performance bond shall cover automatically the extension of the guarantee period. If a product is used in the work and the product fails before the guarantee period (including extensions) has expired, the contractor must replace the defective product and guarantee the product during a new guarantee period for the same length of time as the original guarantee period, unless the defective product is the result of a design error caused by the city, or an architect, engineer, or project manager whom the city employed.

306. LABOR AND MATERIAL PAYMENT BOND

The contractor must procure and pay for a labor and material payment bond (Form 7) which guarantees that all those performing labor or furnishing materials, supplies, tools and equipment under the contract shall be paid. This bond shall be in the amount of one hundred percent (100%) of the dollar amount of the contract. The surety which executes the labor and material bond waives any right to independent notice under the contract if the contractor receives such notice, and consents to any extension of time, modification, waiver, forbearance, or change which may be made in any of the

terms and conditions of the contract or by the parties or by their successors or assigns.

307. INSURANCE POLICIES

The contractor shall procure and maintain, at its own cost, a policy or policies of insurance sufficient to insure against all liability, claims, demands, and other obligations assumed by the contractor pursuant to this section. Such insurance shall be in addition to any other insurance requirements imposed by this contract or by law. The contractor shall not be relieved of any liability, claims, demands, or other obligations assumed pursuant to this section by reason of its failure to procure or maintain insurance, or by reason of its failure to procure or maintain insurance in sufficient amounts, durations, or types.

Contractor shall procure and maintain and, if applicable, shall cause any subcontractor of the contractor to procure and maintain the insurance coverage listed below. Such coverage shall be procured and maintained with forms and insurers acceptable to the city. All coverage shall be continuously maintained to cover all liability, claims, demands and other obligations assumed by the contractor pursuant to this section. In the case of any claims-made policy, the necessary retroactive dates and extended reporting periods shall be procured to maintain such continuous coverage

The Contractor shall obtain and maintain the minimum insurance coverages set forth below, unless specified otherwise in the special conditions. By requiring such minimum insurance, the city shall not be deemed or construed to have assessed the risk that may be applicable to Contractor. Contractor shall assess its own risks and if it deems appropriate and / or prudent, maintain higher limits and / or broader coverages.

A. Insurance Coverages

1. ***Commercial General Liability – ISO CG 00001 or equivalent. Coverage to include:***
   - Premises and Operations
   - Explosions, Collapse and Underground Hazards
   - Personal / Advertising Injury
   - Products / Completed Operations
   - Liability assumed under an Insured Contract (including defense costs assumed under contract)
   - Broad Form Property Damage
   - Independent Contractors
   - Designated Construction Projects(s) General Aggregate Limit, ISO CG 2503 (1997 Edition)
   - Additional Insured—Owners, Lessees or Contractors Endorsement, ISO Form 2010 (2004 Edition or equivalent)
   - Additional Insured—Owners, Lessees or Contractors Endorsement, Completed Operations, ISO CG 2037 (7/2004 Edition or equivalent)

2. ***Automobile Liability including all:***

- Owned Vehicles
- Non-Owned Vehicles
- Hired Vehicles

3. *Excess/Umbrella Liability (applies to large construction projects):*
   - Excess of Commercial General Liability, Automobile Liability, and Employers' Liability.
   - Coverages should be as broad as primary.
   - The city reserves the right to require higher limits.

4. *Workers* ***Compensation***
   - Statutory Benefits (Coverage A)
   - Employers Liability (Coverage B)

5. ***Installation Floater/Builder's Risk***
   - Special cause of loss
   - Theft
   - Faulty workmanship
   - Vandalism
   - Labor costs to repair damaged work

6. ***Contractors Pollution Liability/Environmental Impairment Liability***

This section applies to the following types of proposals, including but not limited to:

- ASBESTOS/LEAD ABATEMENT Contracting Services
- CORE DRILLINGS Contracting Services
- ROOFING Contracting Services
- GENERAL CONSTRUCTION CONTRACTORS
- BOILER REPAIRS & CLEANING
- GAS & ELECTRICAL TURBINES

The city requires this coverage whenever work at issue under this contract involves potential pollution risk to the environment or losses caused by pollution conditions (including asbestos) that may arise from the operations of the Contractor described in the Contractor's bid and specifications. Policy shall cover the Contractors completed operations. Such coverage shall include:

- Bodily Injury, sickness, disease, mental anguish or shock sustained by any person, including death.
- Property Damage including natural resource damages, physical injury to or destruction of tangible property including resulting loss of use, clean up costs, and the loss of use of tangible property that has not been physically injured or destroyed.

- Defense, including costs, charges and expenses incurred in the investigation, adjustment or defense of claims for such compensatory damages.
- Cleanup costs, removal, storage, disposal, and or use of the pollutant; and defense, including costs and expenses incurred in the investigation, defense, or settlement of claims.
- Coverage shall apply to sudden and gradual pollution conditions resulting from the escape of release of smoke, vapors, fumes, acids, alkalis, toxic chemicals, liquids, or gases, natural gas, waste materials, or other irritants, contaminants, or pollutants (including asbestos). If the coverage is written on a claims-made basis, the Contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of this contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (or specify desired number) years beginning from the time that work under this contract is completed.
- On the Automobile Liability Coverage endorsements CA9948 and MCS-90 are required if the Contractor is transporting any type of hazardous materials.
- Contractor shall name the City of Boulder, its elected officials, employees, agents and volunteers as "Additional Insureds" for work that is being performed by the Contractor and as respects the Contractors Pollution Liability.

B. Limits Required

The Contractor shall carry the following limits of liability as required below:

Commercial General Liability

General Aggregate	$2,000,000
Products/Completed Operations Aggregate	$2,000,000
Each Occurrence Limit	$1,000,000
Personal/Advertising Injury	$1,000,000
Fire Damage (Any One Fire)	$ 50,000
Medical Payments (Any One Person)	$ 5,000

Excess/Umbrella Liability (as needed)

General Aggregate Limit	$1,000,000
Products/Completed Operations Aggregate	$1,000,000

Automobile Liability

Bodily Injury/Property Damage (Each Accident)	$1,000,000

Workers' Compensation

Coverage A (Workers' Compensation)	Statutory
Coverage B (Employers Liability)	$ 100,000 Each Accident
	$ 100,000 Disease Ea.

	Employ
	$ 500,000 Disease-Policy Limit

Contractors Pollution Liability/Environmental Impairment Liability (as needed)

Per Loss	$1,000,000
Aggregate	$1,000,000

Installation Floater/Builder's Risk

For materials and equipment to be installed:

- Shall be written for 100% of the completed value (replacement cost basis)
- Deductible maximum is $10,000.00
- Waiver of Subrogation applies on Installation Floater/Builder's Risk

308. ADDITIONAL INSURANCE REQUIREMENTS

Failure of the Contractor to fully comply with these requirements during the term of the Contract may be considered a material breach of contract and may be cause for immediate termination of the Contract at the option of the city. The city reserves the right to negotiate additional specific insurance requirements at the time of the contract award.

A. All insurers must be licensed or approved to do business within the State of Colorado, and unless otherwise specified, all policies must be written on a per occurrence basis.

B. The Contractor shall provide the city 4 (four) copies of the Certificate of Insurance Form, including all required endorsements, evidencing all required coverages, prior to signature of the contract by the city. The city will not execute the contract until the city has verified that all required insurance is in effect.

C. The Contractor shall name "The City of Boulder, its elected officials, employees, agents and volunteers" as an Additional Insured as respects General Liability.

D. Upon request by the city, Contractor must provide a copy of the actual insurance policy effecting coverage(s) required by the contract.

E. The city requires that all policies of insurance be written on a primary basis, non-contributory with any other insurance coverages and/or self-insurance carried by the city.

F. A Separation of Insureds Clause must be included in general liability policies.

G. The Contractor shall advise the city in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limit. At their own expense, the Contractor will reinstate the aggregate limits to comply with the minimum requirements and shall furnish to the city a new certificate of insurance showing such coverage is in force.

H. Contractor's insurance carrier should possess a minimum A.M. Best's Insurance Guide rating of A- VI.

I. Commercial General Liability Completed Operations policies must be kept in effect for up to two (2) years after completion of the project.

J. Contractors Pollution Liability policies must be kept in effect for up to two (2) years after completion of the project.

K. Contractor, or Contractor's insurance broker, shall notify the City of any cancellation or reduction in coverage or limits of any insurance within seven (7) days of receipt of insurer's notification to that effect. The Contractor shall forthwith obtain and submit proof of substitute insurance in the event of expiration or cancellation of coverage.

L. Certificate Holder: City of Boulder, Purchasing, P.O. Box 791, Boulder, CO 80306.

M. Contractor is responsible for any damage or loss to its own vehicles or equipment.

N. The city and Contractor shall cooperate with each other in the collection of any insurance proceeds which may be payable in the event of any loss, including the execution and delivery of any proof of loss or other actions required to effect recovery.

309. NON-WAIVER

The parties hereto understand and agree that the city is relying on, and does not waive or intend to waive by any provision of this Contract, the monetary limitations or any other rights, immunities, and protections provided by the Colorado Governmental Immunity Act, 24-10-101 et seq., as from time to time amended, or otherwise available to the city or its elected officials, employees, agents, and volunteers.

310. RISK OF LOSS OR DESTRUCTION OF THE WORK DURING CONSTRUCTION

The contractor shall bear the risk of any loss or destruction to the work at any time before the city issues a certificate of substantial completion pursuant to section 713. The contractor shall bear any cost or expense arising out of the work, or from the contractor's actions, or from the action of the elements such as wind, flood, snow, hail, etc., or from ground water, or from subsidence or failure of subjacent support, or any other obstruction or difficulty which may be encountered in the work.

311. INSURANCE TERM

All required insurance in this article, except builder's risk, shall remain in effect until the expiration of all guarantee periods. In the event of a material alteration or cancellation of any insurance coverage, the contractor shall notify the project manager immediately and shall suspend work under the contract until the city issues written instructions to proceed with the work.

312. INDEMNIFICATION

The contractor shall defend and indemnify the city, its officers, employees, and agents from and against all claims, damages, losses, and expenses which arise out of or are related to the work. These shall include without limitation reasonable attorneys' fees for any services rendered by the office of the city attorney and employees assisting the office of the city attorney and discovery and litigation costs arising out of or resulting from the performance of the work, provided that any such claim, damage, loss, or expense (1) is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, including without limitation the loss of use resulting therefrom, and (2) is caused in whole or in part by any act or omission of the contractor, any subcontractor,

anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, attorneys' fees due for services by the office of the city attorney shall be at the rates generally charged for similar services by private practitioners within the boundaries of the city of Boulder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this section. If, in a final judgment no longer subject to appeal, the city is determined to be the proximate cause of a percentage of the damages, then the city shall pay that percentage of the damages to the party or parties that have been awarded the judgment and reimburse the contractor for that percentage of the attorneys' fees and costs incurred by the contractor for the defense of the suit. In any and all claims against the city or any of its agents or employees by any employee of the contractor, any subcontractor or anyone for whose acts any of them may be liable, this indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the contractor or any subcontractor under workers' or workmen's compensation acts, disability benefit acts, or other employee benefit acts, except as otherwise provided by law. The obligations of the contractor under this section shall not extend to the liability of the project manager or A/E or their agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs, or specifications by the project manager or A/E or their agents or employees, or (2) the giving of or the failure to give directions or instructions by the A/E or their agents or employees, provided that such giving or failure to give is the primary cause of the injury or damage and provided that a reasonably prudent contractor would have prosecuted the work based on such giving or failure to give directions or instructions.

ARTICLE IV. TERM

401. CONSTRUCTION PROGRESS SCHEDULE

The contractor shall submit to the project manager a proposed construction progress schedule within five (5) days following the notice to proceed. The construction progress schedule shall be subject to the project manager's approval, which approval shall not be unreasonable. The construction progress schedule shall comply with the specifications of the contract documents and shall be in the form of a graphic display indicating the proposed construction sequence for key elements of the work and the anticipated start and finish dates for each of the key elements. The schedule shall be coordinated with the critical times and dates contained in the contract documents. The city will use the construction progress schedule to monitor progress of the work. The contractor shall keep an annotated copy of the construction progress schedule in the contractor's office. The contractor shall adhere to the construction progress schedule, subject to the other requirements of the contract documents and shall provide the project manager with a detailed and accurate update of the actual construction with its monthly application for payment and at regularly scheduled construction meetings. Acceptance of the updates or the making of any payment by the city does not constitute approval of any change in the construction progress schedule or other requirements of the contract documents, nor does it constitute or imply acceptance of any of the work. In addition to liquidated damages as provided in section 406 for failure to substantially complete the work in the time period required by the contract, if the contractor fails to keep up with the construction progress schedule, as revised to reflect approved change orders for time extensions, delays caused by the contractor, the city or the A/E, and delays caused by inclement weather, the contractor shall indemnify the city for

all liability, loss or expense incurred by the city due to the contractor's failure to remain on schedule. If the city acknowledges that the contractor is off schedule, and allows the contractor to continue the work, or if the city accepts the work as meeting other contract specifications, such forbearance or acceptance shall not limit any action the city may have against the contractor for failure to remain on schedule.

402. PERIOD FOR PERFORMANCE

The contract documents shall specify a time period for performance, which may be based on days excluding weekends and city holidays. Alternatively, completion may be required before a certain specified date. Each date or time period specified in the contract documents shall be deemed material to the performance of the contract. The contract time for performance shall run from the date on which the notice to proceed is issued until the date specified for completion. The contractor must begin work no later than ten (10) days after the notice to proceed is issued. If the contractor fails to substantially complete the work within the allotted time, the contractor shall be liable for liquidated damages as set forth in section 406. Contractor acknowledges and agrees that the contract time for performance is a reasonable period in which to complete the work.

403. CONTRACT DAYS

A contract which specifies that construction will be completed within a certain number of consecutive calendar days contemplates that all days, whether weekend, holiday, or days of normal inclement weather will be included in the contract time. Unless the term "calendar days" is used, the term "day" shall refer to a day between Monday and Friday, excluding Saturdays, Sundays, or city-observed holidays.

404. SATURDAY, SUNDAY, HOLIDAY, AND NIGHT WORK

If the contractor believes it necessary to work on Saturdays, Sundays, holidays, or from 5:00 P.M. to 7:00 A.M., the contractor shall make prior arrangements with the project manager and receive written approval before the work commences, which approval shall not be unreasonably withheld. Such approval may be revoked by the project manager for good cause, including, without limitation, failure to maintain adequate equipment and lighting at night for the proper implementation, control and inspection of the work. If work is done without the project manager's prior approval and as a result the project manager is unable adequately to inspect the work, the work done during these periods of time may be declared defective, solely on the grounds that it was not properly inspected. No extra money will be awarded to the contractor by the city due to labor overtime or other increased costs of performing the work on Saturdays, Sundays, holidays, or at night, so long as such work was not caused by the actions or inactions of the city. If inspectors charge overtime or other incidental expenses for performing inspections on Saturdays, Sundays, holidays, or at night, the contractor shall be responsible to pay for all such charges, and shall not be granted a contract price increase for such charges.

405. TIME EXTENSIONS AND CONTRACTOR'S DELAY

The contractor specifically waives any and all claims against the city for monetary damages resulting from any hindrance or delay during the performance of the contract that impede the contractor's performance, except those that qualify for an extension of contract time. The contractor may be granted a time extension as expressly provided below only with respect to any hindrance or delay that impedes its performance and is described in subsections A, B, and C, for which the city will not claim actual damages. The contractor shall provide to the project manager written notice of any delays within three (3) days from the beginning of the delay. The written notice shall explain the causes(s) and the expected duration of the delay. The contractor shall file a written request for a change order extending the contract performance period within five (5) days after the period of delay has ceased. If the contractor fails so to notify the project manager of any such delay, the contractor shall be deemed to have waived any right to request a time extension, and may be held in default on the contract. All time extensions shall be made by written change order. Extensions of time will be granted only to the extent that equitable time adjustments for affected activities exceed the total float along their paths. The project manager will grant time extensions, by written change order, beyond the original schedule of performance for the following reasons only:

A. Suits, Delays by city, Acts of God, and Similar Events

1. A suit or other legal action against the city which causes a delay in the work, other than a suit or legal action asserted by the contractor, will entitle the contractor to an equivalent extension of time unless the period of such delay exceeds three (3) months. When such period is exceeded, the city will, upon a request by the contractor in writing, elect either to terminate the contract or to grant a further extension of time, whichever shall at that time appear most advantageous to the city.

2. If a suspension of work or stop work order caused by a breach of a contract condition by the city or its agents or the negligence of the city or its agents occurs, which, in the opinion of the city, justified delay of the contractor's performance, then the city will grant a reasonable time extension equivalent to the delay. The contractor has the burden to prove the events which caused each such delay, and that the contractor made timely requests for time extensions pursuant to this section. Stop work orders due to improper work or otherwise due to the contractor's acts shall not be cause for extension of time.

3. If in the city's reasonable opinion the contractor's performance is delayed by acts of God, wars, epidemics, or other causes beyond its control or anticipation, then, upon the contractor's written request, the city will grant a reasonable time extension equivalent to the delay. No such extensions shall be granted for delays caused by events within the control of the contractor, nor for delays which the contractor could have foreseen and avoided, prevented, or significantly ameliorated by exercising reasonable prudence or diligence, nor for any delays caused in whole or in part by the contractor

itself, nor by its subcontractors or suppliers, including without limitation, freight carriers, nor for any delays caused by labor unrest. In all instances, the contractor shall use its best efforts to minimize the length of delay. The contractor shall have the burden to prove the events which caused the delays, and that it made timely requests for time extensions pursuant to this section. This paragraph (3) shall not govern cases where the work is suspended for the city's convenience by written change order. Such cases will be governed by section 1003.

B. Changes in Specified Work

If the volume of specified work, measured in dollars, is increased by written change order over the total value shown in the contractor's bid proposal at the time that the contract is awarded, the contractor may be granted an extension proportionately equal to the increase in total value, if the contractor requests a time extension in writing within twenty-one (21) days after service of the change order. If a change order requires work more complex or more difficult than that originally specified and shown on the plans and specifications and such work requires more time to execute than the proportional increase in dollar value, the contractor may be granted a further time extension if the contractor requests such extension in writing within twenty-one (21) days after service of the change order.

C. Excusable, Inclement Weather

1. If the contractor believes that a contract extension should be granted due to delays caused by excusable, inclement weather, it may request a contract extension in writing from the project manager. The project manager shall thereon grant -- subject to the provisions of subsection (4) below -- an extension equal, in the project manager's reasonable opinion, in duration to the delay, if any, that was caused by excusable, inclement weather.

2. The contract time will be extended for as many calendar days in excess of the allotted number of days of excusable, inclement weather -- as set forth in subsection (4) below -- as the contractor is prevented by excusable, inclement weather, or conditions resulting immediately therefrom, from proceeding with an activity on the critical path of the Project Construction Schedule.

3. Excusable, inclement weather is snowfall, rainfall, freezing temperatures or excessive wind conditions, the degree or duration of which varies in excess of the average conditions expected, which is unusual for the particular time and place where the work is to be performed, or which could not have been reasonably anticipated by the contractor, as determined from U.S. Weather Bureau records for the location closest to the site or the work for the preceding 10-year period. No extensions of contract time will be allowed for any inclement weather that could reasonably have been predicted from such weather records.

4. The contractor shall include in its construction schedule the following anticipated number of calendar days lost due to adverse weather conditions for each month based on National Oceanic and Atmospheric Administration (NOAA) data for the Boulder area:

Jan 7	Feb 4	Mar 4	Apr 4	May 6	June 3	July 4	Aug 2	Sep 3	Oct 3	Nov 2	Dec 5

No extension of the contract time limit due to excusable, inclement weather will be considered by the city until after the number of days of excusable, inclement weather allocated to the construction schedule up to the time in question has been reached. No reduction in contract time shall be made if the allocated number of days of excusable, inclement weather is not reached.

406. LIQUIDATED DAMAGES

Time is of the essence for every time period set forth in the Contract Documents. Except for delays specified in Section 405, of the General Conditions, if the contractor fails to perform the work within the time limit set forth in the Contract Documents, or as adjusted by written change orders, the contractor shall be liable to the city for liquidated damages, not as a penalty, for the amount set forth in the Contract Agreement for Construction (Form 5, Part Three) for each and every calendar day that substantial completion of the work is delayed. The city may extend the contract period for performance without impairing its right to collect liquidated damages. The city shall have the right to deduct liquidated damages from any amount due, or that may become due, to the contractor, or to collect such liquidated damages directly from the contractor or the surety. The city has the option to enforce liquidated damages or to waive such damages.

Liquidated damages are intended only to apply to the contractor's delay in performance and are intended to compensate the city for additional city personnel efforts in administering the contract after normally scheduled completion dates, and for city government and citizen inconvenience, lost opportunities, and loss of confidence in government and morale of government when work is not completed on time. Such damages are uncertain in amount and difficult to measure accurately.

By executing the contract, the contractor agrees that the liquidated damages specified in the contract documents are reasonable in amount and are not disproportionate to actual anticipated damages. Liquidated damages do not include any sums of money to reimburse the city for extra costs which the city may become obligated to pay on other contracts which were delayed or extended because of the contractor's failure to complete the work within the contract time. Should the city incur such additional costs due to delays or extensions to other contracts resulting from the contractor's unexcused failure or delay in performing the contract, as extended, the city will assess these extra costs against the contractor in addition to the stipulated liquidated damages. In addition, liquidated damages are not intended to cover attorney's fees and costs incurred by the city in any action involving the contractor, nor any other actual costs which do not result directly from the contractor's delay in performance. In order to recover liquidated damages, the city is under no obligation to prove the actual damages sustained by the city due to the contractor's delay in performance. In addition, the contractor shall pay interest at the rate established by section 124 that shall accrue on liquidated damages from the date on which such damages arise. Liquidated damages shall be incurred in the amount calculated by the project manager as set forth in the special conditions and in

part three of the contract document (Form 5), but in no case less than $1,000 per day for each calendar day the project is incomplete beyond the substantial completion date specified herein.

ARTICLE V. COMMUNICATION AND MAINTENANCE OF RECORDS

501. SERVICE OF DOCUMENTS ON THE CONTRACTOR

Both the business address of the contractor designated in the bid proposal and the work site are designated as places to which notices, letters and other communications or documents to the contractor may be mailed or delivered. The delivery at either of the above named addresses, or the addressing and depositing in any mail box regularly maintained by the United States Postal Service, first class postage prepaid, of any notice, letter, or other communication or document to the contractor, shall be deemed sufficient service thereof upon the contractor, and the date of said service shall be the date of such delivery or mailing. The address set forth in the bid proposal may be changed at any time upon five (5) days notice by an instrument in writing, executed by the contractor and received by the city.

502. CONTRACTOR'S MAINTENANCE OF RECORDS

The contractor shall maintain a complete file of all records, communications, and other documents which pertain to the contract at its main office in Colorado or at its main office outside Colorado if it has no office in Colorado. The contractor shall maintain such records for a period of three (3) years after the date of completion of the contract, and for such longer period as may be necessary to resolve any matters which may be pending at that time.

503. CITY MAY AUDIT CONTRACTOR'S RECORDS

Subject to a requirement of confidentiality in the treatment of all confidential financial data and the contractor's internal memoranda, and privileged documents, the contractor shall permit the city to audit or inspect its records during the term of the contract, for a period of three (3) years following the completion of the contract, and for such further periods as may be necessary to resolve any matters which may be pending at that time. The purpose of this provision is to assure the contractor's compliance with the terms of the contract and to evaluate the contractor's costs and performance under the contract. Any audit conducted shall be at the sole expense of the city.

504. RECORDS OF SUBCONTRACTORS AND CONSULTANTS

The contractor shall require all of its subcontractors and consultants to maintain all of their records which pertain to the project in the same manner and for the same length of time as the contractor is required to do, and to allow the city the same access to those records as it has to the contractor's records.

505. CHANGES IN THE WORK MUST BE NOTED

The contractor shall maintain at the contractor's field office one copy of all drawings and specifications in good condition and immediately note thereon all changes made during the construction process. Any deviation between the drawings and specifications and the work actually

done must be noted on this set of drawings, which should be referred to as the "as built" set of drawings. If the contractor performs work which is at variance with the plans and specifications, the contractor has the burden to prove that it has provided work equally suited for the purpose and of equal value. All underground utility structures encountered or constructed in the process of doing the work shall be correctly located on the drawings. When the work is completed, the contractor shall deliver this "as built" set of drawings and specifications to the project manager as a condition precedent to final payment.

506. PROJECT IDENTIFICATION

In addition to appropriate warning and traffic signs, there shall be a sign at the job site which identifies the contractor and the city department in charge of construction and gives a telephone number for each. The contractor must provide this sign unless the special conditions state otherwise. This sign shall identify an authorized representative of either or both the city and the contractor who is to be contacted whenever there is an emergency at the job site, including without limitation evenings, weekends, holidays, and all times when the job site is unattended. The sign shall be placed in a prominent location, properly supported in position, and maintained in good condition during the life of the project. The contractor must obtain a sign permit from the city manager before erecting the project identification sign, pursuant to Subsection 10-11-4(a), B.R.C. 1981. The sign shall be limited to free-standing, wall or window signs not exceeding sixty-four (64) feet in total area or thirty-two (32) square feet per face and may not exceed eight (8) feet in height. Paragraph 10-11-17(a)(1), B.R.C. 1981. No sign shall obstruct traffic or a motorist's view of traffic signs, signals or other official notices. All signs shall be constructed and conform to the construction standards set forth in Section 10-11-24, B.R.C. 1981, and with the standards for temporary signs as set forth in Section 10-11-17, B.R.C. 1981. All signs shall conform to the setback standards set forth in Section 10-11-12, B.R.C. 1981. Under Section 4-21-2, B.R.C. 1981, only licensed sign contractors shall install signs for which a permit is required.

507. SUPERVISION AT THE JOB SITE

The contractor shall provide and maintain continually on the work site a superintendent for all work being performed under the contract. The contractor shall designate the superintendent, who shall be authorized to act on behalf of the contractor in all matters related to the contract. Within five (5) days after the execution of the contract documents, the contractor shall inform the project manager in writing of the home and residence address and residence telephone number of the person designated as the superintendent. The contractor shall also provide a pager or mobile phone to the superintendent and inform the project manager in writing of the telephone number therefor. A call to any one of these numbers shall constitute notice by the city. The superintendent shall be on-call at all times.

In the event of an emergency, the contractor shall be responsible for remedying all aspects of the work creating the emergency or loss of utility service and respond within two (2) hours. If the contractor does not respond within two (2) hours, the contractor shall be responsible for any and all costs incurred by the city including, but not limited to, deployment of public safety personnel, and any labor, equipment and materials required to remedy the emergency.

Unless the project manager requests that a superintendent be replaced or permits such replacement or the superintendent ceases to be employed by the contractor or becomes sick or disabled, the same person shall continue in the capacity of superintendent and be present continuously or immediately available at the work site until the work has been completed.

508. COMMUNICATIONS AT THE WORK SITE

The superintendent shall be the normal recipient of work site communications from the project manager. Important communications from the project manager shall be in writing and shall be made by field order (Form 10), or a reasonable facsimile thereof. Other important communications from the contractor to the city shall also be in writing. Further, the superintendent shall designate agents at the site to receive such communications when the superintendent is away from the site. When the superintendent is absent, such persons shall be authorized to act immediately on emergency communications given by the project manager. If the project manager issues an emergency communication to the contractor, but there is no authorized representative of the contractor able to act on the emergency communication, the project manager may take whatever action is necessary to deal with the emergency, at the contractor's cost. If the city finds it necessary to communicate at the work site with contractor personnel authorized to receive such communications and none are available to receive such communications, the city may suspend the contractor's operations at the work site which are affected by the communications until such communications can be accomplished.

509. DISPUTES BETWEEN THE CONTRACTOR AND THE PROJECT MANAGER

The contractor shall follow all instructions issued by the project manager. If the contractor requests clarification or interpretation of any contract documents the contractor shall notify the project manager in writing. The project manager shall issue a written response to the contractor within ten (10) days following the contractor's request. If the project manager fails to issue a written reply within ten (10) days after receipt of the contractor's request for interpretation, the contractor may suspend the portion of the work which is the subject of the dispute. The contractor shall be granted a time extension of one (l) day for each day following the suspension for which the project manager fails to issue a written resolution of the dispute if the entire work is suspended. However, if the suspension applies to only a part of the work, a time extension will not be authorized until the partial suspension has run and its effect on the entire contract can be evaluated. The city shall be liable to the contractor under this section for all costs actually incurred which result from resuming the suspended work. The contractor shall not work on any part of the work which is the subject of a dispute between the contractor and the project manager until the project manager issues a written notice to continue. If the contractor proceeds with work which is the subject of a dispute between the project manager and the contractor, and the contractor later must replace this work because the project manager determines that the work was not performed in accordance with the contract documents, the contractor shall bear all costs of removal and replacement of the non-conforming work.

ARTICLE VI. CONSTRUCTION SITE REQUIREMENTS

601. PUBLIC RELATIONS

The contractor shall carry on the work in such a manner as to cause as little inconvenience as possible to the public, particularly to occupants of property near or contiguous to the project, as is consistent with good workmanship. The contractor shall notify such occupants at least forty-eight (48) hours in advance of proposed work that may block entrances or otherwise cause undue difficulty to the occupants of affected property and shall restore such entrances to usable condition as soon as possible. The contractor, subcontractors and employees shall at all times be courteous to the public, the project manager, and other city representative while engaged in work under the contract. Any employees of the contractor, subcontractors or agents who fail to act in a courteous manner toward the public, the project manager or other city representative shall be immediately and permanently removed from the construction site by the contractor upon the reasonable request of the project manager.

The contractor shall notify all business managers and residents affected by the interruption of utilities and other services caused by his operations. Such notice shall be given at least forty-eight (48) hours prior to the interruption of service. Notice shall be given for the interruption of domestic water, irrigation water, sewer, trash pickup, and changes in access to property. Prior to interruption of domestic water service, a second notice shall be given no less than one hour and no more than four hours prior to discontinuation of service. Notifications may be oral or in written form if the business manager or resident cannot be located. Water services shall not be discontinued for more than two (2) consecutive hours without special written permission from the project manager. If requested by a commercial business, potable water bottles and toilets for use by their employees shall be furnished and serviced by the contractor.

The above items required in this section are considered as incidental to the work and no additional payment will be made by the city.

602. PROTECTION OF PERSONS AND PROPERTY

The contractor shall be responsible for initiating maintaining and supervising all safety precautions and programs in connection with the work. The contractor shall designate a person at the work site who is responsible to oversee or take precautions to prevent accidents. The contractor shall take all reasonable safety precautions and provide all reasonable protection to prevent damage, injury, or loss to:

A. All employees at the work site and all other persons affected by the work;

B. All materials and equipment in the care, custody, or control of the contractor or subcontractor, whether stored on or off the work site;

C. All work done under the contract;

D. All property at the site including walks, pavements, roadways, structures and utilities, and all neighboring property which may be affected by the work; and

E. All plant materials including without limitation grasses, trees, and shrubs except where specifically identified for removal.

The contractor shall repair or replace any damage, injury, or loss to all public or private property caused directly or indirectly, in whole or in part, by the contractor or any subcontractor or their employees or agents or anyone directly or indirectly employed by them or anyone for whose acts any one of them may be responsible. The contractor shall give all notices and comply with all applicable laws bearing on the safety of persons or property or their protection from damage, injury, or loss.

603. PROTECTION AND PREVENTION OF SITE ACCESS

Where the work is conducted in or adjacent to any street, alley, bikelane, path, sidewalk or public place, the contractor shall, pursuant to section 211, furnish and erect such barricades, fences, lights, and danger signals and shall furnish such personnel to warn the public and guard the site and shall take such other precautionary measures as are reasonably necessary to protect persons, property, and the work done under the contract. Excavations in or adjacent to public streets, alleys, bikelanes, paths or sidewalks shall be securely barricaded so as to prevent access by small children or any other person or vehicle when work is not being carried on at the site of excavation. Such barricades shall be painted in a color that is visible at night. The contractor shall follow the guidelines set forth in the Manual of Uniform Traffic Control Devices ("MUTCD"). Any costs incurred to satisfy requirements of this section will be considered Costs of the Work.

604. TRAFFIC MAINTENANCE

It is a priority for the city to maintain access for all modes of travel, including vehicles, transit, pedestrian and bicyclists, at all times. Before proceeding with construction, the contractor shall obtain written approval from the city of Boulder Division of Transportation of the proposed method of handling traffic. The MUTCD shall be followed for traffic control. The procedures designated by this hand book may be modified when necessary by change order. Closing or otherwise severely obstructing streets, alleys, bikelanes, paths, sidewalks and road systems will be permitted only after the project manager has authorized the contractor in writing to do so. When a detour is necessary because a street, alley, bikelane, path, sidewalk or road system is blocked in whole or in part by the work, the city will designate its route, and the contractor shall furnish, post, and maintain detour signs of the type and size required by the city of Boulder Division of Transportation at the places designated by the city of Boulder Division of Transportation prior to impairing public access or closing or otherwise obstructing a street, alley, bikelane, path, sidewalk or road system. The superintendent designated pursuant to section 507 shall be responsible for traffic control. The superintendent shall have the responsibility to sign documents on behalf of the contractor related to traffic control, and to handle all other details covered by the contract documents which contribute to the comfort and safety of the traveling public.

605. MAINTAINING TRAFFIC DURING SUSPENSION OF WORK

Upon any suspension of the work under this contract (*see* article 11), the contractor shall make passable and shall open to vehicles, bicyclists and pedestrians such portions of the work site as are reasonably directed by the project manager for the temporary accommodation of the public during

the anticipated period of suspension. Thereafter, until the project manager orders that construction be resumed, the city shall maintain any temporary travel ways through the work site. Unless the city expressly and in writing assumes such responsibility, the contractor shall be responsible for protecting the work site itself during the period of suspension.

606. RESUMPTION OF WORK

When work is resumed, the contractor shall replace or renew any work or materials damaged or lost as a result of temporary use of portions of the work site. The contractor shall also remove, as directed by the project manager, any work or materials used by the city in the maintenance of any temporary travel ways. The contractor shall complete the work in every respect as though its implementation had been continuous and without interruption. Except for suspensions of work pursuant to sections 1003 or 1008, the contractor shall bear the costs which result from the period of suspension and all start up costs associated with resuming the work as set forth in this section.

607. DRAINAGE

The contractor shall provide at its own cost and expense all reasonable methods for adequately draining the work and shall assume full responsibility and liability for damage to any person or property resulting from inadequate or excessive drainage unless the damage resulted from a design error which was caused by the city or by an A/E hired by the city, or is due to sequencing of projects beyond the contractor's control. The contractor shall be responsible for the preservation and protection of storm water collection systems and other natural and developed drainage ways which may be affected by work done under the contract. This municipal service system is operated and regulated by the Utilities Division of the city of Boulder Department of Public Works. The contractor is required to notify the Director of Public Works for Utilities prior to initiation of the work when the work may diminish the system's capabilities or may redirect water flow. This notification process does not, however, relieve the contractor of any responsibility for damage which may result from the contractor's operations.

If the construction requires land disturbance of one acre in size or greater, then the contractor shall conform to the requirements for a stormwater discharge permit associated with construction activity from the Colorado Department of Public Health and Environment (Colorado Department of Public Health and Environment, Water Quality Control Division, 303-692-3500 http://www.cdphe.state.co.us/wq/PermitsUnit/wqcdpmt.html). If this permit is not obtained by the city, the general contractor is responsible for obtaining this permit from the Colorado Department of Public Health and the Environment.

The contractor shall satisfy all environmental quality standards imposed by law and take reasonable steps to minimize the environmental impact of the work. These environmental quality standards include, without limitation, noise control, air pollution control, water pollution control, and dust control, which may be placed at risk by the activities of the contractor:

A. The contractor shall not pollute the water of any pond, lake, stream, ditch, or other watercourse, as prohibited pursuant to Title 11, Chapter 5 "Storm Water and Flood

Management Utility," B.R.C. 1981, which generally prohibits discharge of pollutants to water bodies.

B. The contractor will implement erosion control practices and stormwater best management practices in accordance with Title 11, Chapter 5 "Storm Water and Flood Management Utility," B.R.C. 1981.

C. The contractor will comply with permits required to discharge groundwater to the storm drainage system in accordance with Title 11, Chapter 5 "Storm Water and Flood Management Utility," B.R.C. 1981, which regulates groundwater discharges to storm sewer.

608. WASTE WATER

Except for sanitary sewage which shall be discharged only into the city's sanitary sewer system, the contractor shall not discharge any water or other liquids to the city's sanitary sewer system. All bypassing or pumping of sanitary sewage required during construction shall be to other sanitary sewer facilities approved by the project manager by a field order. All existing sanitary sewer facilities shall remain in continuous and full operation during construction. All costs incurred for bypassing, removal, pumping, and disposal of wastewater and sanitary sewage during construction shall be borne by the contractor.

609. DITCH IMPACTS AND CROSSINGS

The contractor shall confirm, prior to the start of construction, what agreements the city has procured with any ditch company. If a ditch agreement has been negotiated between a ditch company and the city, the contractor is responsible for complying with the terms of that agreement.

The contractor is responsible for notifying a ditch company's representative when the work will breach a ditch, tunnel under a ditch, is within 25 feet of a ditch, redirect the flow of a ditch, or in any way will impact or diminish the ditch system's capability to carry water. Such notification shall occur as soon as the schedule for the work is established, but at a minimum of fourteen (14) days prior to initiating the work. This notification does not relieve the contractor of any responsibility for damage that may result from the contractor's operations, nor does it relieve the contractor of any responsibility to obtain any necessary approvals from a ditch company. Should the contractor require additional approval from a ditch company, the contractor should note that such approvals generally take more than thirty (30) days to obtain.

610. PROTECTION OF MUNICIPAL SERVICE FACILITIES

The contractor shall provide and maintain free access to all municipal service systems including, without limitation, fire hydrants, water and gas valves, manholes, and utility poles. All natural and developed drainage ways shall be kept open unless and until other provisions satisfactory to the project manager are made for the removal of storm water. If the contractor damages any municipal service systems, the contractor shall immediately repair or replace the damaged municipal service facilities at no cost to the city.

611. LIST OF MUNICIPAL SERVICE SYSTEMS

If the contractor's work affects any municipal service system, the contractor shall notify the affected organization immediately. The term "municipal service system" or "facility" shall mean any equipment located in the public right-of-way or in a utility easement, whether or not platted or formally deeded to the city. The list below is not intended to be complete; rather, it identifies the systems which contractors encounter most frequently:

System	Agency to Contact	Telephone #
Telephone	Qwest	1-800-954-1211
Buried Utilities Location Service	Utility Notification Center of Colorado	1-800-922-1987
Streets, Roads, Alleys, Bikelanes, Paths or Sidewalks and Traffic Control Equipment	Department of Public Works/Transportation Division	303-441-3266
Sanitary Sewer Collection, Storm Water Collection and Drainage Ways; Water Distribution	Department of Public Works/Utilities Division	303-413-7100
Electrical Power Lines and Natural Gas Lines	Xcel Energy	303-623-1234
Tree Removal/Pruning in city-owned property and right-of-way	Parks and Recreation Department, Forestry Division	303-441-4406
Work within easements through public parkland	Parks and Recreation Department	303-413-7200
Open Space and Mountain Parks	Open Space Department	303-413-3440
Police and Alarms	Police Department	303-441-3333
Fire	Fire Department	303-441-3350
Cable Television	Comcast	303-930-2000

612. INTERRUPTIONS TO UTILITIES

If the contract requires that any utility be interrupted, or the contractor desires to interrupt a utility for its convenience, it shall promptly contact the affected utility and customers and obtain the necessary permissions. The interruption shall be confined to the least possible time period and cause the least possible inconvenience to service recipients. The contractor shall bear all costs related to a utility interruption. If such an interruption is required by the contract, the contractor shall include its best estimate of those costs in the bid items.

613. UTILITIES, STRUCTURES, AND CONDITIONS SHOWN IN CONTRACT DOCUMENTS

A. Except as set forth in paragraph B, below, existing underground, surface or overhead utilities, structures and conditions may be omitted in the drawings, specifications and other contract documents, and those shown may not be accurately situated or drawn to scale. The contractor shall be responsible for protecting all such utilities as described below.

B. The approximate locations of underground facilities and the tie in points which are owned or operated by the city are shown on the plans and specifications. As part of the work contractor shall, on behalf of the city, locate and mark the precise location of such facilities as required by ' 9-1.5-101 *et seq*., C.R.S. In addition the plans and specifications may indicate that the location of any underground facilities owned or operated by the city are "unknown," "uncertain" or "within a range." The contractor shall have full responsibility for determining the exact location of all the above mentioned underground facilities by "potholing," "handwork" or such other means as may be necessary to determine the precise location without damaging such underground facilities. This work is included in the contract price unless called out as a separate pay item. The precise location of all such underground facilities shall be incorporated into the record drawings by the contractor.

C. Contractor shall notify the "Utility Notification Center of Colorado" in a timely fashion as required by Section 9-1.5-101 *et seq*., C.R.S. Contractor shall request written record of any information from all owners or operators, of underground facilities (as defined in the above statute) regarding the location of the specific underground facilities. Contractor shall comply with all requirements of the above statute as it pertains to the "excavator". The city shall not be responsible for the accuracy or completeness of any information provided by third-party owners or operators of underground facilities, including the marking thereof.

D. The cost of all the following will be included in the contract price and contractor shall have full responsibility for:

1. Reviewing and checking all information and data provided by all owners or operators of underground facilities;

2. Locating all underground facilities shown or indicated in the contract documents;

3. Coordination of the work with the owners and operators of all underground facilities during construction;

4. The safety and protection of all utilities and the entire expense of repairing or replacing any utilities or structures disturbed or damaged during construction.

5. The contractor shall be responsible for all coordination and implementation associated with any necessary relocation or removal of utilities, including relocation and removal which must be performed by third parties.

6. The contractor shall be responsible for the location and protection of all individual service lines, notwithstanding any requirements to the contrary in Section 9-1.5-101 *et seq*., C.R.S.

7. The contractor shall be responsible for the repair of any damage to utilities that have been properly located by the designated utility locating service and for utilities for which the contractor has not obtained the proper field location marking.

E. If any underground facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the contract documents or by reason of information supplied pursuant to Section 9-1.5-101 *et seq*., C.R.S., contractor shall promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any work in conjunction therewith (except in emergency situations) identify the owner of such underground facility and give written notice to that owner, the "Utility Notification Center of Colorado", and the city. The location of all such underground facilities shall be incorporated into the record drawings by contractor. The city will promptly review the underground facility and determine the extent, if any, to which a change is required in the contract documents to reflect and document the consequences of the existence of the underground facility. During such time, contractor shall be responsible for the safety and protection of such underground facility. The contractor shall be allowed an increase in contract price, or an extension of contract time, or both, in accordance with article 8, to the extent that they are attributable to the existence of any underground facility that is not shown or indicated in the contract documents and that the contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If the city and contractor are unable to agree on entitlement to or the amount or length of any such adjustments in the contract price or contract time, contractor may make a claim therefore as provided in the contract documents.

F. In the event of a break in an existing water main, gas main, sewer or underground cable, the contractor shall immediately notify the responsible official of the organization operating the utility interrupted and the project manager, and shall lend all possible assistance in restoring service.

614. ARCHAEOLOGICAL AND HISTORICAL DISCOVERIES

If any fossils or treasure or unusual or valuable geological formations are found during the work, such items shall be carefully preserved by the contractor, who shall notify the project manager and request instructions regarding the disposition of these items. These items are the property of the city. In addition, the contractor shall inform the project manager of any evidence which might suggest to a lay person that deposits of historical or archeological interest or treasure or unusual or valuable

geological formations may be present on the work site. Upon making such a discovery, the contractor shall avoid disturbing that part of the work site. This could require that the contractor's activities be redirected or stopped until the project manager determines how to proceed. No further disturbance of such discoveries shall be made until the Regional Office of the Environmental Protection Agency and the State Historical Preservation Officer have been notified, and the project manager determine how the work should proceed. If the project manager finds that protecting such discoveries causes an increase or decrease in the contractor's cost or time required to perform the work, an equitable adjustment will be made in the contract price, in accordance with article 8 and/or time of performance by way of a change order.

615. HAZARDOUS OR EXPLOSIVE MATERIALS

Before using or storing hazardous or explosive materials at the work site, the contractor shall inform the project manager and the city's fire department of the proposed action in writing, and shall receive the project manager's written approval before proceeding. Explosives or hazardous materials shall be handled and used by experienced workers only. All firing shall be done by electricity. All storage places shall be marked clearly: "DANGEROUS –EXPLOSIVES" or "DANGEROUS - HAZARDOUS MATERIALS." Caps or other exploders shall not be stored at the same place where dynamite or other explosives are stored. All explosives, firing devices, and other hazardous materials shall be kept in locked containers.

616. PROTECTION OF PRIVATE PROPERTY

The contractor shall not enter upon private property for any purpose without having previously obtained permission from the property owner. The contractor shall be responsible for the preservation of, and shall use every reasonable precaution to prevent damage to all private property adjacent to the work site. The contractor shall repair or replace any damage, injury, or loss to such property caused directly or indirectly, in whole or in part, by the contractor or any subcontractor, their employees or agents, or anyone directly or indirectly employed by them or anyone for whose acts anyone of them may be responsible to a condition substantially similar or equal to that existing before such damage was done, by repairing, rebuilding, or otherwise restoring the property or paying the owner for such damage as may be directed by the project manager. If the contractor fails to restore such property or pay for such damage, the city may, upon forty-eight (48) hours written notice to the contractor under ordinary circumstances, and without notice when a nuisance or hazardous condition results, repair, rebuild, or otherwise restore such property or pay for such damage and the cost thereof shall be deducted from any payments due to the contractor under this contract. If not so deducted, the contractor shall immediately reimburse the city for the cost thereof.

The contractor shall immediately notify the project manager of all proposed uses of private property related to the project. The contractor shall provide written verification that the use of the private property has been negotiated with and approved by the private property owner prior to the use of the property. Verification shall include Boulder County records related to property ownership, and signed and notarized agreement(s) between the property owner and the contractor. Uses of private property that are considered directly related to the project include, but are not limited to, material storage, equipment or manpower access, material disposal, and material borrow. In case the

contractor negotiates use of the private land(s) with property owners for its convenience, the contractor shall be fully responsible for all related negotiations and payments.

617. PROTECTION OF EXISTING PLANT MATERIALS

The contractor shall be responsible for taking all reasonable steps for protecting, transplanting, and replanting existing trees, shrubs, and other plant materials which may be affected by the work. Plants designated to remain shall be protected by construction fencing or barriers at all times during the entire contract period. No material shall be stockpiled and no equipment shall be parked or repaired within twenty-five (25) feet of existing trees unless it is impossible to avoid doing so. No oil, gasoline, concrete, or other materials shall be dumped or temporarily stockpiled anywhere on site unless permission is first obtained from the project manager. *See* section 703. Any plants damaged or scarred during construction shall be mitigated immediately at the contractor's expense, *see* Chapter 6-6, "Protection of Trees and Plants," B.R.C. 1981. Where separations expose or damage the root systems of plants designated to remain, the contractor shall take remedial measures at the direction of the project manager within two (2) hours or as soon as reasonably possible to insure the health of the plant. Plants designated to remain but which are, in the opinion of the project manager, damaged beyond repair, shall be replaced by the contractor at the contractor's own expense with a similar size and species chosen by the project manager. Any existing sod damaged by the construction operations shall be replaced by the contractor at the contractor's own expense. The contractor's liability for damages due to injured plant materials shall not be limited to the replacement of such materials, but shall also include damages incidental to removing and replacing such materials. No plant materials shall be cut except with the written permission of the project manager. If the contractor must repair or replace damaged plant materials, the contractor shall guarantee such replacement materials for one full growing season following the planting thereof. As used herein, the growing season begins on April 1 and ends on August 31.

618. PLANTING, PROTECTION AND GUARANTEE OF PLANT MATERIALS

The contractor shall take special care when plant materials have been planted as part of the work. If such plant materials are damaged or die from natural causes or due to the negligence of the contractor within a period of one (1) full growing season from the date of planting, then the contractor shall replace such plant materials with plant materials of the same size and quality at no cost to the city. Damaged plant materials shall be replaced no later than the following growing season, and sooner if possible. As used herein, the growing season begins on April 1 and ends on August 31. The project manager shall approve all plant materials, including replacement materials, in writing before the planting thereof. If the contractor must replace any plant materials, the contractor shall guarantee such replacement items for a period of one full growing season following the planting thereof. If the plant materials so replaced are damaged or die from natural causes or due to the negligence of the contractor during the guarantee period, the contractor shall replace such damaged plant materials, and again guarantee them for an additional full growing season, and so on until the guarantee is fully met.

If the project manager directs, the contractor shall guarantee proper performance of landscaping materials for a period of two years from the date of final completion and secure this guarantee with a maintenance bond. This maintenance bond shall be based on the cost of landscaping as set forth in

the bid schedule or schedule of values, and shall only apply to landscaping maintenance purposes including, without limitation, replacement of trees, shrubs, reseeding, weed control, operation and repair of sprinkler system, and any other maintenance requirements.

619. WEED MANAGEMENT PLAN

All weed control practices shall be in accordance with the city's Integrated Pest Management Policy, available from the city of Boulder, Office of Environmental Affairs (Atrium Building at 13th and Canyon, phone: 303-441-1915). The contractor shall prepare a weed management plan in accordance with this policy and submit it to the project manager. Chemicals shall not be used for weed control unless approved by the project manager. The contractor shall comply with the pesticide notification requirements of this policy and notifications required under Title 6, Chapter 2 "Weed Control," B.R.C. 1981, and Title 6, Chapter 10 "Pesticide Use," B.R.C. 1981.

620. WORK IN EXISTING BUILDINGS

If the work involves an existing building, the contractor shall plan and execute the work to avoid unnecessary damage to walls, ceilings, ducts, pipes, wires, and any other building elements. The contractor shall organize and plan the work to reduce to a minimum the need for cutting or otherwise removing load bearing structural elements to accommodate the installation of piping, ductwork, or equipment. If two or more persons are doing work in the same place, the contract superintendent shall be responsible for coordinating efforts. If cutting or removal of structural elements is necessary because the work could not be organized and planned to avoid such cutting or removal, the contractor shall so inform the project manager. The contractor shall not damage or endanger any portion of other work of the city or any separate contractor by cutting, patching, or otherwise altering any work, or by excavation or except with the written consent of the project manager and of such separate contractor. Such consent shall not be unreasonably withheld. The contractor shall be responsible for all repair, replacement and patching that becomes necessary. If the work involves an existing building, the contractor shall erect and maintain during the progress of the work suitable dustproof partitions to protect the building and the occupants thereof. The contractor shall schedule the work of subcontractors and other persons in order that each may accomplish the work in an efficient and orderly fashion and in a manner which will permit maximum use of the building and minimize impairment of any existing facilities.

621. CONNECTIONS TO EXISTING FACILITIES

Unless otherwise specified or indicated, the contractor shall make all necessary connections to existing facilities, including, without limitation, structures, drain-lines, and utilities such as water, sewer, and electric. In each case, the contractor shall receive permission from the city or the owning utility prior to undertaking connections. The contractor shall protect facilities against deleterious substances and damage.

Connections to existing facilities which are in service shall be thoroughly planned in advance and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously, around the clock if necessary to complete connections in the minimum time. Utilities interruptions shall be kept to a minimum and scheduled for the least

inconvenient time for service recipients. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

622. REMOVAL/REPLACEMENT OF EXISTING FACILITIES

The contractor shall perform all removal and replacement required for, and in connection with, the work, including but not limited to, the following:

A. Removal of improperly timed work;
B. Removal of samples of installed materials for testing;
C. Alteration of existing facilities;
D. Installation of new work in existing facilities.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the work or existing facilities without the project manager's concurrence.

Materials shall be cut and removed to the extent indicated on the drawings or as required to complete the work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by contractor.

All work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to the project manager, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be replaced and refinished.

623. PROTECTION AGAINST WEATHER

All work and construction materials, unless otherwise protected, shall be protected in a manner to prevent damage to the construction materials. Sufficient covering shall be kept ready at the work site for this purpose. If the city chooses to protect any construction materials or work done under the contract which the contractor has left unprotected, the contractor shall reimburse the city for the value of city labor and materials expended in protecting the work or construction materials.

624. TEMPORARY ENERGY, WATER, TELEPHONE AND OTHER SERVICES

The contractor shall pay for all temporary energy, water, telephone, and other services needed to do the work and provide and pay for all temporary facilities needed to deliver such services to the work. Temporary facilities shall be installed and maintained to protect the public and workers and shall conform to any applicable requirements for the delivery of the services. Upon completion of the work, the contractor shall remove all such temporary facilities. The contractor may use a structure's permanent heating system in order to provide temporary heat if the project manager approves this in writing. If temporary heating is required for the benefit of the city before the permanent heating system is available, the contractor shall provide safe heating apparatus acceptable to the project manager and shall provide all fuel that is required. All expenses resulting from temporary heating shall be paid for by the contractor and not reimbursed by the city. When the heating system in any

new construction is ready for operation, the contractor may put it into operation and remove the temporary heating equipment. Operation of the heating system before the city issues a certificate of substantial completion is at the contractor's risk and expense.

625. SANITARY FACILITIES

The contractor shall provide and maintain suitable, weather tight, plastic or painted sanitary toilet facilities for any and all workers engaged on the work for the entire construction period. The contractor shall keep the toilets clean. When the toilet facilities are no longer required, the contractor shall promptly remove them from the site and disinfect and treat the site area as required. Toilet facilities of any existing building at or near the site shall not be used by employees or agents of the contractor or subcontractors unless the project manager grants prior written approval.

626. MONUMENTS AND STAKES

Prior to starting work on site, the contractor shall hire a licensed surveyor to locate and stake, with a very visible temporary stake, all existing property corner markers and survey monuments within the planned disturbance area of the project or within the right-of-way access to the project. The contractor shall not disturb any monuments or stakes until so ordered by the project manager. In case any monument or stake is disturbed by the contractor without orders from the city, the contractor shall pay the cost of the survey and other work required to relocate the same. Any work done without being properly located and established by base lines, offset stakes, bench marks, or other basic reference points located, established, or checked by the city may be ordered removed and replaced by a licensed surveyor at the contractor's expense. In such case, the contractor shall bear any expense to the city caused by improper location of the work.

627. PROTECTION OF THE ENVIRONMENT

The contractor shall satisfy all environmental quality standards imposed by law and take reasonable steps to minimize the environmental impact of the work. These environmental quality standards include, without limitation, noise control, air pollution control, water pollution control, and dust control, which may be placed at risk by the activities of the contractor; (the regulations can be accessed via the city's website at www.ci.boulder.co.us). In addition:

A. The contractor shall not burn any trash, rubbish, or other materials except in accordance with the provisions of Paragraph 10-8-2(b)(29), B.R.C. 1981.

B. The contractor shall not pollute the water of any pond, lake, stream, ditch, or other water course on city property, as prohibited pursuant to Section 5-4-11, B.R.C. 1981.

C. The contractor shall not deposit in any part of the water utility any substance or material that will injure or obstruct the utility, or contaminate or pollute the water or obstruct the flow of water, as prohibited pursuant to Section 11-1-12, B.R.C. 1981.

D. The contractor shall comply with the provisions of Chapter 11-3, B.R.C. 1981, regarding industrial and prohibited wastewater discharges.

E. The contractor shall not discharge visible emissions from motor vehicles pursuant to Section 7-3-5, B.R.C. 1981.

F. The contractor shall implement erosion control practices and stormwater best managements practices in accordance with Section 11-5-6, B.R.C. 1981.

G. The contractor will comply with permits required to discharge groundwater to the storm drainage system in accordance with Section 11-5-7, B.R.C. 1981.

Should the contractor or its subcontractors fail to satisfy environmental quality standards, the city shall have the right to employ outside assistance, city employees, or a private contractor to provide control and clean up, as necessary. All such costs may be deducted from any payment due to the contractor or charged to the contractor directly.

628. NOISE CONTROL

The contractor shall comply with all provisions of Sections 5-6-2 and 5-3-8, B.R.C. 1981. If the contractor believes that the work will violate these provisions, the contractor shall notify the project manager and shall also apply for a variance from the city's Environmental and Zoning Enforcement Division before beginning the work. A variance may be granted if it is found that compliance with these standards twill cause an undue hardship and it is found that:

A. The activity, operation or sound source will be of temporary duration, and even with the application of the best available control technology cannot be done in a manner that would comply; and

B. No reasonable alternative is available to the applicant.

If a variance is granted, reasonable conditions or requirements may be prescribed to minimize adverse effects upon the community or the surrounding neighborhood.

629. STORAGE AND REMOVAL OF CONSTRUCTION MATERIALS

The contractor shall routinely keep the work site and the surrounding premises free of accumulated waste materials and rubbish. Contractor shall provide adequate trash receptacles about the site and shall promptly empty the containers when filled. Waste materials must be removed regularly to a suitable landfill or recycling facility. Volatile wastes shall be properly stored in covered metal containers and removed daily. Wastes shall not be buried or burned on the site or disposed of into storm drains, sanitary sewers, streams or waterways. If space is available, the project manager may designate a place on the site to collect debris, rejected materials and other waste materials. If such a place is designated, the contractor shall, at the contractor's sole expense, install fencing and whatever else is necessary to keep loose materials confined so that they are not scattered by wind. The contractor shall be liable for any damage caused by construction materials which have been scattered by wind. The contractor and all subcontractors are hereby notified of the frequent wind hazards of Boulder, and waive any defense that wind gusts of high velocity could not be anticipated. Reusable construction materials such as concrete forms and scaffolding shall be neatly stacked by contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive

liquids, and cleaning solutions from surfaces to prevent marring or other damage. Progress payments may be withheld if the contractor fails to maintain the work site in a clean, orderly, and safe condition.

The contractor shall re-use and recycle, to the greatest extent possible, the waste produced as a result of the project. Unless otherwise indicated or specified, existing materials and equipment removed as a part of the work shall become contractor's property. Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified or indicated to be salvaged and reused or to remain the property of city. Contractor shall store and protect salvaged items specified or indicated to be reused in the work. Salvaged items not to be reused in the work, but to remain city's property, shall be delivered by contractor in good condition to the city as directed by the project manager or at the city Yards. Any items to be reused or salvaged that are damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by contractor in kind or with new items. Contractor may, at its option, furnish and install new items in lieu of those specified or indicated to be salvaged and reused, in which case such removed items will become contractor's property. Existing materials and equipment removed by contractor shall not be reused in the work except where so specified or indicated.

630. EXISTING TRAVEL WAYS CONDITIONS DURING CONSTRUCTION

When reasonable and appropriate, equipment, tools, and materials shall be kept out of traveled ways such as streets, alleys, sidewalks, paths and bikelanes. Equipment which may endanger vehicular traffic must be lighted and marked to warn motorists. No sand, gravel, rocks, mud, dirt, or other debris may be deposited upon any streets, alleys, sidewalks, paths and bikelanes in violation of Section 8-2-10, B.R.C. 1981. If the contractor does not comply with this provision after receiving written notification, the city may have the debris removed and the costs of removal may be deducted from any payment to the contractor or charged to the contractor directly.

631. POST-CONSTRUCTION CLEANUP AND REPAIRS

At the completion of the work, the contractor shall remove all spots from floors, walls, ceilings, windows and doors and, where necessary, refit windows, doors and cabinet work. The contractor shall also clean all window glass and all plumbing fixtures. The contractor shall make such minor repairs and alterations as may be necessary to make any building or structure ready for occupancy. The contractor shall replace all broken and scratched glass with material which complies with the contract documents. This section shall not apply after or to the extent that the city has taken possession of a building on which the contractor has performed work. On all street construction projects, the contractor shall conform the work to acceptable line and grade, as determined by the project manager. In addition, the contractor shall have the streets, alleys, sidewalks, paths and bikelanes affected by the work swept clean of sand, gravel, rocks, mud, dirt or other debris by a street, alley, sidewalk, path and bikelane cleaner when necessary, as determined by the project manager. The city will not authorize final payment until the contractor has removed all rubble and other debris from the street and adjoining work area.

ARTICLE VII. CONTRACTOR'S WARRANTY AND GUARANTEE

701. CONTRACTOR'S WARRANTY AND GUARANTEE

The contractor's guarantee shall continue for a period of two (2) years after the date of substantial completion, except as otherwise provided in the contract document, notwithstanding the warranty period of any product which may be incorporated into the work which would otherwise expire before the expiration of this two-year warranty period.

The contractor warrants and guarantees to the city that all materials and equipment will be new, unless otherwise specified, suitable for the purpose intended and will be of the highest quality, new, merchantable, and fit for the purpose for which they are intended, and that the work will be performed using the best skills and workmanship to provide a project of the highest quality. The contractor also warrants and guarantees that the workers who perform the work will be sufficiently skilled to produce a high quality product which is free of faults or defects, including blemishes (surface defects) and flaws (internal defects), and in accordance with the requirements of the contract documents and of any inspections, tests or approvals required.

Contractor further warrants that it has full title to all equipment, components and other items conveyed to the city under the terms of this contract, that its transfer of such title to the city is rightful and that all such equipment, components and other items shall be transferred free and clear from all security interests, liens, or encumbrances, whatsoever. The contractor agrees to warrant and defend such title against all persons claiming the whole or any part thereof at no cost to the city.

All subcontractors', manufacturers' and suppliers' warranties and guarantees, expressed or implied, for any part of the work and any materials used therein, shall be obtained by the contractor for the benefit of the city whether or not such warranties have been assigned or otherwise transferred to the city, and enforced by the contractor during its guarantee period. The contractor shall assign or transfer such warranties and guarantees to the city if the city requests the contractor to do so. If within ten (10) days after written notice by the project manager to the contractor, or its agent, requesting such repairs or replacement, the contractor shall neglect to make or undertake with due diligence to do the same, the city may make such repairs or replacement in accordance with the terms of the contractor's performance bond at the contractor's and/or surety's expense, provided, however, that in the case of emergency where, in the judgment of the project manager, delay would cause serious loss or damage, repairs or replacement may be made without notice being sent to the contractor.

The duties and obligations imposed by these general contract conditions and the rights and remedies available hereunder and, in particular but without limitation, the warranties, guarantees and obligations imposed upon the contractor and the remedies available to the city thereunder, shall be in addition to and not a limitation of any otherwise imposed or available by law, by special guarantee or other provisions of the contract documents.

Nothing herein shall be construed to establish a period of limitation with respect to any other obligation which the contractor might have under the contract documents. The establishment of the warranty period set forth above relates only to the specific obligations of the contractor to correct

known defects in the work which are discovered and called to the contractor's attention during the warranty period, and has no relationship to the time within which its obligation to comply with the contract documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the contractor's liability with respect to its obligations and resulting damages. Nothing herein shall limit the city's right to seek recovery for latent defects which are not observable until after the warranty periods have run.

The contractor shall repair or replace all damaged or defective work immediately upon discovering any damage or defect, provided such damage or defect is not due to a design error caused by the city or an A/E hired by the city or an agent or employee thereof. The contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the construction manager, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage to the extent the above do not arise out of contractor's action or failure to act. The contractor shall promptly, without cost to the city and in accordance with the project manager's written instructions, either correct such defective work, or, if it has been rejected by the city, remove it from the site and replace it with non-defective work. The contractor's guarantee shall cover all materials and equipment incorporated in the work, and shall cover the work of the contractor and any subcontractors and their employees and agents engaged in the work.

As used in this contract, the terms "warranty" and "guarantee" shall be synonymous, and the terms "warranty period" and "guarantee period" shall be synonymous.

702. EXPERIMENTAL CONSTRUCTION METHODS

If the contractor proposes to use any method or product which can reasonably be considered to be experimental, the contractor must advise the project manager of that proposed method or product in writing. The contractor shall not employ any such experimental method or product until advised to proceed by the project manager in writing. The city may require special guarantees of the contractor to cover the work produced by the experimental method or product. By failure to require any such special guarantees, however, the city does not excuse the contractor for liability due to damages resulting from the use of experimental methods or products.

703. MATERIALS

The contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials to be used in the work. All materials used shall be, unless otherwise specified in the bid proposal, the standard stock products of reputable manufacturers. From the time of commencement of the work until its completion, the contractor shall be solely responsible for the care of all materials delivered at the site intended for use in the work, unless the materials are damaged by an act of the city or an employee or agent thereof. All injury or damage to any materials, whether or not incorporated into the work, shall be repaired or replaced at the contractor's expense before final payment shall be made unless the injury or damage is caused by an act of the city or an employee or agent thereof. The contractor shall provide suitable protection for all materials intended for use in the work, as well as for all completed work. The contractor may use a portion of the work site for storage of materials and equipment, provided that the use of this portion of the site is approved in writing by the project manager, which approval shall not be unreasonably withheld, and that it is

protected from wind as provided in section 623. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the particular manufacturer, fabricator, or processor, except as otherwise provided in the contract.

704. MATERIALS TESTS

If the contract documents require any portion of the work to be tested or specially inspected, the contractor shall give the project manager forty-eight (48) hour advance notice of its readiness in order that the project manager may observe such testing. In addition, the project manager may order testing or special inspection of any materials employed in the work. The city shall bear all costs of tests or special inspections not called for by the contract documents. If such testing or special inspection reveals a failure of the work to comply with the requirements of the contract documents, the contractor shall bear all costs of replacement thereof including retesting. The contractor shall provide such facilities as the city may require for collecting and forwarding samples and for conducting materials tests. The project manager may require that the contractor not use the materials represented by the samples which have been requested by the project manager until the project manager has informed the contractor that the materials satisfy the requirements of the contract documents. The contractor shall furnish the required samples to the city. If testing results require that the contractor obtain new or additional materials, these shall be obtained at the contractor's expense. In addition, the contractor shall pay all incidental expenses associated with procuring such new or additional materials, including, without limitation, transportation and shipping costs.

705. PROJECT INSPECTOR

A project inspector is assigned to a project to keep the city informed as to the progress of the work and the manner in which it is being done; to keep records; act as liaison between the contractor and the city; and to call the attention of the contractor to any deviations from the contract documents. The project manager shall inform the contractor as to who will be serving as the project inspector.

The contractor shall permit a project inspector unlimited access to the work as well as whatever access is needed to off-site facilities used to store or manufacture materials and equipment to be incorporated into the work.

706. AUTHORITY OF PROJECT INSPECTOR

A project inspector may communicate to the contractor any work directives, change orders, field orders, or other modifications in the work ordered by the project manager. The project inspector is authorized to reject any work or materials which do not conform with the contract documents, and if necessary, to suspend operations until corrective measures are taken, but may not order any modifications in the contract documents, or in the materials or construction methods employed by the contractor, unless specifically authorized by the project manager by a field order or change order.

The project inspector shall not have the power to waive obligations of the contractor, to revoke, alter, enlarge or reduce the requirements of the contract documents, (nor to delay the fulfillment of the contract by failure to inspect materials and work with reasonable promptness), or to approve or accept any portion of the work or to issue instructions contrary to the contract documents. The

contractor may not rely upon information or instruction offered by any person other than the project manager unless the project manager has authorized such other person in writing to deliver or otherwise communicate instructions to the contractor.

If the contractor questions or disagrees with any communication of a project inspector, the contractor shall notify the project manager, who shall inform the contractor in writing how to proceed. The contractor shall not be entitled to claim damages because the contractor relied on information or instructions offered by a project inspector and as a result performed work which was defective, or had to be repaired or replaced, unless the information or instruction was in the form of or pursuant to a writing issued and signed by the project manager.

The presence or absence of a project inspector on the job will be at the sole discretion of the city and such presence or absence of a project inspector will not relieve the contractor of its responsibility to obtain the construction results specified in the contract documents.

707. INSPECTION OF WORK BY PROJECT INSPECTOR

The project manager and project inspector shall at all times have the right and access to inspect the work and materials during normal working hours. The contractor shall furnish all reasonable aid and assistance required by the project manager or project inspector for the proper examining of the work and all parts thereof. Subject to the other provisions of this section, unless otherwise directed by the project manager, no work shall be done or materials used without inspections by the project manager or the project inspector having been performed, and no work shall be covered up or backfilled until the project manager's or project inspector's inspections are completed.

All material and workmanship (if not otherwise designated by the specifications) shall be subject to inspection, during manufacture and/or construction and at any and all places where such manufacture and/or construction is carried on.

Observations, inspections, and tests by the project manager, project inspector, or others are for the express purpose of providing quality assurance for the sole benefit of the city. Such activities shall not relieve the contractor from its quality control obligations or from its obligations to perform the work strictly in accordance with the requirements of the contract documents.

Nothing in this article shall in any way be construed as to require or to place responsibility for the method, manner or supervision of the performance of the work under this contract upon the project inspector or the city. Such responsibility rests solely with the contractor.

Failure of the project inspector to call the attention of the contractor to faulty work or deviations from the contract documents shall not, however, constitute acceptance of said work.

708. UNCOVERING OF WORK

If any portion of the work is covered contrary to the request of the project manager or to requirements specifically expressed in the contract documents, it must, if required in writing by the project manager, be uncovered for the project manager's observation and shall be replaced at the contractor's expense. If any other portion of the work has been covered which the project manager

has not specifically requested to observe prior to being covered, the project manager may request to see such work and it shall be uncovered by the contractor. If such work is found in accordance with the contract documents, the cost of uncovering and replacement shall, by appropriate change order, be charged to the city. If such work is found not in accordance with the contract documents, the contractor shall pay such costs unless it be found that this condition was caused by the city or a separate contractor, in which event the city or the contractor shall be responsible for the payment of such costs.

709. FIELD ORDERS

After a contract has been awarded, the contractor shall submit any requests for explanation or clarification of the contract documents to the project manager. When the city responds to such requests, it will issue a written explanation ("Field Orders") (Form 10) which shall consist of a written explanation with or without amended drawings. Field orders do not provide for either time extensions or changes in contract prices. If the contractor believes that the field order will require a time extension or extra payment, the contractor shall inform the project manager in writing within ten (10)days of the field order, or the contractor shall be deemed to have waived the right to make the request.

710. SUGGESTIONS TO THE CONTRACTOR

Any plan of action, method of work, or construction procedure suggested to the contractor by any city representative other than the project manager shall be adopted or followed at the sole risk and responsibility of the contractor. This section shall not apply to change orders or field orders which have been duly issued by the project manager.

711. CORRECTION OR REMOVAL OF DEFECTIVE WORK

If required by the project manager prior to final payment, and subject to the contractor's right to subsequently dispute the decision of the project manager, the contractor shall promptly, without cost to the city and as specified by the project manager, either correct any defective work, whether or not fabricated, installed, or completed, or, if the work has been rejected by the project manager, remove it from the site and replace it with nondefective work. If the contractor does not correct such defective work or remove and replace such rejected work, all as specified in a written notice from the project manager within a reasonable time, the city may have the deficiency corrected or the rejected work removed and replaced. All direct or indirect costs of such correction or removal and replacement, including without limitation, compensation for additional professional services and costs of additional testing and inspections, shall be paid by the contractor, and an appropriate deductive change order shall be issued. The contractor shall also bear the expenses of making good all work of others destroyed or damaged by the correction, removal, or replacement of its work. The city's failure to reject any material or work at the time of its use in the project shall not constitute a waiver of any rights hereunder. The contractor shall not be entitled to any time extension for performance of the work as a result of the correction of defective work by the contractor or the city.

712. NEGLECTED WORK BY CONTRACTOR

If the contractor should fail to prosecute the work in accordance with the contract, including any requirements of the progress schedule, the city, after seven days written notice to contractor, and subject to the contractor's rights to subsequently dispute the decision of the project manager, may, without prejudice to any other remedy it may have, make good such deficiencies, and the cost thereof (including compensation for additional professional services) shall be charged against contractor, in which case a change order shall be issued incorporating the necessary revisions in the contract including an appropriate reduction in the contract price. If the payments then or thereafter due contractor are not sufficient to cover such amount, contractor shall pay the difference to city.

713. SUBSTANTIAL COMPLETION

"Substantial completion" means that the work is completed to the point that the city may occupy and fully utilize the facilities and no nuisance is created, to the satisfaction of the city. All equipment shall be installed and operational, or temporary arrangements satisfactory to the city shall be made. All performance testing need not be completed prior to the date of substantial completion. The last date for which liquidated damages may be assessed against the contractor for failure to complete work on time shall be the date of substantial completion of the work or designated portion unless otherwise provided in the certificate of substantial completion. The city may, in its sole discretion, choose to allow a portion of the work to be deemed substantially complete prior to substantial completion of all the work.

When contractor considers the work ready for full occupancy or utilization by the city, contractor shall declare in writing to the project manager that the work is substantially complete. Within a reasonable time thereafter, the project manager and contractor shall make an inspection of the work to determine the status of completion. If the project manager does not consider the work substantially complete, the contractor shall be notified in writing giving reasons therefore. If the project manager considers the work substantially complete, the contractor shall receive a "Certificate of Substantial Completion" (Form 12), which shall establish the date of substantial completion and which shall set forth the responsibilities of the city and contractor for security maintenance, heat, utilities, damage to the work, and insurance.. The certificate of completion shall be signed by both the contractor and the project manager and shall include a tentative list of items to be completed or corrected before final acceptance, *see* Section 715, "Final Inspection."

Portions of the work not essential to the city's operation, which can be completed without interruption to the city's operation, may be completed after the work is accepted as substantially complete.

714. PARTIAL UTILIZATION

The city has the right to take possession or use of any completed or substantially completed portions of the work at any time, but such action will not be deemed an acceptance of any work not completed in accordance with the contract documents.

The city's use of any work so identified in the contract documents will not be grounds for extension of the contract time or change in the contract price. The city's use of any work not specifically identified in the contract documents will be in accordance with conditions agreed to prior to such use, and any extra costs or delays in completion incurred and properly claimed by contractor will be equitably adjusted by change order.

Guarantee periods for accepted or substantially completed work, including mechanical and electrical equipment, will commence upon the start of continuous use by the city. The issuance of a certificate of substantial completion for one portion of the work does not indicate final acceptance of the overall work.

715. FINAL INSPECTION

When the work is complete and ready for final inspection, the contractor shall file a written notice with the project manager to that effect. The project manager and the contractor shall then together make a final inspection of the work to determine whether the work has been completed in accordance with the contract documents. Following the final inspection, the project manager shall send the contractor a final inspection report, which shall notify the contractor of any incomplete, unsatisfactory, or questioned work noted by the project manager. Subject to the right to dispute the project manager's final inspection report, the contractor must satisfy any remaining questions or repair or replace the incomplete or unsatisfactory work promptly as directed by the project manager. If the contractor does not begin to take such action within five (5) days after receipt of notice, or does not pursue such action diligently, the city may, without further notice and without impairing the contract, make other arrangements to have the questions answered and the work completed in a satisfactory manner at the contractor's expense. The contractor shall be liable for any costs so expended by the city, and such costs may be deducted from any payments due or which may become due to the contractor under the contract. If the contractor contests any such deductions from payments owed the contractor, the contractor must file a written appeal pursuant to section 1254 with the city manager within five (5) days after receiving notice of the pending deduction. The contractor shall not become eligible for final payment from the city until the project manager finally accepts the work by certifying in writing that the work has been completed and that the contractor has passed the final inspection. The contractor shall be deemed to have finally completed the work when the contractor has remedied all deficiencies to the reasonable satisfaction of the project manager and delivered all construction records, maintenance and operating instructions, schedules, guarantees, certificates of inspection, and other documents required by the contract and the city issues a favorable final inspection report (Form 14).

716. PERFORMANCE DURING THE GUARANTEE PERIOD

The project manager will notify the contractor in writing of any damage or defects which are discovered during the guarantee period, and, subject to its rights to dispute such notice, the contractor shall begin to repair or replace any such defects within ten (10) days of receipt of such notice without cost to the city and in conformance with the project manager's written instructions. If the contractor does not begin to repair or replace such damage or defects within ten (10) days of receipt of notice, or does not pursue such action diligently, the city may without further notice and without impairing the contract make the repairs or replacements at the expense of the contractor, or the city may request

that the surety repair or replace the defects. If the city manager determines that immediate action is necessary to make repairs or replacements because of emergency conditions or to prevent further loss or damage, the city may proceed without prior notice to the contractor but at the expense of the contractor. In any event, the contractor shall be notified of the situation and of the action taken. If the contractor disputes that it is responsible for the damage or defects, the contractor may appeal to the city manager pursuant to section 125. If the contractor does not deliver a notice of appeal specifying the issues in dispute to the project manager within ten (10) days after the project manager serves notice on the contractor of the defects, the contractor shall be deemed to have waived any right to appeal. In any event, the contractor shall correct the damage or defect as specified in this section, and the question of responsibility for the expense will be determined subsequently by the city manager if an appeal is taken pursuant to section 125.

717. EXTENSION OF THE GUARANTEE PERIOD AND ADDITIONAL BOND REQUIREMENTS

If the city notifies the contractor of any defect in the work, other than a defect resulting from a design error caused by the city or by an A/E hired by the city, or damage or defects caused by abuse, modifications not executed by the contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage, the contractor shall remedy the defect pursuant to section 715. The contractor shall guarantee the replacement work for two (2) years from the date of the city's acceptance of the replacement work. In addition, if the bonds provided for in article 3 expire prior to the expiration of this extended guarantee period, then the contractor shall procure a new bond or bonds to be in effect until the expiration of the extended guarantee period. Such new bonds shall be in an amount equal to the cost of the replacement work which is the subject of the extended guarantee. The new bonds shall meet the requirements set forth in sections 304 through 306 except to the extent that they conflict with this section.

718. GUARANTEE PERIOD INSPECTION

The project manager shall make at least one (l) complete inspection of the work after the work has been accepted, and before the guarantee period expires. This shall be known as the guarantee period inspection. The project manager shall schedule and notify the contractor of this inspection, which shall be made during the last month of the guarantee period. The project manager shall send a written report of the guarantee period inspection to the contractor within ten (10) days after the completion of the inspection. If the report calls for repairs by the contractor, and if the contractor does not begin work to repair or replace the damage and defects within ten (10) days following receipt of this report, or does not pursue such action diligently, the city may, without further notice and without impairing the contract, make the repairs or replacements at the contractor's expense, subject to the contractor's right to dispute the guarantee inspection. If the city manager determines that immediate action is necessary to make repairs or replacements because of emergency conditions or to prevent further loss or damage, the city may proceed without prior notice to the contractor, but at the expense of the contractor. In any event, the contractor shall be notified of the situation and of the action taken. If the contractor disputes that it is responsible for the damage or defects, the contractor may appeal to the city manager pursuant to section 125. In any event, the contractor shall correct the damage or defect as specified in this section, and the question of responsibility for the

expense will be determined subsequently by the manager if an appeal is taken pursuant to section 125. The guarantee period inspection report is set forth as Form 19.

719. RIGHT OF OCCUPANCY

At the end of the time for completing the work specified in the contract documents, subject to reasonable insurance requirements contained in policies required by article 3 of the contract, the city shall have the right to take possession of and to use any completed or partially completed portions of the work. If the city possesses any portion(s) of the work or makes regular use of it before the contractor has completed the work, the city shall take all reasonable steps to avoid interfering with the work to be performed by the contractor. If such use or occupancy by the city exposes damage or defects, such damage or defects shall be replaced or repaired by the contractor immediately. The city's possession or use of the work will not be grounds for an extension of the project time or a change in the contract price, except as stated immediately hereafter. When the city partially occupies a facility, it shall share with the contractor the costs of energy to heat and light the facility and the costs of water and sanitary sewer service. The city's share of these costs will be determined by the project manager on an equitable basis, and the contractor will be reimbursed by a change order. The contractor may appeal the project manager's apportionment to the city manager pursuant to section 125.

720. ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK

If the project manager prefers to accept defective or non-conforming work, the project manager may do so instead of requiring its removal and correction, in which case a change order will be issued to reflect a reduction in the contract price which will be reduced as appropriate and equitable by a change order or otherwise. Such adjustment shall be effected whether or not final payment has been made. The contractor may appeal the project manager's reduction in the contract price to the city manager pursuant to section 125.

721. CONTRACTOR'S CONTINUING DUTY TO WARN OF DESIGN OR PRODUCT DEFECTS

The contractor is under a continuing duty to warn the city manager and the project manager of any possible defect in the design of the work and materials incorporated in the work and against potentially unsafe uses of products incorporated in the work which may cause personal injury or property damage, as soon as the contractor discovers the possible defect or has notice that a product may be unsafe. The contractor's duty under this section shall be continuing, and shall not expire until three years after the date of final payment. If the contractor fails to warn the city of a design or product defect of which the contractor is aware, and if personal or property damage thereafter results from such design or product defect, the contractor shall be liable jointly and severally with any other party responsible at law for all damages resulting from such defect.

ARTICLE VIII. CHANGE IN CONTRACT TERMS

801. RIGHT TO CHANGE WORK

The city may order changes by addition, deletion or modification of the work at any time without invalidating the contract. The city reserves the right to contract with any person or entity other than the contractor for any or all extra work authorized by change orders. In the event that the city contracts with a person or entity other than the contractor for such extra work, the city shall be responsible for coordinating the efforts of the contractor and the other person or entity, in order to avoid, insofar as practicable, any interference with the contractor's work.

802. DIFFERING SITE CONDITIONS

The contractor shall promptly, upon discovery, and before the conditions are disturbed, provide written notice to the project manager of any subsurface or latent physical conditions at the site which differ materially from those indicated in the drawings and specifications issued by the city, or unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as being inherent in work of the character provided for in this contract or that could have not been determined at a site investigation conducted pursuant to section 209.

The project manager shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, then the contract price shall be equitably adjusted by a change order as provided in this article 8 upon claim by either party and made within five (5) days after the conditions first become apparent. If the contractor disputes the change order price, the contractor may appeal pursuant to section 125. The contractor shall have the burden to prove that actual conditions under the surface or in an existing building vary materially from those shown in the contract documents and/or that the differing site conditions could not have been discovered at a site investigation conducted pursuant to section 209.

No request by the contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under the contract.

803. FIELD ORDERS

By field order (Form 10), the project manager or project inspector may make minor changes within the scope of the work as long as such changes are reasonable. The contractor is not entitled to extra compensation for such minor changes which are within the scope of the contract, nor is a change order required. Such changes shall be effected by written field order and shall be binding on the city and the contractor. The contractor shall carry out such written orders promptly.

804. CHANGE ORDERS

A change order is a written order from the project manager, issued after the execution of the contract, authorizing a change in the work and a related adjustment in the contract price or the contract time.

Only the project manager is authorized to sign a change order. The contract price and the contract time may be changed only by a change order. Any change order signed by both the project manager and the superintendent or any other representative of the contractor shall be considered a part of the contract and subject to every term and requirement of the contract documents. A change order which changes the contract price must be signed by both the project manager and the city manager or the manager's delegate in the purchasing division. No change order shall be issued which causes the aggregate amount due the contractor under this contract to exceed the original contract price unless the city provides the contractor with a written assurance that funds sufficient to cover the cost of the change have been lawfully appropriated. In addition, the department head of the affected city department or departments must sign any change order which cumulatively adjusts the original contract price by more than ten percent (10%). The form of change orders is set forth as Form 9. Any change order waiving any general condition shall be approved by the city attorney. It is the contractor's duty to notify the surety which issues the bonds required by sections 305 and 306 of any changes affecting the general scope of the work or change in the contract price and, if requested by the city, to increase the amount of the bonds accordingly.

If the project manager determines that a change order requires the contractor to do work which is a substitute for other work originally called for in the bid proposal, and if the project manager determines that the change order does not require the contractor to use substantially more materials or labor than were originally called for in the bid proposal, then, and to that extent, the project manager shall not allow the contractor extra compensation. The contractor shall have the right to dispute the project manager's determination.

805. CHANGE IN THE CONTRACT TIME

If the contractor believes that a change order will significantly affect the contract schedule of performance, and require the contractor to spend more time on the project than was earlier anticipated, the contractor shall submit a written request to the project manager for a time extension within ten (10) days after service of the change order. Such requests for time extensions shall be evaluated as set forth in section 405, paragraph B.

806. CHANGE IN THE CONTRACT PRICE

If any instruction of the project manager or any condition of the work appears to the contractor to require a change in the work for which the contractor should receive extra compensation, the contractor shall make a written request to the project manager for a change order. Except for claims by the contractor arising from design error which is caused by the city or an A/E hired by the city or an agent or employee thereof, no extra compensation shall be authorized for work performed more than ten (10)days before a written request for a change order is received by the project manager. The change order may reflect the agreement of the contractor and the city to a contract price adjustment for the change. On unit price contracts, the change order shall indicate the unit prices which apply. The cost or credit to the city resulting from a change order shall be determined in one or more of the following ways:

A. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data; or

B. By unit price adjustments as determined in section 902, “Unit Price Contracts”; or

C. By actual costs as determined in section 808, “Cost Adjustments for Extra Work.”

807. ELIMINATED ITEMS

Should any item contained in the bid proposal be found unnecessary for the proper completion of the work, the city will by change order eliminate such item from the contract, and reduce the contract price insofar as is possible, according to the prices set forth in the bid proposal. If any change order shall cause the loss of any work or materials already furnished by the contractor under the terms of the original contract, the contractor shall be reimbursed for the actual cost of such work, and the net cost of salvaging such materials. The city may purchase any such materials at the actual cost to the contractor. However, the contractor shall be awarded transportation, storage, installation, and salvage costs which have been incurred for eliminated items, provided the contractor can provide invoices or receipts or other evidence that such costs were incurred by it.

808. EXTRA WORK

The contractor may be called upon to perform extra work which is not provided for in the bid proposal or other contract documents, but which is essential to the satisfactory completion of the contract. Extra work is work not provided for in the contract documents but which is found desirable to include in the contract because of timing, mobilization, or other factors. Any extra work authorized by the project manager shall be compensated for and performed under the general provisions of Article 8 of the General Conditions or by mutually satisfactory negotiation, whichever the city deems most appropriate. Once an agreement has been reached between the contractor and project manager, the project manager may issue a Work Directive (Form 8) authorizing the contractor to proceed with the extra work. Work Directives shall serve as the basis for negotiating subsequent change orders.

Should any oral or written order or instructions appear to the contractor to involve extra work for which, in its opinion, it should receive extra compensation and/or time extension, the contractor shall, within ten (10)calendar days of receiving the order or instruction, submit a written request for extra compensation to the project manager. This written request should include the costs for which the contractor feels it should be compensated. If a request is not made within this time period, the contractor shall waive any right to compensation and/or time extension for the extra work. No extra work shall be performed by the contractor until approved by the project manager.

In the event the parties cannot agree on compensation for the extra work, compensation will be paid on a time and materials basis as follows:

A. Labor

The contractor shall receive the rate of wage agreed upon in the bid proposal for all labor employed in performing the extra work. If the extra work requires labor for which the rate of wage was not earlier established in the bid proposal, the contractor will receive the rate of wage agreed upon in writing before beginning the extra work. If the city and contractor are unable to agree upon an acceptable rate of wage before beginning the extra work, the

contractor shall perform the work and will be paid at the hourly rates as certified by payroll records, plus 50%. The certified payroll record shall include the employee's hourly rate and all fringe benefits resulting from collective bargaining units (trade unions). The 50% loading factor shall not be applied to the fringe benefits. The 50% loading factor shall include such items as overhead, bonds, insurance, taxes, and profit. Only the employees directly involved in the extra work shall be included. Project superintendents or foremen, who generally direct the extra work but who have overall project responsibilities, shall not be included.

B. Materials

For materials accepted by the city and used in the work, the contractor shall receive the actual cost of such materials, including transportation charges (exclusive of equipment rentals as set forth below). The contractor shall furnish invoices to the city for all materials used and transportation charges. If the materials used in performing the extra work are taken from the contractor's stock, then in lieu of invoices the contractor shall furnish an affidavit, certifying that such materials were taken from its stock, that the quantity claimed was actually used in the work, and that the price and transportation claimed represent the actual cost to the contractor. The contractor shall be paid an additional fifteen percent (15%) of the sum of all materials used to cover overhead and profits, unless otherwise agreed by the parties.

C. Equipment Rental Rates

The contractor shall be paid according to rental rates agreed upon by the parties in writing before the extra work is begun for any machinery or special equipment (other than small tools) necessary for performing the extra work. The rental rates shall include fuel, lubricants, and the costs of transporting the special equipment to the site. Equipment rates shall be charged only for the time the equipment is operating. Standby time shall only be paid when the project manager determines the equipment is needed at the site, but is not operating. Non-listed equipment needed for specific jobs will be paid for at hourly rates for operating time only if agreed to in writing before the work begins.

D. Other Miscellaneous Expenses

The contractor shall be reimbursed for the actual cost of other services or expenditures including, without limitation, as agreed upon by the parties before the extra work is begun, use of materials testing laboratories, employment of design professionals and surveyors, bond premiums, and any other cost directly related to accomplishment of the extra work but not provided for in other categories in this section. Additional allowance shall not be made for overhead, general superintendence, the use of small tools, further profit, or any other cost for which no specific allowance is provided herein.

E. Sales and Use Taxes

The contractor shall charge and pay to the city all sales and use taxes which accrue from the extra work. The contractor shall not receive final payment for the extra work until the contractor pays all applicable sales and use taxes.

809. NOTICE OF INTENT TO CLAIM

If after receiving a decision from the project manager that a change order will not be issued as requested by the contractor, or the contractor does not agree with the project manager's decision on a change in price or time or the contractor disputes any decisions of the project manager and the contractor intends to submit a claim therefor, the contractor shall submit in writing a notice of intent to claim to the city manager.

The written notice of intent to claim shall be clearly titled as such and all notices shall be numbered sequentially. The notice shall contain the following:

A. Date of the event giving rise to the claim.

B. A description of the claim.

C. The reasons why the contractor believes additional compensation or time is due or charges were wrongly assessed.

D. An estimate of any additional costs associated with the claim.

E. The contractor's plan for mitigating costs or delays associated with the claim, if mitigation is feasible.

The notice of intent to claim described above shall be given within ten (10) days after denial of any request for a change in the contract amount or contract time, or within ten (10) days after an informal appeal pursuant to section 125 is denied or deemed to be denied pursuant to that section.

810. SUBMITTAL OF CLAIM

The contractor shall, within twenty (20) days after it submits a notice of intent to claim, submit to the city manager a complete and itemized claim which includes any claimed increase in contract time and contract amount. The contractor may request an extension of time to submit the claim, which extension may be granted by the city manager for good cause shown. The claim must be described in sufficient detail to allow the city manager to evaluate the basis of and costs associated with said claim. A claim for increase in contract amount shall be submitted based on actual costs whenever possible, rather than estimate or opinion, and shall be supported by invoices, time cards, and other business records commonly accepted in the construction industry. The claim shall be accompanied by copies of all contract provisions or other documents relied on and a summary of the factual theories supporting the claim. A claim for time extension must be accompanied by a revised construction schedule reflecting the effects of the delay on the critical path and showing actions which the contractor has taken or proposes to take to minimize the effects of the delay. The claim shall also identify any reasonable measures the city can take to minimize the claim.

The contractor shall furnish upon request all additional information and data which the city reasonably determines would be needed to aid in resolving the claim through negotiation or which is required to complete an evaluation of the claim. The contractor shall give the city manager access to its books, correspondence, records and other materials relating to the work described in the claim,

shall require its subcontractors and suppliers to provide the city with such access, and shall make its personnel and that of its subcontractors and suppliers available to discuss and answer cost, schedule and other questions related to its claim. Clear copies of all necessary supporting records shall be provided to the city at no cost. Failure to submit requested information may be the basis for denial of a claim. However, the city may not deny a claim on the basis of incomplete information if the contractor can convincingly demonstrate that the missing information is in the possession of a Subcontractor or supplier, and, despite the contractor's diligence efforts, the subcontractor has failed or refused to provide the contractor with the information.

The contractor shall submit with its claim a sworn and notarized certificate that:

A. The claim is made in good faith;

B. All supporting data are reasonably accurate and complete to the best of the contractor's knowledge and belief as of the time of submitted by the contractor;

C. The amount requested is not overstated or inflated and fairly and accurately reflects that contract adjustment for which the contractor believes the city is liable, and

D. To the best of the contractor's knowledge and belief, the prices stated for material and equipment are the lowest reasonably available to the contractor and include all available discounts.

If the contractor is an individual, the certification shall be executed by that individual. If the contractor is not an individual, the certification shall be executed by (i) a senior company official in charge of the work performed under this contract; or (ii) an officer or general partner of the contractor.

The city manager or his designee shall in good faith investigate, review and evaluate the claim and make a determination. Such determination shall normally be made in writing within thirty (30) days of receipt of a completed and fully-documented claim; however, if special circumstances exist or the claim is unusually complex, the contractor will be notified of a longer period not to exceed sixty (60) days.

The contractor shall proceed diligently with performance of this contract, pending final resolutions of any claim made under this section 810, and shall comply with any reasonable decision of the city pending final resolution of the claim. Failure to proceed with the work shall be grounds for suspension or termination of the contractor.

If the contractor agrees with any determination or resolution by the city requiring a change in contract time or amount, it shall be processed as a change order.

Failure to meet any of the requirements of this section in a timely and complete manner shall constitute a waiver by the contractor of any right to adjustments of contract time or amount either by administrative review or by any other action at law or equity.

ARTICLE IX. PAYMENT PROVISIONS

901. CONSIDERATION (CITY'S PROMISE TO PAY)

The city's promise to pay for the work is limited by the city's charter, code, and other ordinances. Furthermore, this contract is only valid to the extent that funds are appropriated and made available therefor, and is void as to any obligations not covered by available appropriations. The city shall pay the contractor only for the contract price as set forth in the original contract, and for additional price adjustments authorized by change orders. The city shall take all necessary action to ensure that sufficient funds are appropriated for all work performed by the construction manager.

902. UNIT PRICES AND ALTERED QUANTITIES

If payments for portions of the work are based on specially identified units of construction rather than on a lump sum price, the contract is referred to as a unit price contract. The number of units of any specific designation set forth in the proposal is an approximation and may not correspond to the number of units actually completed. When the accepted quantities of work vary from the quantities in the contract, the contractor shall be paid, so far as contract items are concerned, at the contract unit prices for the accepted quantities of work done. The contractor shall also set forth unit prices in all subcontracts to which they apply.

Should the final pay quantity of any major contract item increase or decrease by more than twenty percent (20%) from the quantity in the contract, the contract unit price will be adjusted to balance fixed and job indirect costs as by the parties to the contract. A major contract item is any item having an original contract value in excess of ten percent (10%) of the original contract amount. The new unit prices negotiated will be distributed over, and will apply to, the total final pay quantity for the item, and not solely the excessive overrun or excessive under run quantities.

903. PROGRESS PAYMENTS FOR COMPLETED WORK

Before the first application for payment, for a lump sum or cost plus contract, the contractor shall submit to the project manager a schedule of values allocated to the various portions of the work, subject to the project manager's reasonable approval. For portions of the work based on unit prices, the unit prices shall serve as the schedule of values. This schedule shall be used only as a basis for the contractor's application for payment. The contractor shall submit a signed written statement of the total value of the work completed, together with such data or schedules as may be required, at the end of each month to the project manager as an application for payment. The application shall be accompanied by a copy of the contractor's current construction progress schedule with those shop drawing schedules, procurement schedules and other data specified for periodic submission in the special conditions or reasonably required by the project manager. The project manager shall, within five (5) days, either recommend payment or return the application to the contractor indicating in writing the reasons for refusing to recommend payment. In the latter case, the contractor may make the necessary corrections and resubmit the application. The city shall, within thirty (30) days of presentation to it of an acceptable application for payment, pay the contractor the amount recommended by the project manager. The contractor shall receive progress payments for work authorized by change orders as the contractor completes such work. Ninety-five percent (95%) of

the calculated value of completed work shall be paid. Pursuant to Section 2-8-9(e), B.R.C. 1981, the city may include other retainage provisions in contracts not covered by state law. All of the funds which have been retained pursuant to this section shall be retained until the work is completed and finally accepted by the city. The contractor warrants that it shall pay each subcontractor promptly upon receipt of payment from the city the amount to which the subcontractor is entitled. Notwithstanding anything to the contrary, the contractor shall not be required to pay a subcontractor or supplier that has not performed in accordance with its subcontract or purchase order. The contractor shall, by appropriate agreement with each subcontractor, require each subcontractor to make payments to the subcontractor's sub-subcontractors in similar manner. The city may furnish to each subcontractor information regarding the percentages of completion or the amounts applied for by the contractor.

904. PROGRESS PAYMENTS FOR MATERIALS

The paid invoice price of materials and equipment delivered to the construction site but not yet incorporated in the work may be included as a part of progress payments. Any payment for materials is conditioned upon the contractor's furnishing to the city adequate information to establish the city's title to such materials or otherwise protect the city's interest, including without limitation applicable insurance and transportation to the site for those materials. By submission of a request for a progress payment, the contractor warrants that title to all materials and equipment covered by application for payment will pass to the city either by incorporation in the construction or upon receipt of payment by the contractor, free and clear of all liens, claims, security interest, and encumbrances. The contractor further warrants that no such materials or equipment will be subject to an interest or encumbrance of the seller of such materials or equipment. Payment by the city for such materials and equipment shall not relieve the contractor of responsibility for the care of such materials and equipment, and the city does not assume ownership of the materials or equipment until they are incorporated into the completed work and the certificate of substantial completion is signed by the city and the contractor.

905. PROGRESS PAYMENTS TO SUPPLIERS AND SUBCONTRACTORS

The contractor shall make partial payments of the amount due to each of the contractor's suppliers and subcontractors in the same manner as the city is required to pay the contractor under section 903, provided that the suppliers and subcontractors are performing to the contractor's satisfaction. If the city is notified that the contractor is in arrears in payments to the contractor's suppliers or subcontractors, the project manager shall notify the contractor and determine why such funds are being withheld. If the project manager determines that no legitimate basis exists for the contractor's withholding of such payments, the city may, five (5) days after the mailing of written notice to the contractor, make such payments directly to the contractor's suppliers or subcontractors from funds which otherwise would be due to the contractor, unless the contractor objects to such payments within said five (5) day period, and provides reasonable documentation to support its position.

906. DISPUTE RETAINAGES

In addition to the retainages set forth in section 903, the city may retain up to one hundred percent (100%) of any disputed line item or portion thereof included in progress payments for any unsatisfactory performance of the work, including without limitation:

A. Failure to repair or replace defective work.

B. Claims filed against the contractor, or reasonable evidence indicating that claims may be filed against the contractor.

C. Failure of the contractor to make adequate payments to subcontractors or suppliers for labor or materials.

D. Failure to obtain necessary permits or licenses, or to comply with applicable laws, ordinances, codes, rules or regulations, unless such noncompliance is due to reasons beyond the control of the contractor, or due to acts of the city or an A/E hired by the city, or agents or employees thereof.

E. Failure to satisfy affirmative action and equal employment opportunity requirements.

F. Failure to maintain an adequate rate of progress.

G. Failure to maintain the contractor's portion of the work in a clean and orderly manner.

H. Failure to repair or replace city or private property damaged during the progress of the work.

I. A reasonable doubt that the contract will be completed for the balance of the contract price then unpaid.

J. As a set off for amounts due to the city, whether liquidated or unliquidated, including, without limitation, liquidated damages as provided by the contract.

K. Collusion with other bidders in preparing the bid.

If the reasons for such retainage no longer exist, the city shall make payment to the contractor of the sums withheld pursuant to this section, subject to the amounts required to be retained pursuant to section 903.

907. PAYMENT OF CITY SALES AND USE TAXES

There are two options for payment of city sales and use taxes: A. Estimated Percentage Basis; or B. Monthly payments for holders of a city sales tax license.

If the contractor selects the second method to pay sales and use tax, the contractor and all the subcontractors, after the bid is awarded, must obtain a Boulder Sales and Use Tax License from the city Sales and Use Tax Division, pursuant to Section 3-2-11, B.R.C. 1981.

A. Estimated Percentage Basis

For any contract in which the contract price is $50,000 or more, the contractor shall pay city construction use tax based upon the following percentages:

Type of contract	percentage of contract amount to which tax is applied
Building construction, landscape installation, Playground installation and construction	50 percent
Construction in the city's right-of-way, Sewer or water line installation or rehabilitation	30 percent

For such contracts the contractor shall pay the construction use tax to the city based on the contract price at the time it applies for a building or right-of-way permit. Payment of the sales and use tax at this time will give the contractor proof that tax has been paid and therefore, prevent duplicate payment of taxes to suppliers.

At the time that the contractor applies for final payment it must submit Form 15, attached to the general conditions, to the Lead Sales Tax Auditor ("auditor") for the city. The auditor will determine the total amount paid by the city for the work under the contract, which includes all work performed pursuant to a change order, and compute the total use tax due based on the above percentages. After the total tax payment is received by the city's Sales and Use Tax Division, it will approve Form 15. At this point the contractor may request an audit by the city in accordance with section 909 rather than paying using the percentage method. Depending upon the determination of the city's auditor, the contractor will either be refunded use tax by the city or pay the city additional use tax.

For any contract in which the contract price is under $50,000, the contractor may pay all estimated sales and use taxes due on the work based upon the contract price at the time that the contract is executed. The tax due under this procedure will the rate in effect during the term of this contract multiplied by fifty percent (50%) of the contract price for building construction, landscape installation, playground installation and construction and (30%) for construction in the city's right-of-way, sewer or water line installation or rehabilitation.

B. Actual Basis on Monthly Return

If the contractor elects to obtain a Boulder Sales and Use Tax License from the city Sales and Use Tax Division, pursuant to Section 3-2-11, B.R.C. 1981,the contractor will pay the actual

use tax due by the 20th day of each month for each purchase of tangible personal property and payment of taxable services made during the previous calendar month. The contractor shall be granted a credit for Boulder sales taxes paid to a vendor, if any, upon purchase of tangible personal property or taxable services when filing this monthly return, but not for taxes paid to other municipalities. The contractor shall retain a copy of each monthly report as evidence that sales and use taxes have been paid. Under this method, the contractor shall cause each of its subcontractors and suppliers to obtain a Boulder Sales and Use Tax license and to pay the actual sales and use tax which it owes by the 20th day of each month. The contractor shall be liable for the payment of all sales and use taxes which any of its subcontractors or suppliers fails to remit to the city. The permit pulled for this form of payment will not show that Boulder use tax has been paid therefore, by using this form of payment the contractor and its sub-contractors will not have the protection from duplicate taxation. The city will audit the project at completion and will not give credit to taxes paid to other municipalities.

If additional information is required, please *see* Section 3-2-14, B.R.C. 1981 or contact the city's Sales and Use Tax Division at 303-441-3921.

908. PAYMENT OF CITY SALES AND USE TAXES FOR CHANGE ORDERS

The contractor is responsible for payment of all city sales and use taxes paid on additional work authorized by any change order.

909. SALES AND USE TAX AUDITS

In the event a contractor requests a tax audit, the city's auditor will request the following from the contractor and the contractor shall provide this information:

A. List of all subcontractors and the related information from the contractor.

1. Type of work performed

2. Contract amount

3. Name, address, phone and contact person for the contractor

B. A copy of the general contractor's job cost reports and related invoices, as well as additional information which may be requested.

C. The auditor will contact all of the subcontractors by letter requesting job cost information. Also, as a part of the letter to subcontractors, the auditor will request the amount of materials billed to the contractor.

D. Subcontractors will complete the contractor's letter and return it to the auditor. Rental of equipment is taxable as a cost of the construction project.

If additional information is required, please contact the city's Sales and Use Tax Division at 303-441-3921.

910. REQUIREMENTS FOR FINAL PAYMENT

The contractor shall not receive the final payment due under the contract until the following conditions have been satisfied and the correct forms or certifications have been submitted to the project manager:

A. The contractor passes final inspection, and the project manager formally accepts the work in writing. Form 14.

B. The city Sales and Use Tax Form is completed, submitted and signed by the Lead Sales Tax Auditor for the city; Form 15. If additional information is required, please contact the city's Sales and Use Tax Division at 303-441-4017.

C. Either (1) the contractor files claim releases signed by all suppliers and subcontractors with the project manager certifying that all outstanding claims for payment have been paid (Form 16); or (2) the contractor files conditional claim releases signed by all suppliers and subcontractors from which it has not obtained unconditional claims release and agrees to give the city within ten (10) days after final payment unconditional claims releases from each such subcontractor or supplier or copies of canceled checks showing that each of these subcontractors and suppliers has been completely paid.

D. The surety on the labor and material bond signs the surety release (Form 18).

E. The contractor obtains written certification from the surety that final settlement may be made with the contractor and that the performance bond shall be in effect throughout the guarantee period.

F. The contractor has given the project manager the copy of the contract documents and the as-built drawings which reflect all changes in the work.

911. FINAL PAYMENT PROCEDURE

Prior to receiving final payment the contractor shall make application for final payment following the procedure for progress payments set forth in section 903. The application for final payment shall contain a final estimate of the total value of all work done under the contract. This shall include all extra work performed pursuant to change orders. All prior estimates and payments shall be subject to correction in the final estimate and payment. However, in the absence of error, manifest mistake, or fraud, all estimates, when approved by the project manager, shall be conclusive evidence of the work done and materials furnished. Prior to final payment the project manager will inspect the work and review the application for final payment to determine whether the contractor has fulfilled its obligations under the contract. The project manager will, within five (5) days of receipt of the application for final payment, give written notice to the contractor that the work is acceptable or return the application for final payment indicating in writing the reasons for refusing final payment in which case the contractor shall make the necessary corrections. After making the necessary corrections the contractor shall resubmit its application for final payment which shall be reviewed as outlined above. Final payment shall not be made to the contractor until the city advertises a notice of

final settlement at least twice in a newspaper of general circulation in Boulder County at least ten (10) days prior to the date of final settlement, pursuant to Section 38-26-107, C.R.S. If no claims are filed before final settlement and if the sureties consent pursuant to Form 18, the city shall pay the advertised amount to the contractor, after deducting all payments previously made to the contractor under the contract and all other charges properly chargeable to the contractor under the terms of the contract.

912. PROCEDURE FOR WITHHOLDING ALL OR PART OF FINAL PAYMENT

The city is required to comply with Section 38-26-101 *et seq*., C.R.S. This statute generally allows a supplier or a subcontractor to file a verified statement of claim, upon which the city is required to withhold funds from the contractor as set forth in the statute. Further, the statute allows unpaid subcontractors and suppliers who have filed verified statements of claim to file a notice of lis pendens with the city, in which event the city must continue to withhold amounts from the contractor longer than ninety (90) days after the date of final settlement.

913. WAIVER OF CLAIMS UPON FINAL PAYMENT

The acceptance of final payment shall constitute a waiver of all claims by the contractor except those previously made in writing and identified by the contractor as unsettled at the time of the final application for payment. The making of final payment shall constitute a waiver of all claims by the city excepting those arising from:

A. Unsettled liens;

B. Faulty or defective work appearing after substantial completion;

C. Failure of the work to comply with the requirements of the contract documents;

D. Terms of any special warranties required by the contract documents; or

E. Claims for contribution or indemnification as provided by the contract documents.

ARTICLE X. SUSPENSION AND TERMINATION

1001. SUSPENSION OF WORK BECAUSE OF CONTRACTOR DEFAULT

The project manager may suspend the work or any part of the work without invalidating the contract because the contractor has materially breached any of the contract conditions. A suspension shall not absolve the contractor or the contractor's sureties of any duties or responsibilities except for the performance of the work which has been suspended during the suspension period. If the contractor later resumes work which the city previously suspended because the contractor has materially breached any of the contract conditions, the city shall not be liable to the contractor for additional costs caused by the suspension or for extra start-up costs which result from resuming the suspended work. If the contract is not performed within the time limit set forth due to suspension for the contractor's default, the city shall be entitled to liquidated damages for such delay as set forth in section 406.

1002. SUSPENSION BECAUSE OF ORDER OF STATE OR FEDERAL COURT

In the event a state or federal court order requires suspension of work, the order of suspension shall identify the court order which caused the suspension and shall extend the time limit of the contract by the amount of time specified by the court order. If the court order causes suspension for an indefinite period of time and as a result a time extension cannot be established, the order of suspension will also be for an indefinite period of time. In the event that the contract is suspended for an indefinite period of time, the city may elect to terminate the contract. Should this occur, the contractor shall be paid for all work performed to the date of suspension, and for all other costs which the contractor actually incurs as a result of the suspension. The contractor and the city shall decide which work shall be required to protect completed work and to restore utility service to the area under construction. Payment for such work shall be according to the unit prices listed or, if not specifically covered under the contract, at a price to be determined by the project manager, construction manager, and contractor, in the event that the city elects to terminate the contract because of a suspension due to a court order, arising from the methods or activities of the contractor or its subcontractors in constructing the project, the contractor hereby waives all claims for damages because of such inability to complete the project as planned, including, without limitation, damages for loss of anticipated profits.

1003. SUSPENSION OF THE WORK FOR THE CITY'S CONVENIENCE

The city may at any time and without cause suspend the work or any portion thereof by written change order which shall fix the date upon which work on the project shall be recommenced and state that the suspension is expressly for the city's convenience. If the suspension applies to only a part of the work, a time extension will be authorized based on the project manager's estimate of the delay to the entire project caused by the partial suspension. Liquidated damages will not be assessed by the city during the extended period caused by suspension for the city's convenience under this section. In all cases of suspension for the city's convenience, a price adjustment will be made by the project manager by change order to reflect the reasonable, demonstrable cost to the contractor of the suspension. The contractor shall consult with the project manager about the cost of suspension, if the project manager so requests. Equipment rates shall be charged only for the time the equipment is operating. Standby time shall only be paid when the project manager determines the equipment is needed at the site, but is not operating. Upon receiving such an order of suspension, the contractor shall immediately protect and maintain the work in a condition which will permit its resumption for the least possible start-up cost. If the city wrongfully suspends the contract, this shall be treated as a suspension of the work for the city's convenience. If a portion of the work is suspended for more than three (3) months by the city, the contractor may then terminate that part of the contract. Contractor shall have the right to dispute any decisions made by the project manager.

1004. CITY MAY TERMINATE THE CONTRACT FOR CAUSE

Without prejudice to any other right or remedy, the city may terminate the contract or reassign all or any portion of the work pursuant to section 1006 for any of the following reasons:

A. The contractor assigns work to be performed under the contract without the written permission of the project manager.

B. A petition for bankruptcy is filed relating to the affairs of the contractor. As used in this section 1004, "contractor" shall be deemed to include the contractor, or any of its officers, employees or major shareholders possessing at least ten percent (10%) of the contractor's equity.

C. A general assignment of the contractor's assets is made for the benefit of the contractor's creditors or any of the funds due to the contractor under this contract are assigned for the benefit of the contractor's creditors.

D. A trustee or receiver is appointed for the contractor or any of the contractor's property.

E. The work is being unjustifiably delayed by the contractor, including allowance for any time extensions.

F. The city learns that the contractor has been guilty of collusion with other bidders in preparing the bid.

G. A surety which has bonded the contractor for the work becomes insolvent, bankrupt, or loses its right to do business in the State of Colorado, and the contractor does not provide a substitute bond within the time set forth in section 304.

H. The contractor refuses or fails to supply enough properly skilled workers or proper materials, unless it can convincingly demonstrate to the city that such workers or materials cannot be obtained by exercising reasonable diligence.

I. The contractor fails to make proper payment to subcontractor or suppliers.

J. The contractor breaches any of the conditions of the contract or executes the contract in bad faith or otherwise not in accordance with the terms of the contract.

K. The contractor disregards any law, ordinance, regulation, role, or order of any public body having jurisdiction.

If the city lawfully terminates the contract and reassigns all or any portion of the work, the city may take possession of the work and of all materials thereon owned by the contractor and finish the work by whatever method it may deem expedient. In the event of such a default the city shall give the contractor ten (10) days written notice and the opportunity to cure such default. In the event of termination, the contractor shall not be entitled to receive any further payment until the work is completed and accepted. The contractor and the contractor's surety shall reimburse the city for all expenses sustained by the city in completing the contract, including, without limitation, administrative expense and other expenses incurred even if they exceed the contract price, but not including extra which is authorized after the termination. Where the contractor's services have been so terminated or reassigned by the city, said termination shall not affect any rights of the city against contractor then existing or which may thereafter accrue. Any retention or payment of moneys by the city due the contractor shall not release the contractor from liability.

1005. CONTRACTOR SHALL NOTIFY CITY OF CERTAIN EVENTS

The contractor shall notify the project manager of the following events:

A. Any of the events described in subsections A, B, C or D of section 1004.

B. Any change in the contractor's legal relationship with the surety which may affect the contract.

C. Bankruptcy or insolvency of the surety, or any other event which prevents the surety from doing business in the State of Colorado.

D. Assignment of any of the funds due to the contractor under the contract.

E. Any adverse occurrence which may materially affect the contractor's ability to perform this contract.

F. Proceedings which could lead to the revocation of any of the licenses which are necessary for the contractor to perform work under the contract.

G. Grant of a security interest by the contractor in any of the materials or equipment to be incorporated into the work to any third party.

H. Violation by any subcontractor or supplier of any of the terms of the contract, or occurrence of any event listed in subsections A through G above with respect to a subcontractor or supplier.

1006. CITY MAY REASSIGN THE WORK

If the contractor remains in breach of any of the conditions of the contract after all applicable cure periods have expired, the city may reassign any part of the contract to another party in lieu of terminating the contract. Such reassignment shall not lessen any of the contractor's responsibilities to perform the work on any part of the contract which was not reassigned. The contract price shall be decreased in proportion to the amount of the work which was reassigned. In the event that the city reassigns work, the city may deduct from payments due to the contractor and may claim against the contractor for costs incurred by the city, including without limitation reasonable attorney fees in effecting the reassignment.

1007. CONTRACT TERMINATION FOR REASONS BEYOND THE CONTROL OF THE CONTRACTOR OR THE CITY

In the event that the work cannot be completed within the time set forth in the contract because of conditions or circumstances beyond the control of either the city or the contractor, such as, without limitation, an executive order of the president of the United States with respect to the prosecution of war or in the interest of national defense or an order of any state or federal court prohibiting the construction of the project, the city, acting by and through its city manager and project manager, may terminate the contract or any portion thereof by giving at least seven (7) days written notice to the

contractor. When the contract is terminated under this section before completion of the work in the contract, payment will be made for the actual items of work completed at the contract price. For items which are only partially completed, the city shall pay for the portion of the item actually completed. The contractor also shall be awarded compensation for costs associated with materials which must be returned, rental contracts which the contractor has entered into but may not terminate, and other reasonable costs which the contractor legitimately incurs as a result of the termination. If the contractor disputes the project manager's valuation of work completed, the contractor may appeal pursuant to section 125. Acceptable materials, obtained or ordered by the contractor for the project but not yet incorporated in the work at the time of such termination, may at the option of the city be purchased from the contractor at actual cost as shown by receipted bills and actual cost records at the point of delivery. The intent of this section is to provide a method of equitable settlement with the contractor in the event of termination of the contract because of conditions or circumstances beyond the control of either the city or the contractor. It is also intended by this section that a settlement for the work performed shall not relieve the contractor or its surety from responsibility for defective work and/or materials on the completed portion of the work nor for payment for labor and materials as guaranteed by the surety bond or bonds.

1008. TERMINATION OF CONTRACT FOR CONVENIENCE

The performance of work under this contract may be terminated by the city in whole or in part whenever for any reason, in its sole discretion, the city shall determine that such termination is in the best interest of the city or whenever the city is prohibited from completing the work because of conditions beyond the control of either the city or the contractor. Such termination shall be effected by giving not less than three (3) days written notice to the contractor specifying the extent to which performance of work under this contract is terminated and the date upon which such termination becomes effective.

Upon receipt of notice of such termination, the contractor shall:

A. Stop work as specified in the notice;

B. To the fullest extent possible, terminate all orders and subcontracts except as necessary to complete work which is not terminated;

C. If directed by the city, assign all right, title and interest in subcontracts and materials in progress, as long as the contractor is released from all prospective liability to subcontractors and suppliers, in which case the city will have the right, in its discretion, to settle or pay any and all claims arising out of the termination of such subcontracts;

D. Negotiate or otherwise settle outstanding liabilities and claims with the approval of the city or its designated representative and, upon receipt of all payments due from the city for termination for convenience, pay the amounts that were agreed upon in the settlements;

E. Complete performance of such part of the work as has not been terminated; and

F. Take such other actions as may be necessary, or as may be directed by the city, for the protection and preservation of the property related to the contract.

Except as provided above, any inventory resulting from the termination of this contract may, with written approval of the city, be sold or acquired by the contractor under the conditions prescribed by and at prices approved by the city. Upon receipt of the notice of such termination, the contractor shall submit to the city a request for payment of its termination costs, in the form and with any reasonable certification prescribed by the city. Such request shall be submitted promptly but in no event later than six (6) months from the effective date of termination, unless extended in writing by the city upon the written request of the contractor within such six (6) month period. If the city determines that the facts justify it, a request may be received and acted upon after six (6) months.

The contractor shall be entitled to receive reimbursement for the reasonable cost of the work as of the date of termination, including a release of retainage. The city will additionally reimburse the contractor for other reasonable costs resulting from said termination such as restocking charges and protection of the work. The contractor shall not be entitled to loss of other anticipated profits, profits lost on other work not obtained or any other consequential damages, or any reimbursement for any costs incurred due to the contractor's fault or failure to mitigate as a result of any such termination for convenience, and in no event shall the total sums paid the contractor exceed the contract price.

In arriving at the amount due the contractor under this section, there shall be deducted:

A. All unliquidated advance or other payments theretofore made to the contractor, applicable to the terminated portion of this contract;

B. Any claim which the city may have against the contractor in connection with this contract;

C. The agreed price for, or the proceeds of sale of, any materials, supplies or other things acquired or sold by the contractor or sold pursuant to the provisions of this article not otherwise recovered by or credited to the city; and

D. Any outstanding subcontractor claims.

The city may, from time to time, under such terms and conditions as it may prescribe, authorize partial payments and payments against costs incurred by the contractor for the terminated portion of the contract, if it is estimated that the total of such payments will not exceed the amount to which the contractor will be entitled. If the total of such payments is in excess, the excess shall be payable by the contractor to the city upon demand.

A settlement for the work performed shall not relieve the contractor or its surety from responsibility for defective work and/or materials on the completed portion of the work or for the payment of labor and materials as guaranteed by the payment and performance bonds.

Upon reasonable notice to the contractor the city shall be given full access to all books, correspondence, records and other materials of the contractor relating to this contract in order to

determine the amounts to be paid on account of the termination of the contract. The contractor shall, as requested by the city furnish clear copies of any such materials.

1009. CITY SHALL HAVE ACCESS TO CONTRACTOR'S RECORDS

Upon reasonable notice to the contractor the project manager shall be given full access to all books, correspondence, and papers of the contractor which are necessary to determine the amounts to be paid on account of the termination of the contract, or for any other application for payment made by the contractor, or to determine the amounts paid by the contractor to subcontractors or suppliers or their agents, employees, or assigns.

1010. ACCOUNTING OF COSTS AND AUDIT

Contractor shall keep and maintain and shall contractually require its subcontractors and outside consultants to keep and maintain books, records, accounts and other documents (hereinafter collectively referred to as "records") that are sufficient to accurately and completely reflect all costs incurred pursuant to this contract, including costs which may be the basis of a contractor's request for a change in the contract or a claim by the contractor. Such records shall include the bid estimate and all bid work papers and take-offs, receipts, memoranda, vouchers, and accounts of every kind and nature pertaining to the performance of the work, including, but not limited to, job cost ledgers, invoices from and payments to subcontractors and material suppliers, records of home and field office overhead, as well as complete summaries and reports setting forth all reimbursable personnel-hours expended and payroll and equipment records. All such records shall be kept for three (3) years from the date of final completion.

The city and any firm of auditors retained by the city shall have access, upon reasonable advance notice in writing, to all such records maintained by contractor and its subcontractors and consultants, for the purpose of auditing and verifying contractor's costs or any other costs claimed to be due and payable hereunder.

The contractor shall include in all subcontracts, consulting agreements and any other agreements entered into by contractor for the performance of the work a provision to the effect that its subcontractors, consultants or other parties shall observe and comply with all the obligations of contractor under this provision in the same manner and to the same extent as the contractor.

1011. CONTRACTOR MAY TERMINATE THE CONTRACT

The contractor may terminate the contract for any of the following reasons:

A. The work is suspended for more than three (3) months by the city for its own convenience under section 1003 or by an order of a court or other public authority, provided the suspension does not result from an act or omission of the contractor.

B. The project manager fails to act on a properly completed and substantiated application for payment within twenty (20) days after it is submitted by the contractor.

C. The city fails to issue a check or warrant to the contractor within thirty (30) days after payment is approved by the project manager.

If any of these conditions exist, the contractor shall, ten (10) days after service of written notice on the project manager, terminate the contract. The city shall have the right to remedy and/or cure the problem prior to expiration of the 10 day period. In such event, the contractor shall be entitled to payment for all work executed based on the proportion of the work completed. When the contract is terminated before completion of all items of work in the contract, payment will be made for the actual items of work completed at the contract price. For items which are only partially completed the city shall pay for the portion of the item actually completed. The contractor may appeal such determination pursuant to section 125.

1012. CONTRACTOR MAY SUSPEND WORK

In lieu of terminating the contract under section 1011, if the city fails to issue a check or warrant for payment more than thirty (30) days after approval by the project manager, the contractor may, seven (7) days after service of notice on the project manager, suspend the work until payment is received. If the contractor makes such election and later resumes the suspended work, the city shall be liable to the contractor for extra start-up costs which result from resuming the suspended work.

1013. NO ARBITRATION

Except as may otherwise be provided in the special conditions or by law, or agreed to by the city, no claims, disputes, or other disagreements arising out of the contract or work performed under the contract shall be decided by arbitration. If at any time during the performance of the work the city and contractor agree to submit a dispute to arbitration, then the dispute shall be decided in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect. Unless otherwise agreed in writing, the contractor shall carry on the work and maintain its progress during the arbitration proceedings, and the city shall continue to make payments to the contractor in accordance with the contract documents.

1014. MEDIATION

If disputes remain unresolved after negotiations between the city and the contractor, the parties shall submit the disputes to nonbinding mediation. The mediator shall be a trained mediator with experience on municipal construction projects. The parties shall attempt to jointly select the mediator from a list of proposed mediators generated by the parties. The parties may seek the assistance of the American Arbitration Association in generating a list of potential mediators. In the event that the parties are unable to agree on a mediator, the Chief Judge of Boulder District Court should appoint one. Each party shall bear its own costs associated with presenting any disputes to the mediator, which costs shall not be recoverable as part of a change order or in any subsequent litigation or arbitration.

No decisions or statements of the mediator may be admitted as evidence in any subsequent litigation or arbitration between the parties nor may the mediator be called to testify in any litigation or arbitration between the parties concerning such disputes.

The submittal of disputes to non-binding mediation shall be a condition precedent to commencing litigation or arbitration by either party.

In the event any dispute, mediation, arbitration, or litigation arises under this contract and during the time such dispute, mediation, arbitration, or litigation is pending, the contractor shall continue performance under this contract in accordance with the terms and conditions hereof. The failure of the contractor to continue expeditious performance due to a dispute arising under this contract shall, at the option of the city, be construed as a material breach of this contract justifying termination or such other action as the city deems appropriate.

APPENDIX 1: DEFINITIONS

1. Abnormal Weather. Snowfall, rainfall, freezing temperatures, or excessive wind conditions, which cause a delay in the contractor's performance. *See* section 405(C).

2. Addenda. Written or graphic instruments issued prior to the execution of the contract agreement which modify or interpret the contract documents by additions, deletions, clarifications, or corrections.

3. Architect or Engineer (A/E). As used herein, AA/E@ refers to an architect or engineer hired by the city to design or supervise the work. The duties of the A/E are set forth further in section 113. The contractor may only rely on instructions or communications issued by the project manager and may not rely on instructions or communications of the A/E, unless they are ratified in writing by the project manager.

4. Bid Bond. The security furnished by the bidder as a guarantee of good faith to enter into a contract with the owner if the work is awarded to him. The bid bond is set forth as Form 1.

5. Bidder. Any individual, firm, or corporation submitting a proposal for the advertised work.

6. Bidding Instructions The instructions set forth in article 2 herein.

7. Bid Proposal. The form supplied by the city for the submission of bids. The bid proposal, special conditions, contract agreement, and drawings and specifications are bound in one volume, pursuant to section 212.

8. Boulder Revised Code (B.R.C.). The Boulder Revised Code, which is referred to herein as "B.R.C. 1981," is the code of ordinances adopted by the City of Boulder. This code may be reviewed at the Boulder Public Library, which is located at 1000 Canyon Boulevard, Boulder, Colorado and is also available on line at www.bouldercolorado.gov.

9. Calendar Day. Any day of the week, including Saturdays, Sundays, and city-observed holidays.

10. Calendar Week. A week which begins on Monday and ends on Sunday.

11. Change Order. A written order, set forth as Form 9, issued by the project manager to the contractor, covering changes in the plans or quantities within the scope of the contract and establishing the basis of payment and time adjustments for the work affected by the changes. The contract price and the contract time for performance may only be amended by a change order signed by the project manager.

12. City. This term shall mean the City of Boulder, Colorado, a municipal corporation organized under and by virtue of Article XX of the Constitution of the State of Colorado.

13. City Attorney. The city attorney of the City of Boulder, Colorado, who must sign the contract agreement for it to be effective, and alone has authority to authorize changes to the

general conditions of the contract. The city attorney may be contracted at Office of the City Attorney, P.O. Box 791, Boulder, Colorado 80306; telephone, 303-441-3020.

14. City Manager. The city manager of the city of Boulder, Colorado, who alone has the authority to solicit bids for a contract and must sign the contract agreement for it to be effective. The contractor may appeal decisions by the project manager to the city manager pursuant to section 125, as set forth in the general conditions. The city manager may be contacted at the Office of the City Manager, P.O. Box 791, Boulder, Colorado 80306; telephone 303-441-3090.

15. Colorado Revised Statutes (C.R.S.). The Colorado Revised Statutes, which are referred to herein as AC.R.S.,@ are the statutes adopted by the State of Colorado. If necessary, the contractor may review these statutes at the Office of the City Attorney, P.O. Box 791, Boulder, Colorado 80306; telephone, 303-441-3020.

16. Construction Bonds. The approved form of security, executed by the contractor and the contractor's surety(s), which guarantee complete execution of the contract and all supplementary agreements pertaining thereto, and the payment of all legal obligations pertaining to the performance of the work.

17. Contract. The entire agreement between the contractor and city. The term is used generally, and does not refer to any particular document.

18. Contract Agreement. The written agreement between the city and the contractor who has been awarded the bid. The contract agreement set forth in Form 5.

19. Contract Completion Date. The contract completion date shall be the day that the contractor passes final inspection, as set forth on Form 14. *See* section 715.

20. Contract Documents. All written documents which define the construction work and the obligations of the city and contractor in performing the work. The contract documents consist of the materials set forth in section 103.

21. Contract Performance Period. The contract performance period runs from the date the notice to proceed is issued until the certificate of substantial completion (Form 12) is issued by the project manager.

22. Contract Price. The amount which the contract agreement states the city shall pay the contractor for its work under this contract, as that amount may be adjusted by change orders.

23. Contractor. The individual, firm, or corporation with whom the city contracts for the performance of the work. This term also means the construction manager.

24. Day. As used herein, the term "day" shall apply to a day between Monday and Friday, excluding Saturdays, Sundays, or city-observed holidays.

25. Default. A breach of the contract term(s) and conditions.

26. Drawings and Specifications. All documents approved by the city for the purpose of describing the work under the contract. *See* sections 107, 120, and 206 for further information.

27. Extra Work. Work not provided for in the contract documents but found desirable to include in the contract because of timing, mobilization, or other factors. *See* section 808.

28. Field Orders. A writing issued by the project manager to explain or clarify any of the drawings and specifications or other contract documents. The contract price or period for performance can not be amended by a field order. *See* section 709 and Form 10.

29. Final Settlement. The date of final settlement shall be the day upon which the project manager authorizes final payment to the contractor. The date of final settlement may be the same date as the contract completion date (*see* definition (19) herein), but may not occur before the contract completion date.

30. Finance Director. The finance director of the City of Boulder, Colorado, who must sign the contract agreement for it to be effective. The finance director's duties are outlined further in the general conditions. The finance director may be contacted at the Office of the Finance Director, P.O. Box 791, Boulder, Colorado 80306; telephone, 303-441-3042.

31. General Conditions. The sections set forth in this document. The general conditions may be amended by the city attorney.

32. Growing Season. The growing season for plant materials planted or altered by the contractor (*see* sections 617 and 618) shall begin April 1 and end August 31.

33. Laws. As used herein, "laws" shall include, without limitation, all applicable federal, state, and city codes, charters, ordinances, standards, statutes, rules, and regulations.

34. Notice of Award. The document which certifies that the contractor has been selected to perform the work. *See* section 301 and Form 4.

35. Notice to Proceed. The date of purchase order issued by the purchasing agent is the official notice to proceed. It shall be the beginning date of the contract for purposes of determining the contract performance period and liquidated damages.

36. Project Inspector. An authorized representative of the city assigned to make inspections of the work performed and the materials furnished by the contractor. The inspector's duties are outlined further in article 7. The inspector has no authority to vary any of the terms of the contract documents.

37. Plans. All city-approved drawings or reproductions pertaining to the construction of the work and appurtenances thereof.

38. Project. The entire work which the contractor has been hired to perform under the contract documents. The project shall be identified by a project number. The project shall also include extra and force account work.

39. Project Manager. The city employee who shall supervise the implementation of the contract and represent the city in all matters and questions arising under the contract. *See* section 111. The project manager's duties are also set forth further in other sections of the general conditions.

40. Purchase Order. The purchase order is the document issued by the city purchasing department which commits the payment of city funds for the work. The purchase order is also the notice to proceed, which is the official beginning date of the contract.

41. Purchasing Agent. An employee of the city purchasing division. The purchasing agent's signature is required on the contract (Form 5) and on all change orders (Form 9) in which the contract price is adjusted. The purchasing agent may be contacted at the Purchasing Department, P.O. Box 791, Boulder, Colorado 80306; telephone, 303-441-3060.

42. Special Conditions. Additions or revisions to the general conditions which refer to special aspects of particular contracts. In case of conflict, special conditions supersede general conditions, pursuant to section 105.

43. Specifications. A general term applied to all directions, conditions, requirements, and written agreements which pertain to the method and manner of performing the work, or to the quantities and qualities of materials to be furnished under the contract.

44. Subcontractor. An individual, firm, or corporation to whom the contractor sublets part of the contract but not including one who only furnishes material.

45. Substantial Completion. The date of substantial completion of the work or designated portion thereof is the date certified by the project manager when construction is substantially complete in accordance with the contract documents. *See* Form 12 and section 713.

46. Superintendent. The individual designated by the contractor to act on behalf of the contractor in all matters related to the contract. Unless otherwise agreed, the superintendent shall serve on a full time basis. *See* section 507.

47. Surety. The corporation, partnership, or individual, other than the contractor, which executed a bond or bonds with the contractor guaranteeing the complete execution of the contract and all supplementary agreements pertaining thereto.

48. Work. The completed construction required by the contract documents including all labor, materials, and equipment necessary to produce such construction. Work not covered by the contract documents will not be required unless it is consistent therewith and is reasonably necessary to produce the results intended in the contract documents.

49. Work Directive. A Work Directive, set forth in Form 8, authorizes the contractor to proceed with the extra work. Work Directives shall serve as the basis for negotiating subsequent change orders.

50. Work within the Scope of the Contract. Work which is identified in the bid proposal or other contract documents or which is not identified in the bid proposal or other contract documents but which is necessary for satisfactory prosecution and completion of the work is work, within the scope of the contract. The contractor will not be awarded extra compensation or a time extension for performing work which is within the scope of the contract.

51. Written Notice. Written notice shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by certified mail to the last business address known to the party who gives the notice.

Civic Area Park Development

City -Contractor Agreement - Special Conditions

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Section SC.1 – Contractor's Services

1. The Contractor has been engaged by the City to provide Preconstruction Services and Construction Services described in these Special Condition in addition to those required elsewhere by the Contract Documents.

2. As of the date of this agreement, the Drawings and Specifications are anticipated to require further development by the Architect to fully define the scope of the Work.

3. The Contractor will provide Preconstruction Services as described herein as these Drawings and Specifications are further developed; and commence Construction Services after Notice to Proceed with construction has been issued.

Section SC.2 - Control Estimates

1. The Contractor shall prepare and submit to the city's Project Manager for review, and subsequently for the city's approval, in writing, a Control Estimate either prior to the execution of this Agreement, or if specifically agreed otherwise in writing by the city and contractor, within 14 days of executing this Agreement.

2. The Control Estimate shall include the estimated Cost of the Work plus the Contractor's Fee. The Control Estimate shall be used to monitor the conformance of the Design Documents with the city's budget during the Pre-construction Phase until such time as a the final Construction Documents have been accepted by the city.

3. The Contractor shall update the Control Estimate not later than fifteen (15) days after release of Drawings and Specifications identified by City, either directly or through the Architect.

4. The Control Estimate shall include such information and level of detail as the City and the Contractor mutually agree in advance are appropriate to clearly define the scope of work included; the documents used to prepare the Control Estimate; and are congruent with standards of the industry for such estimates.

5. The Contractor shall meet with the City and its consultants to review the initial Control Estimate. When the Control Estimate is acceptable to the City, the City shall acknowledge so in writing.

6. To the extent that the Drawings and Specifications are anticipated to require further development by the Architect, the Contractor shall incorporate changes in scope, systems, kinds and quality of materials, finishes or equipment, if required, in a revised Control Estimate which shall be likewise be reviewed by the City and its consultants. When the revised Control Estimate is acceptable to the City, the City shall acknowledge so in writing by preparing a Change Order to accept the revised Control Estimate.

Section SC.3 - Preconstruction Services

1. CONSULTATION
   The Contractor, together with the Project Manager and Architect, shall jointly schedule and attend no more than six (6) meetings with the City during preconstruction. The Contractor shall consult with the City, Project Manager and Architect regarding, without limitation, site use and improvements and the selection of materials, building systems and equipment. The Contractor shall provide recommendations on, among other aspects of the Work and the Project, construction feasibility; actions designed to minimize adverse effects of labor or material shortages; time requirements for procurement, installation and construction completion; and factors related to construction cost, including estimates of alternative designs or materials, preliminary budgets and possible economies.

2. MEETING MINUTES

   The Contractor shall record, transcribe and promptly distribute minutes of these meetings to all attendees, the City, Project Manager and Architect, after the Contractor has allowed the Project Manager two (2) business days for review and edit of such minutes. Such Project Manager's edits shall be incorporated into the minutes by the Contractor unless the edits requested are demonstrably inaccurate.

3. CONSTRUCTION AND PROJECT SCHEDULE
   The Contractor shall prepare, and periodically update, the Contractor's Construction Schedule for the Architect's review and the Project Manager's and City's approval. As design proceeds, the Contractor's Construction Schedule shall be updated by the

Contractor to indicate, in increasing detail and without limitation, proposed sequences and durations of the Preconstruction Phase activities and the activities necessary to complete the Work during the Construction Phase; milestone dates for receipt and approval of pertinent information by the City, governmental agencies and other stakeholders; City's submittal dates of information agreed to be required by the Contractor and Architect; dates for Contractor's submittal and Project Manager, Architect and City's review and sub-sequent City's approval of the initial Control Estimate and subsequent updates; preparation and processing of shop drawings and samples; delivery of materials or equipment requiring long-lead-time procurement; City's occupancy requirements showing portions of both the Work and the Project having occupancy priority; and proposed dates of Substantial Completion and Final Payment. If Contractor's Construction Schedule updates indicate that previously approved schedules may not be met, the Contractor shall make appropriate recommendations for acceleration, concurrency of activities and other alternatives to the City, Project Manager and Architect to maintain the most recently approved target dates for the Work.

4. PHASED CONSTRUCTION

   The Contractor shall make recommendations to the City, Project Manager and Architect regarding the phased issuance of Drawings and Specifications (if any) to facilitate the Contractor's Construction Schedule, taking into consideration such factors as, without limitation, economies, procurement and long lead item requirements, time of performance, availability of labor and materials, and provisions for temporary facilities.

5. LONG-LEAD-TIME ITEMS

   The Contractor shall recommend to the City, Project Manager and Architect a schedule for procurement of long-lead-time items (if any) which will constitute part of the Work as required to meet the Contractor's Construction Schedule. If such long-lead-time items are proposed to be procured by the City, they shall be procured on City's terms and conditions, which shall be provided to the Contractor for review. Upon the City's acceptance of any of the Contractor's Contract Sum proposals, all contracts for such items shall be assigned by the City to the Contractor, who shall accept responsibility for such items as if procured by the Contractor. The Contractor shall expedite the delivery of any long-lead-time items.

6. REVISIONS TO CONTRACTOR's CONSTRUCTION SCHEDULE
While performing the necessary services throughout the Preconstruction Phase, the Contractor shall recommend revisions to the Contractor's Construction Schedule, if and when appropriate, for Project Manager's and Architect's review. Subject to such review, and the City's subsequent approval, the Project Manager shall issue Change Orders as needed to the appropriate parties to implement the approved revisions to the Contractor's Construction Schedule.

7. IMPACTS TO THE CONSTRUCTION BUDGET AND SCHEDULE
The Contractor shall make recommendations to the Project Manager and City to mitigate, without limitation the cost and time impacts of any ongoing design changes; unforeseeable delays or scope changes; and other factors beyond the responsibility of the Contractor to control under this Agreement that may result in revision to the Contractor's Construction Schedule or Control Estimate.

Section SC.4 - Construction Services

1. COMMENCEMENT
The Construction Phase shall commence on the earlier of:

.1 the City's issuance of a Notice to Proceed, or
.2 the City's first written authorization (including approval of cost) to the Contractor to:
(a) undertake construction Work with the Contractor's own forces, or
(c) issue a purchase order for materials or equipment required for the Work.

2. CONSTRUCTION ADMINISTRATION PROCEDURES

.1 Promptly after the Notice to Proceed, the Construction Contractor shall update the Contractor's Construction Schedule to reflect current events.

.2 The Contractor shall implement the system of cost control for the Work, including regular monitoring of actual costs for activities in progress and estimates for uncompleted tasks; tracking the status and potential cost and time impacts of pending Proposal Requests, Change Order Requests, and cost and time impact of Change Orders, and

Construction Change Directives. The Contractor shall identify variances between actual and estimated costs and report the variances to the City, Project Manager and Architect at regular intervals as determined by the Project Manager to be necessary given the circumstances.

.3 The Contractor shall establish and implement procedures for expediting and processing, without limitation, requests for information, shop drawings, material and equipment sample submittals, Contractor's Construction Schedule adjustments, Proposal Requests, Change Order Requests, Change Orders, Construction Change Directives, substitutes, payment requests and the maintenance of logs. The Contractor shall maintain daily job reports. The Contractor shall be the party to whom requests for information, submittals, Subcontractor schedule adjustment, requests, substitution requests, Proposal Requests, Change Order Requests, Change Orders, Construction Change Directives and payment requests shall be submitted.

3. PROJECT SITE MEETINGS

Periodically the Contractor shall conduct meetings at the site with each Subcontractor and the Contractor shall conduct coordination meetings with all Subcontractors, the Project Manager and Architect. The Contractor shall record, transcribe and promptly distribute minutes to all attendees, the City, Project Manager and Architect, after the Contractor has allowed the Project Manager two (2) business days for review and edit of such minutes. Such Project Manager's edits shall be incorporated into the minutes by the Contractor unless demonstrably inaccurate or misleading.

4. OBSERVATION, COORDINATION OF OTHER INDEPENDENT CONSULTANTS

Technical inspection and testing provided by the Architect or City's others consultants shall be coordinated by the Contractor. The Contractor shall reasonably promptly be provided a copy of all inspection and testing reports, preferably on the day the results of the inspection or test are available. The Contractor is not responsible for providing, nor does the Contractor control the actual performance of technical inspection and testing. The Contractor is performing a coordination function and is not acting in a manner so as to assume responsibility or liability, in whole or in part, for all or any part of such inspection and testing.

5. CHANGE ORDER CONTROL

The Contractor shall establish and implement a Change Order control system.

.1 After first consulting with the party initiating a request for a change in the Work, and collating the initial information necessary to issue such request, the Project Manager shall provide the Contractor with a general written description of the proposed change, together with any technical information and drawings prepared by the Architect which further detail the impact to the scope of the Work (a "Proposal Request"). The Contractor will promptly acknowledge receipt of the Proposal Request, the sufficiency of the information provided, and the date it will respond; or promptly and specifically request, in detail, the missing information necessary to prepare a response.

.2 The Contractor shall send the Proposal Request to the affected Subcontractor(s). In response to the request for a proposal, the Subcontractor(s) shall submit to the Contractor for evaluation detailed information concerning the costs and time adjustments, if any, necessary to perform the proposed change in Work, including without limitation the request's impact on the quantities and unit costs of Subcontractor(s)' previously contracted portion of time Work, if any. The Contractor shall discuss the proposed change with the Subcontractor(s) and endeavor to determine the Subcontractor(s)'s basis for the proposed cost and time to perform the work, and the effect thereof, if any, on the Contract Sum and Contractor's Construction Schedule.

.3 The Contractor shall assemble, organize, review and validate all the information provided for any request for change to the Contract Time or Contract Sum submitted by Subcontractor(s); and after such analysis shall diligently and vigorously negotiate the best value on behalf of the City with each such Subcontractor.

.4 In instances where the Contractor's analysis supports the validity of the request, and the Contractor's negotiations with the Subcontractor have resulted in the City receiving good value, the Contractor shall prepare a detailed Change Order Request for the Project Manager's and Architect's review. Such Change Order Request shall include, without limitation deltas in quantities and unit costs from the Work included in the Contract Sum and impacts to specific scheduled activities in the most recently approved Contractor's Construction Schedule occasioned by the Proposal Request.

.5 The Contractor shall carefully review the Change Order Request and its supporting detail with the Project Manager and Architect; and make recommendations to them for mitigating the cost and schedule impacts thereof to both the Contractor's Work and the City's Project.

.6 The Project Manager shall consult with the Architect to evaluate the merits and validate the appropriateness of the Contractor's Change Order Requests, and incorporate the Architect's opinions into the Project Manager's recommendations to the City.

.7 The Project Manager shall consult with the City prior to the City's acceptance of any Change Order Request. Following City acceptance, the Project Manager shall prepare the Change Order documents for signature by the Contractor, Architect, Project Manager and City, in that order.

6. REVIEW AND INCORPORATION OF TIME EXTENSION REQUESTS

The Contractor shall, prior to the issuance of a Change Order Request to the Project Manager and Architect, determine, diligently validate, and negotiate on behalf of the City the least proposed effect of time extensions requested by the Subcontractor on the Contractor's Construction Schedule. If such Change Order Request is approved by Change Order, the Contractor shall verify that the Work and any adjustment of time required by such approval has been promptly incorporated into the Contractor's Construction Schedule and that of the affected Subcontractor(s).

7. CONTRACTOR'S CONSTRUCTION SCHEDULE

The Contractor shall adjust and update the Contractor's Construction Schedule frequently, and distribute updated copies not less than monthly to the Project Manager and Architect for review, and subject to such review, for the City's approval. All adjustments to the Contractor's Construction Schedule shall be made for the benefit of the City.

8. SUBCONTRACTOR'S CONSTRUCTION SCHEDULE

The Contractor shall review each Subcontractor's Construction Schedule frequently, and shall verify that the schedule is congruent with the Contractor's Construction Schedule, and its established milestone and completion date(s) comply with the requirements of the Contractor.

Section SC.5 - Additional Special Conditions

1. SITE LOGISTICAL PLAN
   The Contractor will be required to prepare a logistic plan for the bid. The selected Contractor will work with the City to determine the points in construction for which a logistics plan must be developed. Approval of a site logistic plan will also be required as part of the City's R.O.W. or Traffic Control Addendum permitting process.

   The plan must, at a minimum, address the following:

   .1 Site access and egress points.

   .2 Materials and equipment staging that follows all Federal, State, County, and City regulations regarding permitted activities in the floodplain

   .3 Detours of the Boulder Creek Path. See SC.5-2 for Boulder Creek Path detour requirements.

   .4 Any parking spaces that are anticipated to be closed-off for construction related activities must be approved by the City as part of the logistic plan. The use of parking spaces for construction activities cannot be guaranteed and this should be a consideration in the development of the logistical plan.

   .5 Contractor shall restrict access to the site. Contractor shall be solely responsible to protect and replace, as needed, any new construction or existing facilities damaged as a result of the work.

   .6 Contractor shall maintain a safe, clean condition on the surface of the existing roadway adjacent to the project. Contractor shall continually monitor roadway and sidewalks for rocks, mud, and any materials on a daily basis or more frequently as conditions require at no additional cost to the Owner.

2. BOULDER CREEK PATH DETOURS

The Boulder Creek Path must remain open during, functional, and safe during construction. Detours of the Boulder Creek Path must be approved as part of the R.O.W permitting process.

.1 In no instance will the Boulder Creek Path alignment be allowed to detour along Arapahoe Ave.

.2 In no instance will the Boulder Creek Path alignment be allowed to detour along Broadway.

3. LICENSES AND PERMITS

The Contractor shall obtain the necessary licenses and permits as required in Section 204 of the General Conditions.

The city will obtain and pay for the following permits:

- City of Boulder Stream, Wetland, Water Body Permit
- 404 Nationwide Permit
- Grading
- Electrical

Upon selection and successful contracting with a general contractor, the City will require that all permits obtained by the City be changed to the name of the selected general contractor.

The selected contractor will, at a minimum, be responsible for obtaining the following permits:

- Right of Way and Work Area Traffic Control Addendum
- Stormwater Discharge (State Permit)
- City of Boulder Erosion Control (issued after State stormwater Permit)

It will be the responsibility of the Contractor to be aware of and where necessary, obtain, all permits that will be necessary to complete the work. All permits not specifically identified as the City's cost in the list above will be at the cost of the Contractor, who shall also be responsible for obtaining them. The Contractor will be responsible for scheduling and closing out all project permits.

4. EXISTING FACILITES FOR CONSTRUCTION RELATED ACTIVITIES

   The City is currently investigating the possibility of providing a work location in lieu of a job trailer.

5. CONTRACTOR PARKING

   Contractors shall not park in the parking lot adjacent to the project site off of Canyon Blvd. or Arapahoe Ave. Contractors shall not park in adjacent neighborhoods. The City is in the process of identifying a location for parking for Contractors and Subcontractors. The identified parking is not meant to serve as long-term staging construction related equipment, materials, or vehicles. It is anticipated that the parking will be within one mile of the project site and accessible by public transportation.

6. EROSION CONTROL, STORMWATER DISCHARGE, AND STORMWATER POLLUTION PREVENTION PLAN

   The contractor will be responsible for obtaining a stormwater discharge permit from the Colorado Department of Public Health and Environment prior to the commencement of any construction activities associated with this project for disturbance in excess of one (1) acre. For disturbance of less then one (1) the contractor will be responsible for obtaining a City of Boulder stormwater discharge permit.

   The contractor will be responsible for preparing all necessary plans, details, notes, and specifications necessary to obtain such permit. Information should be made available to the City for review prior to permit submittal.

   A City of Boulder Erosion Control Permit will not be issued until a State Stormwater Discharge Permit has been obtained.

The Contractor will be responsible for coordinating with the City's Water Quality engineer(s) to implement best practices deemed necessary to ensure any water quality standards for in creek work are maintained.

7. PUBLIC SAFETY

In accordance with generally accepted construction practices and the requirements of State and Federal safety regulations, Contractor will be solely and completely responsible for conditions on the job site, including safety of all persons, children, and property during performance of work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Project Manager or his/her representative is to conduct construction observation of the Contractor's performance and is not intended to include review of the adequacy of the Contractor's and Subcontractors' safety measures, in, on, or near the construction site.

Contractor shall at all times, whether or not so specifically directed by the Project Manager or his/her representatives, take necessary precautions to insure the protection of the public. Contractor shall furnish, erect and maintain, at his own expense, all necessary barricades, temporary fencing, suitable and sufficient amber flashing lights, construction signs, provide a sufficient number of watchmen or flagmen and take all necessary precautions for the protection of the work and the safety of the public through or around his construction operations.

8. UTILITY VERIFICATION

The locations of utilities shown on the drawings are approximate. It is specifically the Contractor's responsibility to call for locates and field locate all utilities that may conflict with this project as to both line and grade (this includes, but is not limited to, water lines, sewer lines, storm sewer lines, manholes, water valve boxes, survey monuments, gas, fiber optic, electric, telephone, cable TV, etc.). The Contractor shall verify the location and depth of all tie-in points and utilities potentially affected by the work prior to beginning construction. This shall include obtaining field location marking from designated utility locating services. Any deviations from the drawings shall be reported immediately to the Project Manager.

The Contractor shall be responsible for the repair of any damage to utilities that have been properly located by the designated utility locating service or to utilities for which the Contractor has not obtained the proper field location marking.

Protection of Existing Utilities: Any information concerning underground utilities shown on the Drawings is intended to be merely an aid to the Contractor. The accuracy of information furnished with respect to underground utilities is not guaranteed and the Contractor must independently verify any such information. The Contractor shall notify all utility companies or privately owned organizations who may have installations in the area where the work is to be performed and solicit their aid in locating utilities including, but not limited to, water, sanitary and storm sewer, gas or other fuel, electrical, telephone, communication, cable television and other installations. All utilities encountered must be kept in operation by the Contractor and must be protected and/or repaired at his own expense.

The Contractor shall determine the actual location of all existing utilities prior to starting any work that may cause damage to such utilities. The Contractor shall be liable for all damages done to existing utilities in the performance of his work.
The Contractor shall inform the Project Manager of existing utility installations which need relocation other than those identified in the project construction documents.

If the Contractor requests that utility companies relocate their utilities for his convenience in construction of any portion of the work, the cost of such shall be at the Contractor's expense. The Contractor shall be responsible for coordination with these utility owners and providing them with the required information to move the utilities as required so that they do not interfere with the final constructed improvements. The Contractor shall initiate meetings with the necessary utility owners, to be held at the project site with the Project Manager present, to coordinate relocation work sufficient time in advance of the Contractor's work in these areas. All work required for the relocation of existing utilities shall be completed by the owner of the utility unless otherwise agreed upon in writing.

.1 Pot Holing of Existing Utilities: The Contractor may pothole the existing utilities to verify the horizontal and vertical location. The Contractor shall notify the Project Manager of potential conflicts between existing utilities and proposed improvements. The Contractor shall schedule the pot holing at the start of the project and prior to

construction of the proposed improvements that may be in conflict with these utilities to allow time for relocation of existing utilities or design modifications.

9. HOLIDAY WORK

Construction will not be permitted on the following dates unless the Contractor makes prior arrangements with the Project Manager and receives written approval before the work commences.

- Martin Luther King Jr. Day
- President's Day
- Memorial Day
- Fourth of July
- Labor Day
- Veteran's Day
- Thanksgiving
- Christmas Eve
- Christmas Day
- New Years Eve
- New Years Day

10. CIVIC AREA ART REMOVAL AND STORAGE

A number of artwork pieces are located within the limits of work for the construction project. The Contractor shall follow the requirements in **SC.6.2** Attachment Two – Art Removal and Storage. The Contractor will coordinate with the City on identifying all artwork; developing a written plan for; and executing its implementation for removing, transporting, and storing, staging, and reinstalling the artwork.

11. CONNECTIONS TO EXISTING FACILITIES

Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain-lines, and utilities such as water, sewer, and electric. In each case, Contractor shall receive permission from the City or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

Connections to existing facilities that are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

12. TREE PROTECTION REQUIREMENTS

Existing trees to be preserved within or in close proximity to the project limit line shall be protected with fence. Contractor shall install and maintain construction fence around trees to remain during entire construction period from mobilization to substantial completion or as directed by the Project Manager.

Chapter 6-6, BRC 1981, prohibits removing, damaging or destroying trees within the public right-of-way, easements or City owned property without the permission of the City Manager.

If desirable public trees are removed, damaged, or destroyed by the Contractor, the loss shall be mitigated. The City Forester shall determine the degree of damage and whether the tree(s) can be restored or must be replaced.

To prevent tree root smothering NO SOIL STOCKPILES, NO SUPPLIES, NO EQUIPMENT, or any other material shall be placed or stored within a tree dripline or, for columnar-shaped trees, within fifteen feet of a tree trunk.

For root protection, tree roots shall not be cut unless it is unavoidable. The City Forester, Kathleen Alexander at 303.441-3406, shall be notified prior to any cutting of roots greater than one inch in diameter. Service trenches outside of the pavement shall be hand dug when within the tree dripline and when in close proximity to low branching trees. Exposed roots shall be covered immediately to prevent desiccation with burlap and kept moist.

When root cutting is unavoidable, a clean sharp cut shall be made to avoid shredding and mashing. Root cuts should be made back to a lateral root and protected as

mentioned above. Within the trench, damaged roots one inch in diameter or greater shall be cut back to the edge of the trench by the appropriate method. No power tools shall be used to prune roots, with the exception of approved root cutting equipment and under the supervision of the City Forester. Only scissor type hand pruners and loppers (anvil type unacceptable) and arborist type pruning saws will be acceptable.

When more than one root with a diameter of two inches or greater is cut, supplemental watering is necessary if tree lacks an operational sprinkler system. Watering shall be provided by the Contractor at their expense.

The attachment to trees of any metal material, sign, cable, wire, nail or any other material foreign to the natural structure of the tree is prohibited. No heavy objects shall lean against or come into contact with any tree trunk.

No pruning shall occur, without approval of the City Forester, during or after construction activities. The City Forester shall hire a certified arborist to properly trim trees potentially affected by the project prior to construction at the City's expense. Damage which compromises the tree health or structure shall be mitigated.

13. TRAFFIC SIGNAL AND SIGNAGE RESTORATION

Prior to proceeding with the work in this contract, the Contractor shall identify any and all existing traffic signal installations, signage and pavement markings that will be affected by his work. If any of these installations will be interrupted or temporarily removed during the course of the work, the Contractor shall restore such installations to their original conditions at his expense.

The following specifications for the provision of traffic signal and lighting installations are intended to provide a set of minimum standards that shall be followed when work is done for the City of Boulder. These standards, plans, and any special provisions shall apply to all materials supplied, methods and procedures of work to be followed, and other general minimum requirements that shall be complied with before work is accepted by the City. The following standard specifications shall apply:

Standard Specifications for Road and Bridge Construction (current edition), Colorado Department of Transportation, and all amendments and revisions pertaining thereto.

Manual on Uniform Traffic Control Devices (current edition), Federal Highway Administration, and the Colorado Supplement thereto.

Design Criteria and Standard Specifications (current edition), City of Boulder.

The standard specifications outlined in this document are revisions and amendments to the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction. In situations where there is a conflict or question of interpretation, these specifications and any special provisions will prevail.

14. COMPLIANCE WITH STATE OF COLORADO LEGAL LOAD LIMITATIONS

All Contractors, Subcontractors, and suppliers shall comply with the State of Colorado Legal Load Limitations for Interstate and Non-Interstate Highways. Contractors, Subcontractors, and suppliers shall provide the Project Manager with copies of certified scale tickets for all materials and incidental project items transported and delivered to the project site. Contractors, Subcontractors, and suppliers will not be compensated for materials and incidental project items transported and delivered to the project site in vehicles whose gross weight exceeds the State of Colorado Legal Load Limitations.

15. ASBESTOS, PCBS, PETROLEUM, HAZARDOUS WASTE OR RADIOACTIVE MATERIAL

The City shall be responsible for any asbestos, PCBs, petroleum, hazardous waste or radioactive material uncovered or revealed at the site which was not shown or indicated in the drawings or specifications or identified in the contract documents to be within the scope of the work and which may present a substantial danger to persons or property exposed thereto in connection with the work at the site. The City shall not be responsible for any such materials brought to the site by Contractor, Subcontractor, suppliers, or anyone else for whom Contractor is responsible.

Contractor shall immediately: (i) stop all work in connection with such hazardous condition, and (ii) notify CITY (and thereafter confirm such notice in writing). CITY shall determine the necessity for CITY and Local Government to retain a qualified expert to

evaluate such hazardous conditions or take corrective action, if any. Contractor shall not be required to resume work in connection with such hazardous conditions or in any such affected area until after CITY has obtained any required permits related thereto and delivered to Contractor special written notice: (i) specifying that such condition and any affected areas is or has been rendered safe for the resumption of work, or (ii) specifying any special conditions under which such work may be resumed safely. If CITY and Contractor cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in contract price or contract times as a result of such work stoppage or such special conditions under which work is agreed by Contractor to resume, either party may make a claim.

If after receipt of such special written notice Contractor does not agree to resume such work based on a reasonable belief that it is unsafe, or does not agree to resume such work under such special conditions, then CITY may order such portion of the work that is in connection with such hazardous condition or in such affected area to be deleted for the work. If CITY and Contractor cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in contract price or contract times as a result of deleting such portion of the work then either party may make a claim. CITY may have such deleted portion of the work performed by CITY's own forces or others.

To the fullest extent permitted by laws and regulation, CITY shall indemnify and hold harmless Contractor, Subcontractors, Consultants and all the officers, directors, employees, agents, and other consultants and Subcontractors of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from such hazardous condition, provided that (i) any such claim, costs, loss or damage is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself), including the loss of use resulting therefrom, and (ii) nothing in this subparagraph shall obligate CITY to indemnify any person or entity from and against the consequences of that person's or entity's own negligence.

This clause applies to property of the Local Government. If such problems are encountered on areas owned by others, then that portion of the project will be stopped until the City takes corrective action.

The CITY is not responsible for such problems or their correction on the property of others.

If the CITY decides to discontinue the project or affected portions of the work, then the Contractor shall not be entitled to costs beyond the costs incurred to date, and shall not be entitled to future overhead costs or profits that may have been realized if the project or the affected portions of the project had been completed.

The Contractor shall follow the requirements in **SC.6.1** Attachment One – Materials Management Plan.

16. SELECTION AND/OR ACCEPTANCE OF LANDSCAPE MATERIAL

The City reserves the right to be present during the selection of plant material at any nursery providing any landscape material. The City may accept or reject any plant material at the nursery or prior to installation at the project site. The Contractor will be responsible for providing landscape material in the quantities necessary to fulfill the requirements of the construction drawings.

17. CITYWIDE INTEGRATED PEST MANAGEMENT PLAN

Contractor must be familiar with and comply with all requirements pertaining to the City's Integrated Pest Management Plan (IPM). No pesticides or herbicides are to be used without the approval of the Project Manager.

18. SAFETY

In accordance with generally accepted construction practices and the requirements of State and Federal safety regulations, the Contractor will be solely and completely responsible for conditions on the job site, including safety of all persons, children, and property during performance of work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Project Manager or his/her representative is to conduct construction observation of the Contractor's performance and is not intended to include review of the adequacy of the Contractor's and Subcontractor's safety measures, in, on, or near the construction site.

The Contractor shall at all times, whether or not so specifically directed by the Project Manager or his/her representatives, take necessary precautions to insure the protection of the public. The Contractor shall furnish, erect, and maintain, at his own expense, all necessary barricades, temporary fencing, suitable and sufficient amber flashing lights, construction signs, provide a sufficient number of watchmen or flagmen and take all necessary precautions for the protection of the work and the safety of the public through or around his construction operations.

19. SURVEYING

Contractor will be responsible for all construction staking and offsets during construction. All construction stakes shall be marked with finished grades for Project Manager review and approval prior to placing formwork, after placing formwork and before pouring concrete, or continuing with any and all other work as directed by the Project Manager. Construction staking includes, but is not limited to, all grades, corners, footers, structures, lighting, electrical improvements, fencing, curbs, ramps, sidewalk and other hard surfacing, trails, bike features, bridges and other pertinent improvements as deemed necessary by the Parks Construction Inspector.

Contractor shall provide a Colorado Licensed Surveyor, an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the construction staking and layout Work. In addition, Contractor shall furnish, without charge, competent persons from his force, and such tools, stakes, and other materials as the Project Manager may require in establishing or designating control points, or in checking survey and layout Work performed by Contractor.

The Contractor is responsible for protecting any survey stakes or monuments installed. The cost of any re-staking necessitated by the Contractor's operations, or the cost of any retesting necessitated by the Contractor's work not meeting project specifications, will be withheld from monies due the Contractor. The Contractor is required to notify the Project Manager at least two (2) working days in advance of any survey work or testing needed.

All proposed finished grades and pavements shall abut, in both line and grade, existing grades, pavements, etc. The Contractor shall notify the Project Manager of any discrepancies.

20. SUPERVISION AT THE WORK SITE

The Contractor shall assign an employee to be responsible for all aspects of this project during and after normal working hours and over weekends as emergency standby. The Contractor's Construction Supervisor shall be on-site at all times work is being performed. Telephone numbers, including pager and mobile phone, for this individual shall be submitted to the Project Manager during the Pre-construction meeting. The Construction Supervisor must be approved by the Owner prior to commencement of work. The Contractor may not change the Construction Supervisor without prior approval of the Owner. The Owner requires that the Construction Supervisor must be able to make a decision for the Contractor within a reasonable amount of time should the need arise during the course of the construction. See Section 507 of the General Conditions.

Section SC.6 - Special Conditions - Attachments

The following documents are attached to these Special Conditions, and incorporated herein by reference:

SC.6.1 Attachment One – Materials Management Plan

SC.6.2 Attachment Two – Art Removal and Storage

Section SC.7 - Special Conditions – Base Bid and Alternates

The Base Bid is the price to provide, without limitation, the materials, labor, equipment, supervision and services for complete and operable systems and improvements described in the proposed Contract Documents, with a Notice to Proceed date of the Contractor's choice, and a final completion date of not later than December 31, 2018.

Each Contractor must clearly specify its proposed Base Bid Notice To Proceed/Commencement Date; calendar days to Substantial Completion; and the proposed Substantial Completion date on the Bid Form. Failure to do so may be grounds for rejection of the Bid by the City, at its sole discretion.

The cost to comply with **S.C.6.1** Attachment One – Materials Management Plan and remove, store and reinstall the public art as described in **S.C.6.2** Attachment Two – Art Removal and Storage should not be included in the Base Bid.

The Alternates are as follows:

Alternate 1.0

Comply with the requirements of **S.C.6.1** Attachment One – Materials Management Plan.

Alternate 2.0

Remove, store and reinstall the public art as described in **S.C.6.2** Attachment Two – Art Removal and Storage.

Alternate 3.0

Commence work based on a Notice to Proceed from the City on August 29, 2016.

Each Contractor must clearly specify its proposed Alternate 3.0 Notice To Proceed/Commencement Date; calendar days to Substantial Completion; and the proposed Substantial Completion date on the Bid Form. Failure to do so may be grounds for rejection of the Bid by the City, at its sole discretion.

Alternate 4.A – Library Plaza

Area affected by this alternate is bounded by outline shown on the proposed Contract Documents. Scope includes sawcut and removal of existing concrete sections to increase planter areas. Scope also includes new planting areas, soil, planting and irrigation.

Alternate 4.B – Centennial Walk

Area affected by this alternate is bounded by outline shown on the proposed Contract Documents. Scope includes grading and definition the creek edge along the south side of the. Creek edge is defined with a new Boulder Embankment detail. Scope also includes a new 8' concrete path, new lawn and irrigation.

Alternate 4.C – North and South Peace Garden

Area affected by this alternate is bounded by outline shown on the proposed Contract Documents. Scope includes new planting and irrigation areas, new custom cut sandstone paving, and new boulders at edge of planters to protect eroded edge.

Alternate 4.D – Concrete Mow Curb

Provide a 6x6 inch concrete mow curb at edge of planting area and lawn in lieu of the steel edge detail shown in the Base Bid.

Alternate 4.E – Cordwood Seat Walls and Posts

Provide all cordwood seat walls made with salvaged wood, weathered steel frame, foundation and wood decking. Includes two cord wood posts at 11th Street Spine.

Section SC.6 - Special Conditions - Attachments

Written questions will be accepted until May 13, 2016 at 4:00 P.M. Questions shall be directed via email to Mr. Doug Godfrey, Project Manager at GodfreyD@bouldercolorado.gov with a cc: to csquadra@peakprogramvalue.com, both of whom may, at their discretion contact candidates to confirm receipt of information, participation in the process, etc. The City may, but is not obligated to respond to questions received after this deadline, and will only be held accountable for information provided to candidates in writing via this the RFP, and Addenda thereto.

NO OTHER CONTACT SHALL BE MADE REGARDING THIS REQUEST FOR PROPOSAL WITH ANY OTHER CITY STAFF, CITY COUNCIL MEMBER, PROJECT TEAM MEMBER, or with REPRESENTATIVES OF ANY CITY, COUNTY, REGIONAL, STATE OR FEDERAL AGENCIES. FAILURE TO COMPLY WITH THIS REQUIREMENT MAY, IN and OF ITSELF, RESULT IN THE OFFENDING CANDIDATE BEING REMOVED FROM CONSIDERATION.

Response to written questions will be issued by Addendum on or before May 20, 2016. Interview(s) of selected candidates (if any) will be held on the morning of June 7, 2016 (please note date change from previous information, and reserve this time for your team if needed).

Environmental Engineering and Consulting
Remediation and Management Services

MATERIALS MANAGEMENT PLAN

FOR THE

CIVIC AREA PARK DEVELOPMENT
BOULDER, COLORADO

APRIL 2016

Prepared for:

Boulder Parks & Recreation
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1.0 INTRODUCTION

The City of Boulder's Parks & Recreation (the "City") is planning to complete park improvements in the vicinity of the Boulder Civic Center and adjacent areas (Figure 1). The project is referred to as the Civic Area Park Development. The development includes the area between Canyon Boulevard on the north, Arapahoe Avenue on the south, Broadway on the east, and approximately 9th Street on the west (Figure 2). The area includes an existing park and recreation area and numerous municipal buildings aligned along and adjacent to Boulder Creek (the "Property"). An existing pedestrian bridge is located in the development area.

The Civic Area Park Development will include pavilion structures, walking paths, bike trails, paved parking areas and driveways, a new pedestrian bridge, and new underground utilities.

Casey Resources, Inc. ("CRI") has been engaged by the City to develop a Materials Management Plan ("MMP") for the soil disturbing activities completed during the planned construction of the Property. This MMP has been prepared to be used as a standalone document for use by contractors conducting site work and utility installation activities during the subject development.

1.1 ENVIRONMENTAL CONDITION OF THE PROPERTY

There are no known environmental impacts in soil or groundwater in the Property area. Geotechnical drilling at the Property identified areas of manmade fill within the alluvial deposits of Boulder Creek; however, the manmade fill areas were not delineated (Ground Engineering, Inc., 2016). There is a potential that slag materials will be encountered while excavating in or near Boulder Creek. In 2015, City contractors encountered slag materials while working adjacent to Boulder Creek to repair the Evert Pierson Kids' Fishing Ponds located west of 9th Street. The slag materials were black in color and exhibited a glass like appearance. The slag materials were inter-dispersed in the alluvial deposits associated with Boulder Creek. The source of the slag material was surmised to be former smelter operations located upgradient of the Evert Pierson Kids' Fishing Ponds site.

Slag is the glass-like by-product remaining after a desired metal has been separated from the raw material/ore by melting (smelting). Slag is usually a mixture of metal oxides and silicon dioxide and often contains concentrated metal sulfides and remnant elemental metals.

1.2 PURPOSE OF THE MATERIALS MANAGEMENT PLAN

The development of the Property will involve the excavation and management of soil that may contain materials that are considered special solid waste as designated by the State of Colorado's

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Solid Waste regulations. Once Property development activities are complete and soils managed in accordance with this MMP, the Property's environmental condition will be protective of human health and the environment for its intended end use. This MMP is intended to provide contractors performing excavation (soil handling) activities at the Property with a procedure for identifying and managing contaminated soils or groundwater as they are encountered.

This MMP has been prepared to define how excavation activities will be monitored during the development of the Property. For purposes of this MMP, the Property is defined as any area associated with the Property and includes surrounding land that requires construction related activity to support the development of the Property. This includes those areas where utility connection is required to existing utilities that may not be physically located on the Property.

The development of the Property will comply with the hazardous and solid waste regulations of the State of Colorado (administered by the Colorado Department of Public Health and Environment ["CDPHE"]), requirements of the Colorado Department of Labor and Employment ("CDLE") Oil and Public Safety Section ("OPS"), and requirements established by the City and County of Boulder and associated utilities with regard to street and utility right-of-ways as these relate to contaminated soil, water generated during construction, and other materials. This MMP is intended to:

- Provide procedures for identifying contamination or other environmental concerns during development;
- Be compatible with earthwork activities;
- Minimize the quantity of excavated soil managed as contaminated; and
- Determine the disposition/disposal options for regulated materials.

The MMP outlines procedures to protect workers, public health, and the environment during development activities. This MMP also provides the administrative requirements under all contracts administered by the City so that the appropriate cost accounting measures are followed to effectively account for remediation expenses incurred during development. This MMP addresses the decontamination procedures for equipment and materials. Earthwork operations and decontamination are discussed in the context of the procedures to be followed when regulated soils and/or groundwater are encountered during construction activities.

This MMP has been prepared primarily to facilitate coordination between the City, the City's Construction Manager, the environmental Materials Management Coordinator ("MMC"), and all contractors performing excavation activities (as defined in this MMP) on the Property under contract with the City. Contractors performing work shall utilize this MMP to identify and manage

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contaminated soils, water generated from construction, materials, and equipment. This MMP applies only to existing contamination that may be encountered. *Contamination caused by the contractor in execution of its work is the sole responsibility of the contractor to remediate as necessary in accordance with State and Federal requirements. contractors responsible for a release as defined by the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") must provide the necessary No Further Action ("NFA") documentation from the appropriate regulating entity that the release/spill has been remediated satisfactorily.*

2.0 PROJECT CONTACTS AND GENERAL DEFINITIONS

2.1 PROJECT CONTACTS

Project contacts may change from preliminary planning to the actual implementation of the project. Project contacts will be confirmed and identified at the implementation of the project and will become a part of this document at that time. A list of "Project Specific" contacts will be developed and maintained with a copy of this MMP in the onsite construction office for the project. At this time, the following contacts and their contact information have been identified.

Property Owner:
Boulder Parks & Recreation
3198 Broadway
Boulder, Colorado 80304

Owner's Representative
Boulder Parks & Recreation
3198 Broadway
Boulder, Colorado 80304
Attn: Mr. Doug Godfrey, PLA
303-413-7200

godfreyd@bouldercolorado.gov

Construction Manager - Responsible Party in Control of the Development Construction

To be determined

Materials Management Coordinator ("MMC") - Responsible for Responding to and Mitigating Environmental Conditions Encountered During Construction

Casey Resources, Inc.
4890 Kipling Street
Wheat Ridge, Colorado 80033
Attn: To be determined
303-940-7800
Contact@caseyresoucesinc.com

2.2 GENERAL DEFINITIONS

The following general definitions apply to terms used in this MMP:

ACM	Asbestos Containing Material
ACS	Asbestos Contaminated Soil
CABI	CDPHE Certified Asbestos Building Inspector
CDLE	Colorado Department of Labor and Employment
CDPHE	Colorado Department of Public Health & Environment
CDPS	Colorado Discharge Permit System
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
City	City of Boulder's Parks & Recreation
CRI	Casey Resources, Inc.
DFA	Daily Force Account (Cost Tracking)
DRO	Diesel Range Organics
EPA	Environmental Protection Agency
GRO	Gasoline Range Organics
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MMC	Materials Management Coordinator
MMP	Materials Management Plan
NFA	No Further Action
OPS	Oil and Public Safety
ORO	Oil Range Organics
OSHA	Occupational Safety and Health Administration
PAHs	Polynuclear Aromatic Hydrocarbons
PCE	Tetrachloroethene
PID	Photo-ionization Detector
PLM	Polar Light Microscopy
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act

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RSLs	Regional Screening Levels
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbon
Trigger Level	One Cubic Yard
VOCs	Volatile Organic Compounds
WAF	Work Authorization Form
XRF	X-Ray Fluorescence

3.0 SITE TRAINING REQUIREMENTS

Full-time environmental oversight by the MMC is not anticipated for the development of the Property and, as such, personnel, including supervisors and management, must have training that that will assist them in identifying potential environmental conditions as well as the procedures to be followed should environmental conditions be encountered. For this project, it is the responsibility of all contractors to be aware of environmental conditions and to notify the appropriate supervisor(s).

The awareness training for onsite personnel does not supersede any Federal and/or State training required to perform the craft of an individual's job but instead compliments it specific to environmental conditions. It is the responsibility of each of the City's contractors and subcontractors to ensure that these training requirements are met before personnel begin working on the Property. Enforcement of these requirements may be delegated at any time, but generally is the responsibility of the City's Construction Manager to ensure that these training requirements are met for the intended site development.

The following training shall be conducted in a manner that the attendee is able to understand.

3.1 SITE SPECIFIC AWARENESS TRAINING

All personnel performing and/or overseeing soil disturbing activities will have Site Specific Awareness Training, which will be provided by the MMC. This training shall cover, at a minimum, the following:

- A description of the Property and/or development site (i.e., the current Property development), its boundaries, and its history;

- A description of environmental conditions that could possibly be encountered during the development of the Property;
- A description of activities taking place on the Property and/or development site, and those that could result in exposure to environmental conditions;
- Response actions if suspect environmental conditions are encountered and contact information for the MMC;
- Engineering controls, work practices, and other measures to prevent contact with environmental conditions; and
- Personnel and equipment decontamination.

It is the responsibility of the City's Construction Manager or other designee to ensure that these training requirements are met before personnel begin working on the Property. Enforcement of these requirements may be delegated at any time. Attendance at Site Specific Awareness Training shall be documented and copies of such documentation shall be maintained on Property and/or development site by the City's Construction Manager or other designee. Copies of all certificates of training shall be provided to the MMC.

3.2 ASBESTOS CONTAINING MATERIAL AWARENESS TRAINING

Asbestos containing material ("ACM") has not been identified on the Property; however, there is a possibility that ACM could be discovered. As such, all personnel receiving Site Specific Awareness Training shall also receive Asbestos Containing Material Awareness Training. This training shall cover the following:

- The background of asbestos;
- The possible health effects associated with exposure to asbestos;
- The nature of operations that could result in exposure to ACM;
- Identification of suspect ACM;
- Response actions if suspect or known ACM is encountered and contact information for the MMC; and
- Engineering controls, work practices, and other measures to prevent contact with ACM.

This training shall be conducted by a CDPHE Certified Asbestos Building Inspector ("CABI") from CRI.

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Asbestos awareness training is not required if the employee has current CDPHE issued certification as an Asbestos Worker, Supervisor, Building Inspector, Management Planner, Project Designer, and/or Air Monitoring Specialist; however, a copy of the CDPHE certification will be required from that employee.

4.0 ACCOUNTING OF CONTAMINATION EXPENSES[P1]

This section provides specific contract requirements for the handling and disposition of regulated soils and groundwater encountered during construction. The management of regulated materials requires specific cost (force account) procedures, which will provide the necessary project controls for the contractor to be reimbursed under a change order condition, if appropriate. The contractor shall follow these administrative procedures in order to seek reimbursement under the contract for the management of contaminated materials.

If the geotechnical engineer or his designee deems the soil/impacted soil to be unsuitable and must be removed from the Property, it will be designated for offsite disposal as special solid waste unless environmental screening (as described below) determines it to be other than special solid waste.

Environmental screening will be completed after geotechnical screening is completed. Environmental screening will be performed by the MMC during soil disturbing activities of identified impacted areas. Those soils that are not usable onsite and require offsite disposal will be subject to the force account. Any handling of such soils will be addressed as a changed condition using the cost accounting procedures provided in this section.

Identification of non-anticipated suspected contaminated soil, e.g. volatile organic contamination, the contractor shall stop work and the MMC will be summoned. All notifications will be given a priority response with appropriate contingency measures being employed by the contractor until the MMC assesses the condition/hazard. **If necessary, the contractor shall coordinate with the Construction Manager regarding working in another location until the MMC deems the area accessible for construction activities to resume.**

The contractor shall continue working at an alternative location as directed by the Construction Manager or unless directed otherwise by the contractor's authorized health and safety officer. No standby charges will be incurred unless the health and safety officer and the MMC concur that work be stopped and the area be vacated and the Construction Manager determines that no alternative work locations are available to the contractor. The MMC will further assess the suspected contamination and perform the required characterization so that recommendations regarding the

appropriate personal protective equipment ("PPE") and materials handling procedures are made to the contractor.

As the contractor continues work, the MMC will direct the segregation and placement of materials (stockpiling of soils or pumping of construction water). The contractor shall be compensated for any additional labor and equipment to excavate soils suspected to be contaminated.

The contractor, in cooperation with the MMC, shall prepare a Work Authorization Form ("WAF"), which describes the additional work required as a result of managing regulated soils or groundwater. A copy of this form is attached in Appendix A. Upon review and approval, the MMC and the Construction Manager shall sign the WAF, which authorizes the execution of the force account work basis, which is designated on the Work Authorization Form (i.e., time and expense, unit price, or lump sum estimate). This authorization procedure shall form the basis for compensation under the contract when accompanied by the required Property and/or development site Force Account documentation as backup (Daily Force Account ["DFA"]; also attached in Appendix A). The contractor and MMC shall execute the Force Account Sheets daily until the City, Construction Manager, and/or MMC considers the scope of work covered under the WAF complete.

The contractor shall submit approved WAF and accompanying DFAs for payment as a change order to the contract within ten days of the Work Authorization approval as part of the normal monthly progress payment process. All quantities associated with Force Account work shall be agreed upon between the contractor and the Construction Manager on a daily basis unless directed otherwise by the Construction Manager.

5.0 FIELD SCREENING METHODS

It is not anticipated that environmental impacts will be encountered during the development work at the Property, with the exception of the potential discovery of slag materials in the stream banks and terrace areas of Boulder Creek. Site contractors will have undergone Site Awareness Training that will assist them with the identification of environmental impacts. The site contractors will be expected to notify their superiors if they encounter soils that exhibit odors and/or are different in color based on the surrounding soil (looks bad/smells bad). Non-impacted soil should be light brown to brown in color, without any noticeable odor, although this is not always the case.

Intrusive activities could disturb soils impacted with a variety of different compounds. Polynuclear aromatic hydrocarbons ("PAHs") impacted soil will typically have black, dark brown, or mottled coloration and slight to strong petroleum-type odor. Total petroleum hydrocarbon ("TPH")

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impacted soil will be gray to black and also exhibit slight to strong petroleum odor. Volatile organic compounds ("VOCs") may or may not discolor the soils; however, depending on the level of contamination, will exhibit slight to strong odor. The odor will be similar to cleaning solvent odor and can also be "sweet" smelling. Metal impacted soil and slag material will not exhibit any odor. The metal impacted soil can be black or mottled with yellow, red, orange, and rusty brown pigments and have an appearance of very fine-grained sand tailings. The slag material will be black in color with a glass-like or melted appearance. Slag can also be more brown-red brown and look like pumice (i.e., abundant voids throughout the rock).

Site contractors should be aware of the "looks bad/smells bad" rule of thumb and stop work if any of the above soil impacts are discovered. If any of these potential impacts are identified by the site contractors, the work in the area must be stopped, the project supervisor alerted of the discovery, and CRI notified.

CRI personnel will travel to the discovery site as quickly as possible to complete field screening. Field screening refers to the use of portable devices capable of detecting metals and VOCs including petroleum compounds on a real time basis or by rapid field analytical techniques, and field observations. Field screening specific to soil and groundwater is discussed in the following sections.

5.1 SOIL SCREENING

Environmental field screening of the excavated soil will be conducted as follows:

- Observation – This includes observation of the material color, odor, or other characteristics, with these being noted in the field logbook.
- PAH monitoring – PAH concentrations in soil cannot be determined by field equipment or other field techniques. In general, all soil determined by observation to be impacted by evidence of staining will be sampled and analyzed for PAHs by Environmental Protection Agency ("EPA") Method 8270-SIM. Depending on site circumstances, the PAH analysis will be conducted on one, three, or five day turn-a-round. At a minimum, at least one soil sample per 100 cubic yards of suspect material will be collected.
- Volatile vapor monitoring - VOCs are not anticipated to be discovered on the Property. A photo-ionization detector ("PID") will be used to assess the potential occurrence of VOCs. Soils exhibiting these characteristics will be segregated into a separate stockpile. If field screening indicates volatile vapors, a soil sample from the segregated stockpile will be collected and analyzed for VOCs by EPA Method 8260. Depending on site circumstances,

the VOC analysis will be conducted on one, three, or five day turn-a-round. At a minimum, at least one soil sample per 100 cubic yards of suspect material will be collected.

- Heavy metal monitoring - Heavy metal impact is not anticipated to be discovered on the Property. If suspected metal impact is identified (yellow to orange stained soils, slag pieces, tailings, or other indications), the soil will be screened using x-ray fluorescence ("XRF") field equipment and a soil sample will be submitted to the offsite laboratory for confirmation analysis. Excavated soils suspected of being impacted will be placed in separate stockpiles.
- TPH impact monitoring - TPH impact again is not anticipated to be discovered. TPH impact will be determined by observation (staining), odor, and use of the PID. Soils exhibiting these characteristics will be segregated into a separate stockpile. If petroleum impact is suspected, a composite soil sample from the segregated stockpile will be collected and analyzed for TPH carbon chain by EPA Method 8015 and VOCs by EPA Method 8260. At a minimum, at least one soil sample per 100 cubic yards of suspect material will be collected.

The contractor shall not be responsible for any laboratory analysis as part of the characterization and confirmation sampling required by this MMP unless the contractor mismanages stockpiled soil or excavates/handles soils beyond the limits of its contract and was not otherwise directed to manage said soil as part of this MMP.

5.2 ASBESTOS SCREENING

Asbestos regulations promulgated in 2014 require asbestos monitoring if any debris is identified. Based on the identification of fill material on the Property (Ground Engineering, Inc., 2016), there is a potential that debris may be encountered. As such, steps to monitor for ACM are presented in this section. However, it is not anticipated that ACM will be discovered. Debris is defined in the regulation by "any discarded material that contains or consists of any of the following: construction, renovation and demolitions debris (regardless of how it was generated), building or facility components, components of building systems (HVAC, plumbing, electrical, control, fire protection, roofing), components of pavement or drainage systems, industrial or machinery components, and/or mechanical components from motorized vehicles (6 CCR 1007-2; CDPHE, 2014c). In the unlikely event ACM is discovered and the quantity exceeds one cubic yard, procedures outlined in Section 5.5.7 of the subject regulations shall be followed to address that impact.

If debris is encountered or suspect ACM identified by site contractors, soil disturbing activities in these areas will be inspected/monitored by a CABI who has at least six months of documented experience performing ACM inspections in soil. Inspection of soil imported to the Property that meets the Import Soils Protocol (Appendix B) does not require inspection unless required as a result

of the import evaluation. Import soils that are known not to contain fill material and are native soils does not require inspection.

The steps described below will be completed when suspect ACM is observed. When debris is encountered that is not green waste (biodegradable waste), natural stone, metal, glass, plastic, wood, and/or bare concrete, the debris shall either be (1) assumed to contain ACM or (2) analyzed by polar light microscopy ("PLM") by a National Voluntary Laboratory Accreditation Program participating laboratory. Debris that is assumed to contain asbestos or determined to contain asbestos by PLM, plus six inches in all directions of surrounding soil or other matrix material, is considered asbestos-containing soil ("ACS"). Debris that is determined not to contain ACM by PLM shall be managed in the same manner as other material at the discretion of the contractor performing the soil disturbing activity with consultation from the geotechnical engineer and MMC.

ACS may be removed or left-in-place and its location documented. ACS may be removed using hand methods by the CABI or by mechanical means using low emissions methods, but if at any time the quantity of ACS exceeds or will exceed one cubic yard ("trigger level"), all ACS disturbing activities must stop and all future ACS disturbing activities at that location must be performed in accordance with Section 5.5.7 of 6 CCR 1007-2 (CDPHE, 2014c). ACS *less* than the trigger level shall be handled as follows:

- Placed in asbestos waste bags with a minimum thickness of six-mils if the ACS contains non-friable ACM; or
- Placed in two asbestos waste bags, each with a minimum thickness of six-mils, one inside the other, if the ACS contains any friable ACM.

All bagged ACS shall be properly disposed as either friable or non-friable asbestos containing waste material. Disturbance of ACS less than the trigger level shall comply with Occupational Safety and Health Administration ("OSHA") requirements.

5.3 GROUNDWATER SCREENING

Any water generated from construction dewatering activities must comply with a permit obtained by the contractor from the State of Colorado's Discharge Permit System ("CDPS") or the water must be contained and treated offsite. If groundwater is encountered during construction, it must be contained and appropriate samples collected and analyzed. Field screening of groundwater is limited to observation (color, oil sheen), odor, and measurement of volatile vapors with a PID.

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6.0 SUMMARY OF SOIL AND WATER ACTION LEVELS

The future use of the Property as a municipal park will result in the requirement to remediate the Property to residential levels.

6.1 SOIL ACTION LEVELS

Soil concentrations will be compared to the EPA Regional Screening Levels ("RSLs") for residential use. The latest version of the *Regional Screening Level (RSL) Summary Table (TR=1E-6, HQ=1)* can be found online at http://www.epa.gov/risk/risk-based-screening-table-generic-tables and is attached as Appendix C. It is noted that the RSL values are updated on a routine basis by the EPA and that the values shown below and Appendix C are current as of the publication dated November 2015 (EPA, 2015). In the past, revisions have been made by EPA in January, June, and November; however, a new version for 2016 has not been developed as of the date of this MMP. The RSLs should be reviewed and revised as necessary should the project not be implemented within one year of the date of this MMP.

The following specific soil cleanup concentrations will be used at the Property:

Table 1 - Resource Conservation and Recovery ("RCRA") Act Metals

Metal Name	EPA RSL - Residential Use	EPA RSL - Commercial/Industrial Use	Toxicity Characteristic Regulatory Level**
Arsenic	11 mg/kg *	11 mg/kg *	5.0 mg/L
Barium	15,000 mg/kg	220,000 mg/kg	100.0 mg/L
Cadmium	71 mg/kg	980 mg/kg	1.0 mg/L
Chromium	120,000 mg/kg	1,800,000 mg/kg	5.0 mg/L
Lead	400 mg/kg	800 mg/kg	5.0 mg/L
Mercury	23 mg/kg	350 mg/kg	0.2 mg/L
Selenium	390 mg/kg	5,800 mg/kg	1.0 mg/L
Silver	390 mg/kg	5,800 mg/kg	5.0 mg/L

*CDPHE designated soil cleanup value (CDPHE, 2014b).
**See Section 7.0
mg/kg = milligram per kilogram
mg/L = milligrams per liter

Table 2 - Selected Volatile Organic Compounds ("VOCs")*

VOC Name	EPA RSL - Residential Use	EPA RSL - Commercial/Industrial Use	Toxicity Characteristic Regulatory Level**
Benzene	1.2 mg/kg	5.1 mg/kg	0.5 mg/L

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Toluene	4,900 mg/kg	47,000 mg/kg	NA
Ethylbenzene	5.8 mg/kg	25 mg/kg	NA
Xylene	560 - 650 mg/kg	2,400 - 2,800 mg/kg	NA
Carbon tetrachloride	0.65 mg/kg	2.9 mg/kg	0.5 mg/L
1,2-Dichloroethane	0.46 mg/kg	2.0 mg/kg	0.5 mg/L
cis-1,2-Dichloroethene	160 mg/kg	2,300 mg/kg	NA
Tetrachloroethene (“PCE”)	24 mg/kg	100 mg/kg	0.7 mg/L
Trichloroethene (“TCE”)	0.94 mg/kg	6.0 mg/kg	0.5 mg/L

* See Appendix C for other VOC RSLs.
**See Section 7.0; mg/L = milligrams per liter.
NA = Toxicity Characteristic “Not applicable”.

Table 3 - Polynuclear Aromatic Hydrocarbons (“PAHs”)		
PAH Name	**EPA RSL - Residential Use**	**EPA RSL - Commercial/Industrial Use**
Acenaphthene	3,600 mg/kg	45,000 mg/kg
Acenaphthylene	NE*	NE
Anthracene	18,000 mg/kg	230,000
Benzo(a)-anthracene	0.16 mg/kg	2.9 mg/kg
Benzo(a)-pyrene	0.016 mg/kg	0.29 mg/kg
Benzo(b)-fluoranthene	0.16 mg/kg	2.9 mg/kg
Benzo(g,h,i)-perylene	NE	NE
Benzo(k)-fluoranthene	1.6 mg/kg	29 mg/kg
Chrysene	16 mg/kg	290 mg/kg
Dibenzo(a,h)-anthracene	0.016 mg/kg	0.29 mg/kg
Fluoranthene	2,400 mg/kg	30,000 mg/kg
Fluorene	2,400 mg/kg	30,000 mg/kg
Table 3 - Polynuclear Aromatic Hydrocarbons (Continued)		
PAH Name	**EPA RSL - Residential Use**	**EPA RSL - Commercial/Industrial Use**
Indeno(1,2,3-C,D) pyrene	0.16 mg/kg	2.9 mg/kg
Naphthalene	3.8 mg/kg	17 mg/kg

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Phenanthrene	NE	NE
Pyrene	1,800 mg/kg	23,000 mg/kg

*NE = EPA RSL "Not Established".

Table 4 - Total Petroleum Hydrocarbons ("TPH")		
TPH	**EPA RSL - Residential Use**	**EPA RSL - Commercial/Industrial Use**
TPH Carbon Chain*	82 mg/kg	420 mg/kg

*TPH Carbon Chain includes gasoline range organics ("GRO"), diesel range organics ("DRO"), and oil range organics ("ORO").

6.2 GROUNDWATER ACTION LEVELS

If construction dewatering is necessary, any water generated from construction dewatering activities must comply with a permit obtained through the CDPS.

If a CDPS permit is required, it will be obtained by the contractor. The permit will outline the water quality standards that must be measured prior to discharge of the water. In general, the Colorado Groundwater Standards (CDPHE, 2013) will apply along with general water quality parameters (pH, conductivity, total dissolved solids, etc) associated with the CDPS permit for the Property.

6.3 IMPORTED SOILS ACTION LEVELS

All soils imported for use on the Property shall be certified by the generator of the soil (borrow source owner) to be "clean" soil. Clean is defined as having cleared the Import Soils Protocol, which includes meeting the CDPHE's proposed soil cleanup values (EPA RSLs) for residential development. This certification along with the appropriate analytical data for the imported material shall be made in writing by the contractor supplying the soil or by the source generator. If this information is not available from the generator, the MMC will initiate an investigation of the source site per the Import Soils Protocol. The Import Soils Protocol is included as Appendix B to this MMP. Note that the costs associated with certifying an import soil as clean under the Import Soils Protocol are the responsibility of the contractor importing/using the soil on the Property.

7.0 SLAG, SOIL, AND GROUNDWATER MANAGEMENT

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The discovery of slag material, impacted soil, or impacted groundwater developed during dewatering will result in special management requirements for those materials.

7.1 SLAG MATERIALS

If during excavation, slag materials are identified in the excavated soils, the excavated soils with slag material must be placed in a separate stockpile. The slag soils should be physically screened to remove the visible slag to produce a slag stockpile and a "screened soil" stockpile. If such screening is not possible or deemed impractical, stockpiles of soil containing slag will be managed without separation and will be considered slag waste.

For slag stockpiles, screened on not screened, a soil sample will be collected and analyzed for metals. If metals concentrations greater than the residential RSLs are identified and the concentrations exceed 20 times the toxicity characteristic regulatory value listed in Table 1, that soil sample will also be analyzed by the toxicity characteristic leaching procedure ("TCLP") using EPA extraction method 1311 and analytical method 6020B. In addition, a sample of the slag material (no soil) will also be analyzed by TCLP. If any of the concentrations exceed the EPA's maximum concentration for the toxicity characteristic listed in Table 1 for any of the listed metals, the soil must be handled and disposed of as a characteristic hazardous waste at an offsite licensed hazardous waste disposal facility. If the soil/slag meets the listed toxicity concentrations, the soil/slag will be disposed offsite as a special waste with disposal tracked using non-hazardous special waste manifests.

7.2 SOIL EXCEEDING PROPERTY ACTION LEVELS

If the excavated soils contain concentrations of a contaminant at or above the residential action levels discussed in Section 6.0 (Tables 1 through 4) and Appendix C of this MMP, the soil will require special management as outlined below. The impacted soils will have previously been placed in separate stockpiles or the excavation at the area of discovery was placed on hold for field screening and determination of proper disposition.

Metal concentrations - If metals concentrations greater than the residential RSLs are identified and the concentrations exceed 20 times the toxicity characteristic regulatory value listed in Table 1, that soil will be sampled and analyzed by TCLP using EPA extraction method 1311 and analytical method 6020B. If any of the concentrations exceed the EPA's maximum concentration for the toxicity characteristic listed in Table 1 for any of the listed metals, the soil must be handled and disposed of as a characteristic hazardous waste at an offsite licensed hazardous waste disposal facility. If the soil meets the listed toxicity concentrations and the metal concentrations are equal to or greater than the listed residential EPA RSL and less than the commercial/industrial EPA RSLs,

the soil can be disposed offsite as a special waste with disposal tracked using non-hazardous special waste manifests, or with permission from the City, may be transported to another project site that can accept soil meeting commercial/industrial levels. If metal concentrations are greater than the commercial/industrial EPA RSLs and meet the listed toxicity concentrations, the impacted soil must be disposed as a special waste with disposal tracked using non-hazardous special waste manifests.

VOC concentrations equal to or greater than the listed EPA RSL - Soil containing VOC concentrations equal to or greater than the listed residential EPA RSL and less than the commercial/industrial EPA RSLs must first be assessed by the 20 times toxicity characteristic rule. If the concentration is equal to or greater than 20 times the toxicity characteristic regulatory level, the soil must also be analyzed for TCLP concentration. If any of the concentrations exceed the EPA's maximum concentration for the toxicity characteristic listed in Table 2 or additional VOCs listed in 40 Code of Federal Regulations ("CFR") 261.24, the soil must be handled and disposed of as a characteristic hazardous waste at an offsite licensed hazardous waste disposal facility. If the soil meets the listed toxicity concentrations and the metal concentrations are equal to or greater than the listed residential EPA RSL and less than the commercial/industrial EPA RSLs, the soil can be disposed offsite as a special waste with disposal tracked using non-hazardous special waste manifests, or with permission from the City, may be transported to another project site that can accept soil meeting commercial/industrial levels. If metal concentrations are greater than the commercial/industrial EPA RSLs and meet the listed toxicity concentrations, the impacted soil must be disposed as a special waste with disposal tracked using non-hazardous special waste manifests.

PAH concentrations equal to or greater than the listed EPA RSL - Soil containing PAH concentrations equal to or greater than the listed residential EPA RSL and less than the commercial/industrial EPA RSLs (Table 3) can be disposed offsite as a special waste with disposal tracked using non-hazardous special waste manifests, or with permission from the City, may be transported to another project site that can accept soil meeting commercial/industrial levels. If PAH concentrations are greater than the commercial/industrial EPA RSLs, the impacted soil must be disposed as a special waste with disposal tracked using non-hazardous special waste manifests.

TPH concentrations - Soil containing TPH concentrations equal to or greater than 82 mg/kg will be removed from the Property and disposed offsite as a special waste with disposal tracked using non-hazardous special waste manifests. It is recommended that TPH soil not be transported to another project site.

If impact other than metals, VOCs, PAHs, or TPH is identified during screening, these soils will be separately stockpiled and sampled. The MMC will evaluate the results and determine the deposition of the materials at that time. The MMC will make a recommendation to the City

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regarding the management of such soils based on the costs and benefits of offsite disposal versus onsite management of such soils.

7.3 SOILS MEETING RESIDENTIAL ACTION LEVELS

If the excavated soils contain concentrations of a contaminant less than the established residential action levels, the excavated soils may remain onsite for unrestricted use including placement in utility corridors. These soils can also be removed from the Property and transported to a different project site as backfill material or disposed at a landfill as solid waste. The only exception to this is TPH soils.

7.4 GROUNDWATER MANAGEMENT DURING CONSTRUCTION[P2]

Any water generated from construction dewatering activities will abide by the requirements of the CDPS permit obtained for the project. When management of groundwater is anticipated, the contractor shall apply for a CDPS dewatering permit and will implement the requirements of the permit. Additional analysis to further characterize water generated during construction will be conducted by the contractor, as necessary. Should the contractor choose to dispose of the groundwater at an offsite treatment and disposal facility, no CDPS permit will be required. In either case, all groundwater generated by construction activities must be contained. The CDPHE Water Quality Control Division will determine what characterization samples will be required, which parameters will be field monitored and/or analyzed on a weekly basis, and whether or not treatment of the discharge water will be required.

No water generated from construction dewatering activities will be directly discharged into any storm or sanitary sewers, directly discharged into a ditch or other type of conveyance, or land disposed unless the specific permit allows.

8.0 MATERIAL MANAGEMENT DURING CONSTRUCTION

In order to comply with the project requirements and minimize impacts to the project schedule, materials management during earthwork operations will be approached with the following emphases:

- Schedule impacts to the earthwork contractors can be minimized by the efficient screening, sampling, and analysis of excavated soil, the efficient handling of soil which exceeds action levels, and effective coordination among the City, Construction Manager, MMC, and the contractor; and

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- Expenses relating to the management of contaminated material can be minimized by prioritizing the movement and staging of soil, and by reducing or eliminating "double handling" of soil exceeding action levels. For example, where possible every effort will be made to manage and load out soil at the location where it is generated rather than moving it to a stockpile.

The following shall apply for all intrusive activities where soil action levels are exceeded:

- The contractor will provide equipment, operators, and foreman/supervisors familiar with the requirements of this MMP and the Property conditions. Earthwork operations will be closely supervised by the Construction Manager and monitored by the MMC to avoid costs associated with mismanagement of soil or health and safety issues resulting from mismanagement of soil. Also, mismanagement of soils resulting in the generation and release of fugitive dust will not be tolerated.
- Where slag is encountered the contractor performing the work should upgrade its current PPE to a modified Level D as defined by OSHA (29 CFR 1910) to include work gloves being worn at all times when handling soils containing slag. Where other soil impacts are identified, the MMC will notify the contractor on the types and concentrations of the contaminants discovered. It will be the contractor's responsibility to develop the proper level of PPE protection for its employees.
- Haul roads and access roads will be selected to minimize transport over areas of the Property where soils exceeding action levels are exposed or anticipated to be near surface.
- The contractor shall cooperate with the MMC at both the cut and fill working surfaces to allow for observation and sampling of soils, as necessary.
- Soil Screening, as appropriate by the MMC will take place at the 'working face' of the excavation. The MMC or his designated technician will screen soil and direct the contractor where soils greater than action levels are identified.
- Soil exceeding action levels will be segregated at the direction of the MMC and the Construction Manager. To the extent possible, areas will be taped, roped, or fenced off to alert operators to their location. The contractor shall also be responsible for communicating to all equipment operators and labor personnel of separately stockpiled impacted soil so no disturbance of such soil occurs without direction from the Construction Manager. At a minimum, colored flagging or survey stakes color coded with fluorescent paint or survey ribbon will be placed by the MMC at the boundaries of exposed soil exceeding action levels to distinguish them from soil stockpiles meeting action levels. The contractor may be directed to place certain soils exceeding action levels on plastic liners (Visqueen or

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equivalent) or where directed into roll-off containers or drums. Such soil stockpiles shall be covered with plastic or sprayed with a dust suppressant approved by the Construction Manager during non-operating hours (when typical dust control measures are not available) to prevent windblown dust and provide odor control. Appropriate silt fencing to comply with stormwater management requirements shall be placed around all temporary stockpiles to prevent erosion in accordance with the site Stormwater Management Plan.

- Direct loading may occur possibly during large excavations that require export. If direct loading from the working face is employed, screening of soils will be implemented at the excavation face.
- Encountering of foreign objects such as underground tanks and/or hazardous waste is not anticipated. In the unlikely event that such a condition should be encountered, activities in the area are to cease immediately. The MMC will provide appropriate information to the contractor so that the contractor can make the appropriate decision regarding levels of protection for its employees. The contractor shall maintain sole responsibility for the protection of its employees in accordance with OSHA regulations. The MMC will provide direction for the abatement and removal of the condition.

The MMC will document soil screening activities in daily logs and periodic reporting to the Construction Manager and the City to further document that soils handled as part of the development activities are appropriately managed.

9.0 FUGITIVE DUST EMISSIONS

The primary method of minimization of fugitive dust emissions will be the use of water to control dispersion of soil during excavation, loading, transport, stockpiling, and/or placement of soil. The contractor will provide Best Management Practices on the Property during all earthwork operations for use as needed to control dust.

If necessary, the contractor will moisturize and mechanically roll stockpiles to minimize dust dispersion. As necessary, the surface of stockpiled soil will be re-moistened as necessary to eliminate the potential for dust emissions. **All work that takes place in the development of the Property will be held to a goal of zero dust emissions. There will be no tolerance for any visible dust leaving the Property.**

As such, each contractor will be responsible for submitting a “Property Specific Dust Control Plan” for review and approval by the Construction Manager and the MMC prior to mobilization by the

contractor. Dust control plans and their implementation shall meet all State requirements under the regulations.

10.0 DECONTAMINATION OF PERSONNEL AND EQUIPMENT

For general construction work in the Property area, decontamination of personnel will include only typical hygiene requirements such as washing hands and limiting eating and smoking in the work area. Decontamination of equipment leaving the site will include visual inspection and hand removal of caked on mud, primarily to meet the City or County road tracking requirements. **Note: contractors are reminded that spreading impacted soil across the site is to be avoided, especially in areas that are capped with clean soil. If these areas are re-impacted, the contractor will be required to remediate that area and replace the cap material as necessary.**

Should significant impacted soil areas be discovered, the following decontamination procedures will be implemented by the remediation contractors.

9.1 DECONTAMINATION AREA

A decontamination area will be designated at the access/egress portion of the contaminated soil removal and stockpile area. This area will be used for equipment, tools, and personnel decontamination, as appropriate. Every effort will be made to limit decontamination activities on portions of the Property that have previously been capped with clean soil. If it is necessary to perform decontamination on portions of the Property that have previously been capped with clean soil, the area will be cleaned by removing any contaminated soil and/or water and additional cap placed if necessary to meet the clean cap requirements.

9.2 DECONTAMINATION PROCEDURES

All personnel working in contaminated areas shall minimize contact with and exposure to contaminated soils and water. Prevention of contamination is the first step in any decontamination operation. PPE that is reused by personnel will be decontaminated to meet a visual standard. Such personnel shall be trained to use PPE. Training requirements for personnel involved in regulated materials management shall comply with OSHA regulation (29 CFR 1910.120). All PPE that is planned for reuse shall be inspected for potential problems or defects. Disposable PPE, such as coveralls and gloves, shall be placed in containers designated by the contractor, labeled, and disposed of as a waste (i.e., profiled and manifested as a solid or hazardous waste, as appropriate). This standard is considered appropriate based on the nature and occurrence of contamination at the Property. **All Property contractors are responsible for the health and safety of their employees**

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in accordance with OSHA regulations. At no time shall the City or its agents, the Construction Manager or the MMC be responsible for the health and safety of any individuals employed by a contractor.

Note: In the event of a life-threatening emergency, decontamination procedures are a secondary concern. If traditional decontamination procedures are not conducted under life threatening or emergency conditions, emergency medical personnel should be warned (in advance, if possible) of the type and extent of contamination. If emergency personnel enter a work area considered contaminated, inform the emergency medical personnel of potential hazards in the work area.

9.3 EQUIPMENT DECONTAMINATION

Equipment will be decontaminated to meet a visual standard. Equipment shall be free from visible soil clods. If necessary, physical cleaning of the equipment payload areas (e.g., loader bucket, truck bed) will be implemented to remove soil clods. Trucks exiting the Property are required to have all loose soil and soil clods removed from tires and undercarriage. If needed, a decontamination pad shall be set up for heavy equipment based on the Property conditions and the nature of contamination. Under no circumstances shall equipment be removed from the contaminated work area which does not meet the visual standard. Water generated from a decontamination procedure shall be placed in designated containers, labeled, properly stored, and managed. Decontamination water will be disposed of in accordance with recommendations from the MMC.

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11.0 REFERENCES

Colorado Department of Labor and Employment, Division of Oil and Public Safety (OPS), 1999. *Risk-Based Corrective Action for Underground Storage Tanks, Surface Soil Cleanup Values for Residential and Commercial Use*.

Colorado Department of Public Health and Environment ("CDPHE"), 2013. *The Basic Standards for Ground Water, CDPHE Water Quality Control Division, 5 CCR 1002-41, Regulation No. 41*. Dated January 31, 2013.

Colorado Department of Public Health and Environment ("CDPHE"), 2014a. *Groundwater Protection Values Soil Cleanup Table.* Dated March 2014.

Colorado Department of Public Health and Environment ("CDPHE"), 2014b. *Arsenic Concentrations in Soil - Risk Management Guidance for Evaluating*. Revised July 2014.

Colorado Department of Public Health and Environment ("CDPHE"), 2014c. *Section 5.5 Management of Regulated Asbestos Contaminated Soil ("RACS"), Colorado Solid Waste Regulations (6 CCR 1007-2, Part 1)*. Dated August 2014).

Environmental Protection Agency ("EPA"), 2015. *Regional Screening Level (RSL) Summary Table November 2015*. Updated November 2015.

Ground Engineering, Inc., 2016. *Geotechnical Subsurface Exploration Program, Boulder Civic Area Park Development Boulder, Colorado.* Dated March 31, 2016.

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FIGURES

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APPENDIX A

WORK AUTHORIZATION AND DAILY FORCE ACCOUNT FORMS

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APPENDIX B

IMPORT SOILS PROTOCOL

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APPENDIX C

ENVIRONMENTAL PROTECTION AGENCY ("EPA") REGIONAL SCREENING LEVEL ("RSL") SUMMARY TABLE NOVEMBER 2015

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Civic Area Development Plan - Special Conditions

SC.6.2 Attachment Two – Art Removal & Storage

Table of Contents

Artwork impacted by Civic Area Construction (Zones A-F): pp. 2-6

1. John King “Dragonfly Giraffe”
2. Turtle play form
3. Bill Vielehr “Winnie the Pooh” bronze sculptures
4. Kristine Smock “Day Dream Dragon” mixed media sculptures
5. Christian Muller “Stone Seating Area” stone, bronze inlay

Map of locations: p. 7

1. "Dragonfly Giraffe"

John King
303-823-6828

Powder-coated, steel sculpture

Points to note:

KINETIC COMPONENT!: Please remove the top of the sculpture first. Most joints are in place with set screws, which will require the appropriate size allen wrench for removal.

The artist is available for consultation if necessary.

The sculpture needs to be padded when dismantling and transporting. Moving blankets, foam and ratchet straps should suffice.

However, the sculpture and handling/rigging equipment should never come in contact with one another (raw metal against metal).

Storing:

Laying the sculpture flat is fine, however it should not come in direct contact with concrete or soil. Please elevate on a palette to prevent water trapping/pooling.

Ideally, please store with tarp overtop.

Prior to reinstall, the artist will outfit sculpture with new bearings and a fresh coat of paint.

2. "Concrete Play Turtle"
Unknown

Concrete/Aggregate

Points to note:
No information is available as it relates to this work. Please take caution in removing, using best judgement and best practices. It appears as the work may best be removed with a straight, flush cut parallel to its base. Please store until further information is available.

Storing:
This sculpture is durable. Special precautions have not been identified.

3. "Winnie the Pooh Garden"
Bill Vielehr, deceased
Contact: Mandy Vink, Office of Arts + Culture: 303-441-4342 OR Chuck Vielehr: 970-532-2040

Bronze: 7 figures, 1 fence

Points to note:
Please note there are **7 individual figures and one fence** that comprise this artwork. The fence is considered a component of the work. Each is screwed to its base. Some access points are more challenging to find than others. ALL components should be stored together, included screws and bases. Please wrap the work in foam or moving blankets individually when handling and/or moving. Sculptures are relatively light for their material, but please take caution when handling. Do not be surprised by weight. Handle with care.

Storing:
These sculptures ideally would be stored indoors. However, if exterior storage is required please store under a canopy. Please store the work upright so water does not pool inside each piece. Works may be supported against one another if appropriate padding (foam/moving blankets) are in place.

4. "Day Dream Dragon"
Kristine Smock – haven't be able to get a hold of
Contact: Mandy Vink, Office of Arts + Culture: 303-441-4342

Ceramic?

Points to note:
Sculpture is in two pieces. Each piece has many facades so please handle with care and be mindful of the various faces. Sculpture is mounted directly to stone pad. Remove screws to remove sculpture. Please wrap in foam/moving blankets/ratchet straps when handling/transporting.

Storing:
Sculpture should have a strong enough foundation that it can be stored resting on a level surface. Ideally it would be tarp-wrapped to be somewhat protected from the conditions as it is currently experiencing deteriorating skim coatings and surface corrosion.

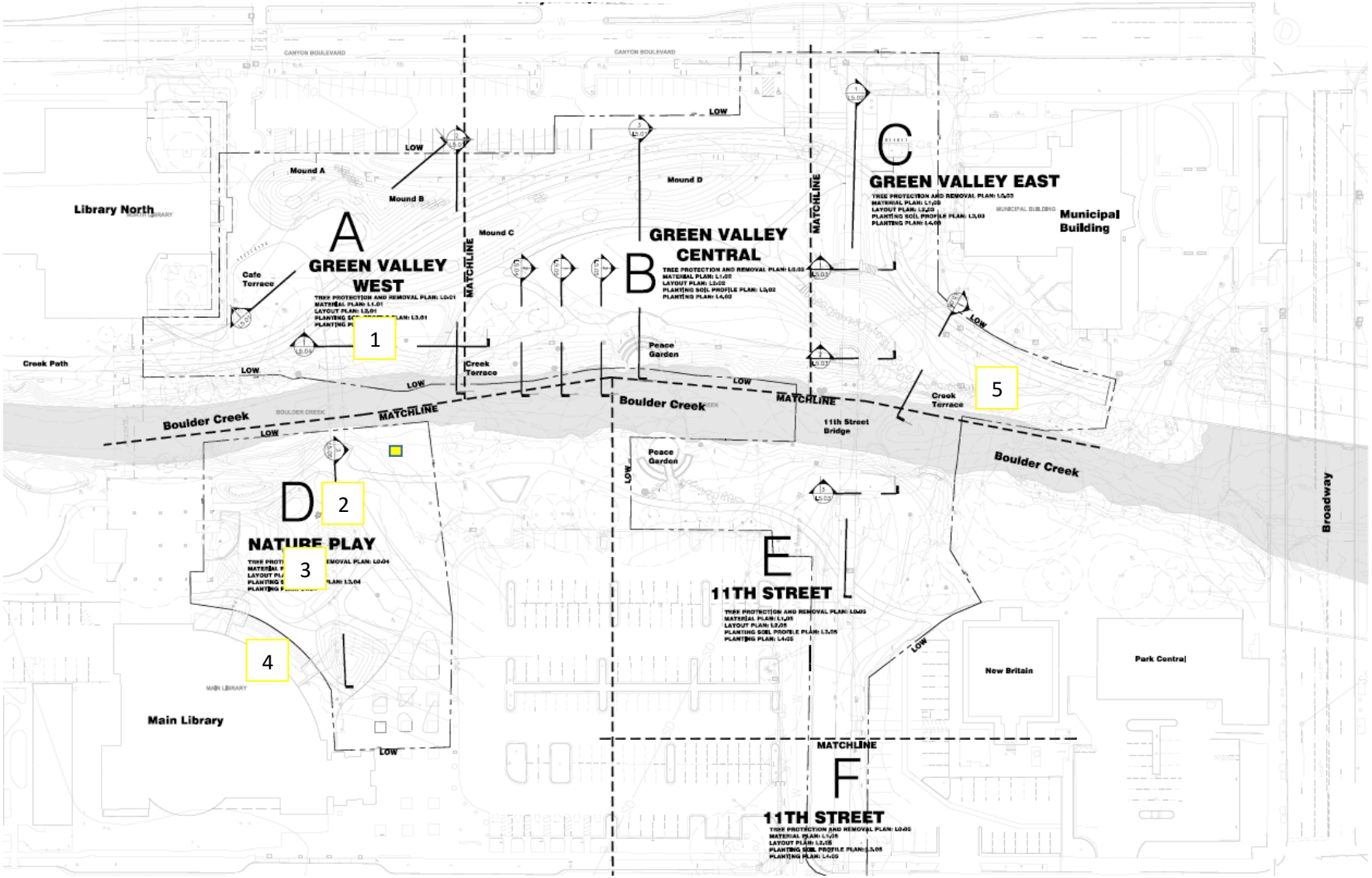
5. "Stone Seating Area"
Christian Muller
Contact:
303-998-0600 home/office
303-807-1039 mobile
christian-muller@comcast.net

Stone with bronze inlay

Points to note:
Artist is in the midst of finding original install files, to be provided. However, if he is unable to find them the recommendation is to remove stone mosaic footer pad and 3 stone seating components. Remove stone slabs first to reveal footer of each seating component. Although a durable material, please take precaution in handling to not scratch or damage the polished surfaces.

Storing:
Stone slabs can be stored together in a crate. Stone seats should be safe uncovered, unprotected. If possible, please elevate.

IF additional details are provided by the artist, they will be submitted.


Library North
Mound A
Mound B
Mound C
Mound D
A
GREEN VALLEY WEST
Cafe Terrace
1
Creek Path
Creek Terrace
Peace Garden
B
GREEN VALLEY CENTRAL
C
GREEN VALLEY EAST
Municipal Building
5
Boulder Creek
MATCHLINE
LOW
11th Street Bridge
D
2
NATURE PLAY
3
4
Main Library
E
11TH STREET
New Britain
Park Central
Broadway
F
11TH STREET

SECTION 00 31 32 – GEOTECHNICAL REPORT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reports of explorations and tests of subsurface conditions at the project site.

1.2 RELATED SECTIONS

A. Section 01 10 00 – Summary of Work

B. Section 31 00 00 – Earthwork

1.3 INVESTIGATION

A. Soil and subsurface investigations were conducted at the site, the results of which are to be found in the report issued by Ground Engineering, March 31, 2016, City of Boulder, Parks and Recreation.

B. A reference copy of the report is included herein, Supplement A (01020)

C. Bidders are expected to examine soils investigation data and to make their own investigation of the site on or prior to the bid date.

1.4 INTERPRETATION

A. Soil investigation data is provided only for information and the convenience of bidders. Owner and Engineer disclaim any responsibility for the accuracy, true location, and extent of the soils investigation that has been prepared by others. They further disclaim responsibility for interpretations of that data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and the presence, and level and extent of underground water.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION 00 31 32

GROUND ENGINEERING

Geotechnical Subsurface Exploration Program
Boulder Civic Area Park Development
Boulder, Colorado

Supplement A (01020)

Prepared for:
City Of Boulder – Parks and Recreation
3198 N. Broadway
Boulder, Colorado 80304

Attention: Mr. Doug Godfrey

Job Number: 16-3524 **March 31, 2016**

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Summary of Soil Corrosion Test Results	Table 2

PURPOSE AND SCOPE OF STUDY

This report presents the results of a subsurface exploration program performed by GROUND Engineering Consultants, Inc. (GROUND) for the proposed improvements to be constructed at the Boulder Civic Area Park Development located southwest of the intersection of Canyon Boulevard and Broadway Street in Boulder, Colorado. This study was conducted in general accordance with GROUND's proposal number 1602-0206, dated February 4, 2016.

Field and office studies provided information regarding surface and subsurface conditions, including existing site vicinity improvements and groundwater. Material samples retrieved during the subsurface exploration were tested in our laboratory to assess the engineering characteristics of the site earth materials. Results of the field, office, and laboratory studies for the proposed improvements are presented below.

This report has been prepared to summarize the data obtained and to present our conclusions and opinions based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of engineering considerations related to construction of the proposed improvements are included herein.

PROPOSED CONSTRUCTION

We understand that proposed construction will consist of a new pedestrian bridge and new walking paths/trails. Lightly loaded pavilion/shelter structures and landscape walls are also being considered; specific locations were not provided. Structural loads for the potential structures were unavailable at the time of this report preparation but are assumed to be relatively light. Additionally, paved parking areas, internal private drives, and underground utilities are also planned. According to the project structural engineer, the pedestrian bridge design will utilize the LRFD method.

If proposed construction, including the anticipated site grading, differs from that described above, or changes subsequently, GROUND should be notified to re-evaluate the information in this report.

SITE CONDITIONS

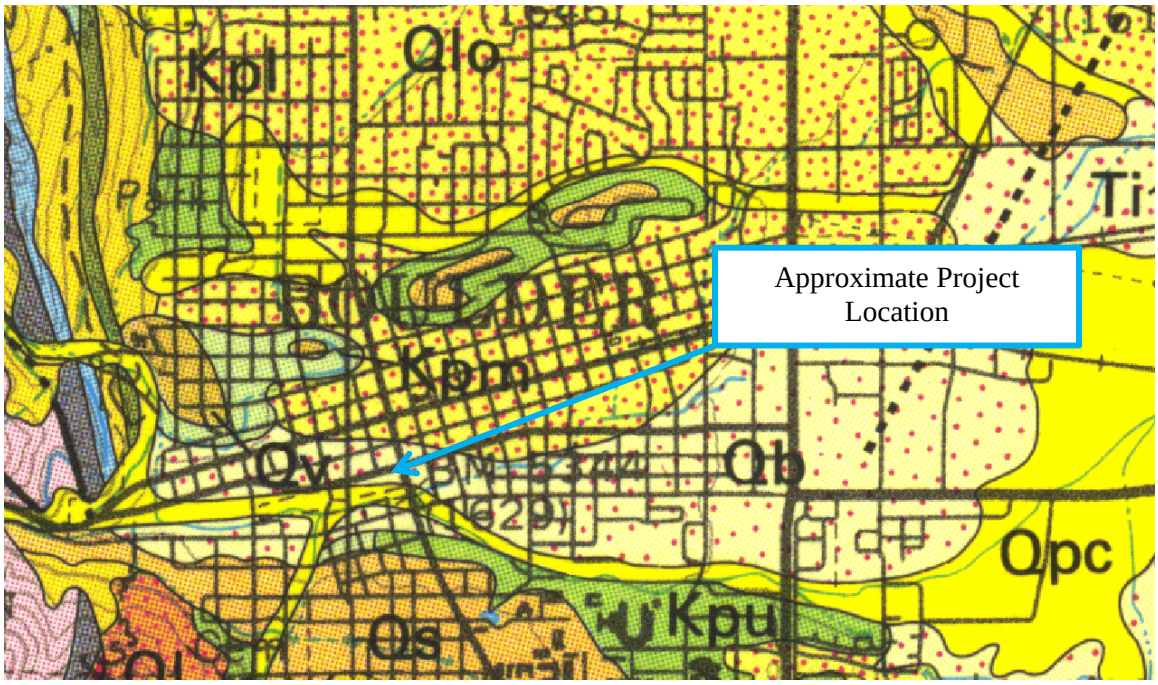
The project area consisted of an existing park/recreation area with landscaped vegetation consisting of short grasses, shrubs, deciduous and evergreen trees. Boulder Creek traverses the site in a generally western to eastern manner. An existing pedestrian bridge crosses over Boulder Creek near the eastern extent of the site. Several underground utilities were located within the project site along the creek and throughout the landscaped areas including water, irrigation, fiber, and electric. Municipal buildings lie to the east and west of the site. Topographically, the project site generally contains gentle slopes up to approximately 2 percent descending towards the existing creek. The project site is bordered by Canyon Boulevard to the north, Arapahoe Avenue to the south, Broadway Street to the east, and 9th Street to the west.

Man-made fill was observed in Test Hole 7 during the subsurface exploration program. The exact extents, limits, and composition of any man-made fill were not determined as part of the scope of work addressed by this study and should be expected to potentially exist at varying depths and locations across the site.

GEOLOGIC SETTING

The subject parcel lies within the Denver Basin geologic province that consists largely of a sequence of sedimentary rock formations deposited and preserved in a structural depression in north-central Colorado. In the general project area, these sedimentary rocks dip eastward at low angles (less than 10 degrees, typically) and are overlain by a variety of surficial deposits including alluvial (stream-laid) sediments, eolian (wind-blown) materials and colluvial (slope-wash) deposits.

According to available geologic maps (Colton, 1978[1]) the overburden deposits underlying the project area are mapped as Upper Holocene to Pleistocene Colluvium (**Qpc**), and Pinedale Glaciation to Pleistocene Broadway Alluvium (**Qb**). These materials generally consist of sand and gravels with boulders to sandy silt and clay. These materials are underlain by Upper Cretaceous Pierre Shale (Upper Member) (**Kpu**) generally consisting of silty shale. A replica of the geology map is provided below.



[1] Colton, Roger B., 1978, Geologic Map of the Boulder-Fort Collins-Greeley Area, Colorado: U.S. Geological Survey, Miscellaneous Investigation Series, Map I-855-G.

SUBSURFACE EXPLORATION

The subsurface exploration for the project was conducted on March 3rd and 4th, 2016. A total of ten (10) test holes were drilled with an all-terrain buggy-mounted power auger rig, advancing continuous flight power auger to evaluate the subsurface conditions as well as to retrieve soil and bedrock samples for laboratory testing and analysis. Of these, three (3) test holes were drilled within the proposed pedestrian bridge location, and the remaining seven (7) test holes were drilled within potential pavement/flatwork/shelter improvement areas. The pedestrian bridge test holes were drilled to depths ranging from approximately 29 to 40 feet below existing grade and the pavement/flatwork/shelter improvement areas test holes were drilled to depths ranging from approximately 5 to 11 feet below existing grades. A representative of GROUND directed the subsurface exploration, logged the test holes in the field, and prepared the soil and bedrock samples for transport to our laboratory.

Samples of the subsurface materials were retrieved with a 2-inch I.D. California liner sampler. The sampler was driven into the substrata with blows from a 140-pound hammer falling 30 inches. This procedure is similar to the Standard Penetration Test described by ASTM Method D1586. Penetration resistance values, when properly evaluated, indicate the relative density or consistency of soils. Bulk composite samples were also retrieved from the test holes for Proctor testing. Depths at which the samples were obtained and associated penetration resistance values are shown on the test hole logs.

The approximate locations of the test holes are shown in Figure 1. Logs of the exploratory test holes are presented in Figures 2 and 3. Explanatory notes and a legend are provided in Figure 4. GROUND utilized the Client-provided site plan indicating existing features, etc., and Google Map imagery to approximately locate the test holes.

LABORATORY TESTING

Samples retrieved from our test holes were examined and visually classified in the laboratory by the project engineer. Laboratory testing of soil and bedrock samples obtained from the subject site included standard property tests, such as natural moisture contents, dry unit weights, grain size analyses, swell-consolidation testing, direct shear testing, unconfined compressive testing, and liquid and plastic limits. Water-soluble sulfate and corrosivity tests were completed on selected samples of the soils as well. A Proctor test was also performed on a representative composite bulk sample. Laboratory tests were performed in general accordance with applicable ASTM and AASHTO protocols. Results of the laboratory testing program are summarized in Tables 1 and 2.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the test holes generally consisted of a thin veneer of topsoil[2]-like material (approximately 6 to 8 inches thick) or asphalt (approximately 6 to 9 inches in thickness). These materials were generally underlain by man-made fill and/or sand and gravels. These materials were underlain by bedrock consisting of interbedded claystone and sandstone as part of a shale formation, encountered at depths ranging from approximately 14 to 17 feet below existing grades. The test holes extended to depths of approximately 5 to 40 feet below existing grades.

It should be noted that coarse gravel, cobbles and boulders are not well represented in samples obtained from small diameter test holes. At this site, therefore, it should be anticipated that gravel and cobbles, and possibly boulders, may be present in the fill and native soils, as well as comparably sized fragments of construction debris, even where not included in the general descriptions of the site soil types below.

Man Made Fill (Granular Overburden Materials) was comprised of sands and clays/silts with gravel, fine to coarse grained with occasional gravels, low to highly plastic, slightly moist to moist, and brown to gray/black in color.

Delineation of the complete lateral and vertical extents of any fills at the site, or their compositions, however, was beyond our present scope of services. If fill soil volumes

[2] 'Topsoil' as used herein is defined geotechnically. The materials so described may or may not be suitable for landscaping or as a growth medium for such plantings as may be proposed for the project.

and compositions at the site are of significance, they should be further evaluated using test pits.

Sands (Granular Overburden Materials) were somewhat silty/clayey, were fine to coarse grained with cobbles and boulders likely, non to moderately plasticity, very loose to very dense, slightly moist to wet, and tan to brown in color.

Sands and Gravels (Granular Overburden Materials) were interbedded and somewhat silty/clayey, were fine to coarse grained with cobbles and boulders likely, non to moderately plasticity, very loose to very dense, slightly moist to wet, and tan to brown in color.

Clay (Cohesive Overburden Materials) were somewhat silty, were fine to medium grained, low to moderately plastic, stiff to hard, slightly moist to wet, and brown in color.

Weathered Claystone (Comparatively Weathered Bedrock) were fine to medium grained, moderately to highly plastic, medium hard, slightly moist to moist, and olive to gray in color.

Claystone and Sandstone Bedrock (Comparatively Unweathered Bedrock) were interbedded, fine to medium grained, moderately to highly plastic, very hard, slightly moist to moist, and olive to gray in color.

Groundwater was encountered in some of the test holes at a depth of approximately 10 feet below existing grades at the time of drilling. The test holes were backfilled immediately following drilling due to safety. Groundwater levels can be expected to fluctuate, however, in response to annual and longer-term cycles of precipitation, irrigation, surface drainage, nearby rivers and creeks, land use, and the development of transient, perched water conditions.

Swell-Consolidation Testing of samples of the on-site materials encountered in the project test holes indicated a slight potential for consolidation (See Table 1). A consolidation of approximately 0.2 percent was measured at a surcharge load of 2,000 psf.

SEISMIC CLASSIFICATION

We estimate that the proposed pedestrian bridge site would meet the parameters of a Seismic Site Class D site, in accordance with 2007 AASHTO Bridge Design Specifications with 2009 Interim Revisions, based on extrapolation of available data to depth.

Seismic coefficients for the site are as follows:

Peak Ground Acceleration (PGA)	=	0.064 g
Spectral Acceleration for short period (S_S)	=	0.135 g
Spectral Acceleration for long period (S_1)	=	0.035 g
Coefficient at zero-period (F_{pga})	=	1.6
Coefficient for short period (F_a)	=	1.6
Coefficient for long period (F_v)	=	2.4

The response spectrum for the bridge seismic design is shown in Figure 8. The project area falls within Seismic Zone 1 (Table 3.10.6-1, AASHTO 2014) based on an acceleration coefficient (S_{D1}) of 0.084, and is considered to have a low probability for large damaging earthquakes. However, if an earthquake were to occur, liquefaction could potentially be a significant design concern based on the subsurface conditions.

PEDESTRIAN BRIDGE FOUNDATION SYSTEM (LRFD)

We understand that a deep foundation system consisting of drilled piers is being considered to support the bridge structure. The following design criteria are provided for drilled pier foundations. We estimate post-construction movements of approximately ½ inch if the measures presented in this report are implemented effectively.

It should be noted that significant volumes of shallow groundwater and caving of overburden soils may create difficulties with placement of drilled piers, and casing seated into the bedrock may be necessary.

Please note that all references to depth in this report are relative to the ground surface at the time of our subsurface exploration program.

DRILLED SHAFTS (LRFD)

The design recommendations presented below should be observed for a drilled pier foundation system. The design criteria should be considered when preparing project documents and construction details.

1) Drilled piers should be designed based on the following resistances developed in general accordance with procedures and guidelines in the "LRFD Bridge Design Specifications" published by AASHTO (2014). Additionally, resistance factors for geotechnical strength limit state in axially loaded drilled shafts are also given in the following table.

Material and Loading Type	Axial Capacity				Uplift Capacity	
	Nominal Tip Resistance	Resistance Factor (Φ)	Nominal Side Resistance	Resistance Factor (Φ)	Nominal Resistance	Resistance Factor (Φ)
Granular Overburden Materials (Above the Water Table)	-	-	0.5 ksf	0.55	0.5 ksf	0.45
Granular Overburden Materials (Below the Water Table)	-	-	0.6 ksf	0.55	0.6 ksf	0.45
Cohesive Overburden Materials	-	-	1.6 ksf	0.45	1.6 ksf	0.35
Weathered Claystone Bedrock	-	-	1.5 ksf	0.45	1.5 ksf	0.35
Claystone/Sandstone Bedrock	-	-	8.0 ksf	0.45	8.0 ksf	0.35
Claystone/Sandstone Bedrock	63.0 ksf	0.50	-	-	-	-

2) A post-construction downdrag should be taken as 0.5 ksf in the upper 10 feet of material with a load factor of 1.24.

3) Due to the granular nature of some of the materials encountered and/or the lack of observed swell potential within the materials encountered, a minimum dead load pressure may not be necessary.

4) Piers should penetrate at least 10 feet into competent bedrock. Based on the depth to bedrock encountered in the test holes, piers of approximately 38 to 40 feet in length should meet these minimum criteria. However, the actual pier lengths should be based on the design loads, the requirement for minimum dead load pressure, etc., as determined by the Structural Engineer, and the actual conditions encountered in the field at each pier location during installation.

5) Relatively clean to clayey/silty sands and gravels were encountered below the water table. These materials may cave during the drilling process and slurry drilling and/or casing into the bedrock may be required to complete the pier holes. Zones of caving should not be included in load calculations and the pier length should be increased an amount equal to the vertical extent of caved material.

6) **L-Pile Parameters** Geotechnical parameters to be used for the laterally loaded drilled pier analysis are provided below. The parameters were developed based on the field and laboratory data obtained for the subject site and GROUND's experience with similar sites and conditions. Resistance to lateral loads should be neglected in the upper 5 feet of soils, whether fill or native. However, any new fill materials generated from the on-site materials, properly processed and compacted, may be utilized for lateral resistance.

ESTIMATED GEOTECHNICAL PARAMETERS FOR LATERAL LOAD ANALYSIS

Soil Type	**Overburden Materials** (Sand and Sand/Gravels w/o free water) (Above Water Table)	**Overburden Materials** (Sand and Sand/Gravels with free water) (Below Water Table)	**Overburden Materials** (Cohesive with free water) (Below Water Table)	**Weathered Claystone Bedrock** (Stiff Clay w/o free water) (Below Water Table)	**Claystone / Siltstone Bedrock** (Stiff Clay w/o free water) (Below Water Table)
Density *(pcf)*	114	55	69	131	133
Cohesion, C *(psf)*	-	-	2,000	2,500	6,000
Friction Angle *(degree)*	38	38	-	-	-
E_{50} *(in / in)*	-	-	0.010	0.007	0.004
K_h *(pci)*	100	100	1,300	1,500	2,500

Unconfined compressive strength values are presented in Table 1.

7) A minimum pier diameter of 24 inches is recommended to facilitate proper cleaning and observation of the pier hole.

8) Bedrock penetration in pier holes should be roughened artificially to assist the development of peripheral shear between the pier and bedrock. Artificially roughening of pier holes should consist of installing shear rings 3 inches high and 2 inches deep in, at least, the portion of the pier penetrating comparatively unweathered bedrock. The shear rings should be installed 18 inches on centers. The specifications should allow the Geotechnical Engineer to waive the requirement for shear rings depending on the conditions actually encountered in individual pier holes, however.

9) Piers should be spaced apart at least 3 pier diameters from center to center. At this spacing or greater, no reduction in axial capacities or horizontal soil modulus

values is required. Piers grouped more closely than 3 diameters on-center should be studied on an individual basis to determine the appropriate reductions in lateral and axial capacities. To avoid lateral capacity reductions, piers in the line of lateral loads should be spaced no closer than 8 pier diameters. In the event that piers are located closer together than the above spacings, the piers should be studied as a group, or we should be contacted to provide reduction coefficients.

Refer to Figures 6 and 7 for additional information regarding reductions in lateral and axial capacity for closely spaced piers.

Drilled Pier Construction The following should be considered during the construction of drilled pier foundations.

10) The depth of comparatively unweathered bedrock should be determined in the field at each drilled pier location and may differ from other information provided herein.

11) Lenses or beds of relatively soft bedrock not suitable for foundation support may be encountered within the comparatively unweathered bedrock section, which may result in lengthening the drilled piers.

    Some bedrock beneath the site was hard to very hard and relatively resistant. Similarly, cobbles and boulders are likely present in the overburden materials as well. The pier-drilling contractor should mobilize equipment of sufficient size and operating capability to achieve the design lengths and bedrock penetration.

    If refusal is encountered in these materials, a geotechnical engineer should be retained to evaluate the conditions to establish whether true refusal has been met with adequate drilling equipment.

12) Groundwater was encountered in the test holes at depths of approximately 10 feet below grades at the time of drilling, and should be anticipated to be encountered in the drilled pier holes. Groundwater, combined with granular soils, often results in caving during pier installation. Seating of the casing in the upper

layers of the bedrock may not create positive cutoff of water infiltration. The contractor should be prepared to address this condition.

13) In no case should concrete be placed in more than 3 inches of water, unless placed through an approved tremie method. The proposed concrete placement method should be discussed during the pre-construction meeting by the Project Team.

14) Where groundwater and unconsolidated soils and/or caving bedrock materials are encountered, the installation procedure of drilled piers can be a concern. Commonly in these conditions, the drilling contractor utilizes casing and slurry during excavation of the drilled pier holes, which may adversely affect the axial and/or lateral capacities of the completed drilled piers. During casing withdrawal, the concrete should have sufficient slump and must be maintained with sufficient head above groundwater levels to displace the water or slurry fully to prevent the creation of voids in the drilled pier.

    Because of these considerations, the drilling contractor should submit a written procedure addressing the use of casing, slurry, and concrete placement prior to commencement of drilled pier installation.

15) Drilled pier holes should be properly cleaned prior to placement of concrete.

16) Concrete utilized in the drilled piers should be a fluid mix with sufficient slump so that it will fill the void between reinforcing steel and the drilled pier hole wall, and inhibit soil, water and slurry from contaminating the concrete. The concrete should be designed with a minimum slump of no less than 5 inches.

17) Concrete should be placed by an approved method to minimize mix segregation.

18) Concrete should be placed in a drilled pier on the same day that it is drilled. Failure to place concrete the day of drilling may result in a requirement for lengthening the drilled pier. The presence of groundwater or caving soils may require that concrete be placed immediately after the pier hole drilling is completed.

19) The contractor should take care to prevent enlargement of the excavation at the tops of drilled piers, which could result in "mushrooming" of the drilled pier top. Mushrooming of drilled pier tops can increase uplift pressures on the drilled piers.

20) Sonic integrity testing (sonic echo or cross-hole sonic) should be considered to be performed for an appropriate percentage of the drilled piers to assess the effectiveness of the drilled pier construction methods. Additional information on sonic integrity testing can be provided upon request.

A representative of the Geotechnical Engineer should be retained to observe pier drilling operations on a full time basis.

WING WALLS

To achieve similar performance, any abutment or wing walls for the bridge should be founded in the same manner as the bridge. Geotechnical parameters for wall foundation design are provided in the *Pedestrian Bridge Foundation System (LRFD)* section of this report.

Lateral load parameters for design of the abutment and wing walls for the bridge are provided in the *Lateral Loads* section of this report. Wall design should incorporate any upward sloping backfills, live loads such as traffic, construction equipment, material stockpiles, etc., and other surcharge pressures.

Wall Drainage Abutment and/or wing walls should be provided with drains at the heels of the walls. In addition, damp-proofing should be applied to the backs of the walls and Tencate MiraFi® G-Series backing (or comparable wall drain provisions) should be placed on the backs of the walls, extending to within about 2 feet of the top-of-wall. The wall drain system should be in hydraulic continuity with the heel drain. Each heel drain system should be tested by the contractor after installation and after placement and compaction of the overlying backfill to verify that the system functions properly.

Geotechnical Parameters for Wall Heel Drain Design Heel drains for the walls should be designed in accordance with the recommendations below. The actual underdrain layout, outlets, and locations should be developed by wall designer.

1) A heel drain should consist of perforated, rigid, PVC collection pipe at least 4 inches in diameter, non-perforated, rigid, PVC discharge pipe at least 4 inches in diameter, free-draining gravel, and filter fabric.

2) The free-draining gravel should contain less than 5 percent passing the No. 200 Sieve and more than 50 percent retained on the No. 4 Sieve, and have a maximum particle size of 2 inches. Each collection pipe should be surrounded on the sides and top (only) with 6 or more inches of free-draining gravel.

3) The gravel surrounding the collection pipe(s) should be wrapped with filter fabric (MiraFi 140N® or the equivalent) to reduce the migration of fines into the drain system.

4) The underdrain system should be designed to discharge at least 10 gallons per minute of collected water.

5) The high point(s) for the collection pipe flow lines should be at or below the base of the wall as shown on the detail.

   The collection and discharge pipe for the underdrain system should be laid on a slope sufficient for effective drainage, but a minimum of 1 percent.

6) 'Clean-outs' should be provided for each heel drain to facilitate maintenance of the underdrains.

7) The underdrain discharge pipes should be connected to one or more sumps from which water can be removed by pumping, or to outlet(s) for gravity discharge.

SCOUR

Depth of scour will be a design consideration for bridge or culvert improvements at the site. We assume that analysis of potential scour will be performed by others. Foundation elements should be protected from potential scour by either adequately armoring the channel and slopes, or by founding improvements below the depth of scour.

FOUNDATION/FLOOR SYSTEMS OVERVIEW (Pavilion/Shelter Structures)

Geotechnical Considerations for Design As stated, anticipated structure loads were unavailable at the time of this report preparation but are anticipated to be relatively light. Based on Google Earth Imagery and site observations, it appears that minimal cuts/fills (less than 1 foot) should be necessary to facilitate construction of pavilion/shelter structures.

Existing man-made fill was observed in Test Hole 7 extending to a depth up to approximately 4 feet below existing grade. It is unknown if these fill soils are documented (controlled fill). Ideally, the fill soils should be removed and replaced as properly compacted fill. In undocumented fill soils, there exists a largely unquantifiable risk of volume change of the fill (primarily from consolidation of materials) associated with the presence of unknown materials and voids in the fill. Though the development of sinkholes or other large-scale volume changes in the existing on-site fill likely is relatively low, the risk of these features developing still exists where undocumented fills soils are not removed and replaced. We anticipate that some of the existing fill materials (soil) may be reused in project fills provided any deleterious or other unsuitable materials encountered are removed.

Additionally, variable penetration values and moisture/density laboratory results were observed within the materials. We estimate that foundations and floor systems placed directly on the on-site earth materials could experience movements of approximately 1 inch or more.

Foundation/Floor Systems For the least potential of post-construction movement, a deep foundation system consisting of straight-shaft drilled piers advanced into the underlying bedrock should be utilized, provided with a structural floor system. This will result in the least risk of movement. Additionally, other attached structure appurtenances should ideally be founded on piers the same as the main structure, to reduce the potential of differential movement. Utilizing this option as well as other applicable parameters provided in this report, GROUND anticipates potential post-construction movements of approximately ½-inch. If drilled pier parameters are desired for shelter/pavilion structures, GROUND should be contacted, and additional drilling exploration will be required.

As an alternate foundation/floor system (but not equal in performance), drilled footings or shallow spread footings utilized in tandem with a slab-on-grade floor system could be considered to support the proposed structures. Provided the Owner understands and accepts the risks associated with potential post-construction movements (on the order of approximately 1 inch), the pavilion/shelter structures could be founded on drilled/shallow foundations bearing in the existing on-site soils. Actual movements may be more or less than that indicated above especially in the event man-made fill soils are allowed to remain in place. Due to some of the likely locations (typically within landscaped areas), the movement estimates provided above will likely be exceeded as a result of moisture infiltration. If the tolerance for movement is low, a deep foundation system should be utilized.

Inadequate site drainage and/or ineffective fill processing (moisture treatment and compaction) will result in an increase in the movement estimates provided. In addition, actual movements may be more or less depending on the actual subsurface materials present and the overall site drainage after construction is completed, and when landscape irrigation commences.

FOUNDATION SYSTEMS

Shallow Foundations

The geotechnical parameters indicated below may be used for design of shallow foundations for the proposed structures.

Geotechnical Parameters for Shallow Foundation Design

1) Footings bearing on properly compacted site-generated materials may be designed for an allowable soil bearing pressure of 750 psf for footings up to 3 feet in width (anticipated load of approximately 7 kips). In the event the footing width is greater than 3 feet, we should be notified to reevaluate these parameters. In the event drilled footings are utilized, compaction of the bottom excavation may not be feasible. In this event, post-construction movements may be slightly greater than indicated previously.

These values may be increased by ⅓ for transient loads such as wind or seismic loading. For larger footings, a lower allowable bearing pressure may be appropriate.

Compression of the bearing soils for the provided allowable bearing pressure is estimated to be 1 inch, based on an assumption of drained foundation conditions. If foundation soils are subjected to an increase/fluctuation in moisture content, the effective bearing capacity will be reduced and greater post-construction movements than those estimated above may result.

This estimate of foundation movement is from direct compression of the foundation soils.

To reduce differential settlements between footings or along continuous footings, footing loads should be as uniform as possible. Differentially loaded footings will settle differentially.

2) Spread footings should have a minimum lateral dimension of 16 or more inches for linear strip footings and 24 inches for isolated pad footings. Actual footing dimensions should be determined by the structural engineer.

3) Footings/structures (slabs) should bear at an elevation 3 or more feet below the lowest adjacent exterior finish grades to have adequate soil cover for frost protection

4) Continuous foundation walls should be reinforced as designed by a structural engineer to span an unsupported length of at least 10 feet.

5) Geotechnical parameters for lateral resistance to foundation loads are provided in the *Lateral Earth Pressure* section of this report.

6) Connections of all types must be flexible and/or adjustable to accommodate the anticipated, post-construction movements of the structure.

Shallow Foundation Construction

7) The contractor should take adequate care when making excavations not to compromise the bearing or lateral support for nearby improvements.

8) Care should be taken when excavating the foundations to avoid disturbing the supporting materials particularly in excavating the last few inches.

9) Footing excavation bottoms may expose loose, organic or otherwise deleterious materials, including debris. Firm materials may become disturbed by the excavation process. All such unsuitable materials should be excavated and replaced with properly compacted fill or the foundations deepened.

10) Foundation-supporting soils may be disturbed or deform excessively under the wheel loads of heavy construction vehicles as the excavations approach footing bearing levels. Construction equipment should be as light as possible to limit development of this condition. The movement of vehicles over proposed foundation areas should be restricted.

11) All foundation subgrade should be properly moisture-density treated prior to placement of concrete.

12) Fill placed against the sides of the footings should be properly compacted in accordance with the *Project Earthwork* section of this report.

FLOOR SYSTEMS/CONCRETE SLABS

Geotechnical Parameters for Slabs-on-Grade

1) Prior to placement of lightly loaded slabs, subgrade soils should be properly compacted, as discussed in the *Foundation/Floor System Overview* section below the bottom of the underslab gravel layer.

2) An allowable subgrade vertical modulus (K) of 60 pci may be utilized for lightly loaded slabs supported by the site soils/fill materials. This value is for a 1-foot x 1-foot plate; it should be adjusted for slab dimension.

3) The prepared surface on which the slabs will be cast should be observed by the Geotechnical Engineer prior to placement of reinforcement. Exposed loose, soft, or otherwise unsuitable materials should be excavated and replaced with properly compacted fill, placed in accordance with the *Project Earthwork* section of this report. All slab subgrade should be properly moisture-density treated prior to placement of concrete.

4) Slabs should be separated from all bearing walls and columns (as applicable) with slip joints, which allow unrestrained vertical movement.

5) Joints should be observed periodically, particularly during the first several years after construction. Slab movement can cause previously free-slipping joints to bind. Measures should be taken to assure that slab isolation is maintained in order to reduce the likelihood of damage to walls and other interior improvements.

6) Interior partitions (if applicable) resting on floor/concrete slabs should be provided with slip joints so that if the slabs move, the movement cannot be transmitted to the upper structure. This detail is also important for wallboards and door frames. A slip joint, which will allow at least 2 or more inches of vertical movement, is recommended. If slip joints are placed at the tops of walls, in the event that the slabs move, it is likely that the wall will show signs of distress, especially where the slabs meet the exterior wall.

7) Concrete slabs-on-grade should be placed on properly prepared subgrade. They should also be constructed and cured according to applicable standards and be provided with properly designed and constructed control joints. The design and construction of such joints should account for cracking as a result of shrinkage, tension, and loading; curling; as well as proposed slab use. Joint layout based on the slab design may require more frequent, additional, or deeper joints, and should also be based on the ultimate use and configuration of the slabs. Areas where slabs consist of interior corners or curves (at column blockouts or around corners) or where slabs have high length to width ratios, high degree of slopes, thickness transitions, high traffic loads, or other unique features should be carefully considered. The improper placement or construction

of control joints will increase the potential for slab cracking. ACI, AASHTO, and other industry groups provide many guidelines for proper design and construction of concrete slabs-on-grade and the associated jointing.

8) Slabs should be adequately reinforced. Structural considerations for slab thickness, jointing, and steel reinforcement in floor slabs should be developed by the Structural Engineer. Placement of slab reinforcement continuously through the control joint alignments will tend to increase the effective size of concrete panels and reduce the effectiveness of control joints.

9) All plumbing lines should be carefully tested before operation. Where plumbing lines enter through the floor, a positive bond break should be provided. Flexible connections allowing 2 or more inches of vertical movement should be provided for slab-bearing mechanical equipment. Greater movements may occur depending upon the fill prism section selected by the owner.

10) Moisture can be introduced into a slab subgrade during construction and additional moisture will be released from the slab concrete as it cures. Placement of a properly compacted layer of free-draining gravel, 6 or more inches in thickness, beneath the slabs should be performed. This layer will help distribute floor slab loadings, ease construction, reduce capillary moisture rise, and aid in drainage. The free-draining gravel should contain less than 5 percent material passing the No. 200 Sieve, more than 50 percent retained on the No. 4 Sieve, and a maximum particle size of 2 inches.

11) The Client/Project Team should review the American Concrete Institute's (ACI) Sections 301/302/360 for additional guidance regarding slab on grade design and construction. Vapor Barriers should meet applicable performance standards as stated in ASTM E 1745.

Slab movements are directly related to the increases in moisture contents to the underlying soils after construction is completed. The precautions and parameters itemized above will not prevent the movement of floor slabs if the underlying materials are subjected to moisture fluctuations. However, these steps will reduce the damage if such movement occurs.

LATERAL EARTH PRESSURES

Structures which are laterally supported and can be expected to undergo only a limited amount of deflection should be designed for "at-rest" lateral earth pressures. The cantilevered retaining structures will be designed to deflect sufficiently to mobilize the full active earth pressure condition, and may be designed for "active" lateral earth pressures. "Passive" earth pressures may be applied in front of the structural embedment to resist driving forces.

The at-rest, active, and passive earth pressures in terms of equivalent fluid unit weight for the on-site backfill and CDOT Class 1 structure backfill are summarized on the table below. Base friction may be combined with passive earth pressure if the foundation is in a drained condition. The use of passive pressure under a saturated condition is not suggested. The values for the on-site material are provided in the table below were approximated utilizing direct shear results and our experience with similar soils.

Lateral Earth Pressures (Equivalent Fluid Unit Weights)

Material Type & Test Hole Location	Water Condition	Unit Weights *(pcf)*	Friction Angle *(degree)*	At-Rest *(pcf)*	Active *(pcf)*	Passive *(pcf)*	Friction Coefficient
Granular Overburden Materials	Drained	115	38	44	27	485	0.52
	Submerged	115	38	83	75	-	0.52
Cohesive Overburden and Weathered Bedrock Materials	Drained	132	-	78	56	315	0.30
	Submerged	132	-	104	92	-	0.30
Claystone/Siltstone Bedrock	Drained	133	-	73	50	355	0.34
	Submerged	133	-	101	89	-	0.34
Structure Backfill (CDOT Class 1)	Drained	125	-	55	35	400	0.45

If the selected on-site soil meets the criteria for CDOT Class 1 structure backfill (additional testing necessary) as indicated in the *Project Earthwork* section of this report, the lateral earth pressures for CDOT Class 1 structure backfill as shown in the above table may be used. To realize the lower equivalent fluid unit weight, the selected

structure backfill should be placed behind the wall to a minimum distance equal to the retained wall height.

The lateral earth pressures indicated above are for a horizontal upper backfill slope. The additional loading of an upward sloping backfill as well as loads from traffic, stockpiled materials, etc., should be included in the wall/shoring design. GROUND can provide the adjusted lateral earth pressures when the additional loading conditions and site grading are clearly defined.

Wall Drainage Retaining walls should be provided with drains at the heels of the walls, or with weep holes, or both, to help reduce the development of hydrostatic loads and water infiltration to the foundation soils (see *Wing Wall* section above).

In addition to surrounding the drain pipes with at least 6 inches of free-draining gravel, the gravel should extend upward to within 12 inches of the backfill surface behind the wall or the wall should be backed with a layer of geocomposite drainage medium, e.g., an appropriate MiraDrain® product or approved equivalent. The gravel or drainage product backing the wall should be in hydraulic connection with the wall heel drain. If gravel is selected, it should be separated from the enclosing soils by a layer of filter fabric to reduce the migration of fines into the drainage system. Damp proofing should be applied to the backside of rigid types of retaining walls.

EXTERIOR FLATWORK

Care should be taken with regard to proper design and subgrade preparation under and around site improvements. Exterior flatwork and other hardscaping placed on the soils encountered on-site will experience post-construction movements due to volume change of the subsurface soils and the relatively light loads that they impose. Both vertical and lateral soil movements can be anticipated. Distress to hardscaping will result. The measures outlined below will help to reduce, but not eliminate, damages to these improvements.

As stated in the *Foundation/Floor System* section, foundations and floor systems/slabs placed directly on the on-site materials could experience approximately 1 inch or more of movement (including differential and total movements). Similar movement potentials should be anticipated for exterior flatwork and other hardscaping. Provided the owner

understands the risks identified above and accepts the potential for post-construction movement as discussed in this report, the subgrade under exterior flatwork or other (non-structure) site improvements can be processed to a depth of at least 12 inches, but will likely result in movements and subsequent distress to site improvements. These movements will likely be more severe if surface drainage in not effective and maintained.

The processing depth should occur prior to placing any additional fill required to achieve finished design grades. This processing depth will not eliminate potential movements. The excavated soil should be replaced as properly moisture-conditioned and compacted fill as outlined in the *Project Earthwork* section of this report.

Prior to placement of flatwork, a proof roll should be performed to identify areas that exhibit instability and deflection. The soils in these areas should be removed and replaced with properly compacted fill or stabilized.

Flatwork should be provided with effective control joints. Increasing the frequency of joints may improve performance. Industry guidelines developed by ACI, PCA, and others should be consulted regarding construction and control joints.

In no case should exterior flatwork extend to under any portion of the structure where there is less than several inches of clearance between the flatwork and any element of the structure. Exterior flatwork in contact with brick, rock facades, or any other element of the structure can cause damage to the structure if the flatwork experiences movements.

As discussed in the *Surface Drainage* section of this report, proper drainage also should be maintained after completion of the project and re-established as necessary. In no case should water be allowed to pond on or near any of the site improvements or a reduction in performance should be anticipated.

Concrete Scaling Climatic conditions in the project area including relatively low humidity, large temperature changes and repeated freeze – thaw cycles, make it likely that project sidewalks and other exterior concrete will experience surficial scaling or spalling. The likelihood of concrete scaling can be increased by poor workmanship during construction, such as ‘over-finishing’ the surfaces. In addition, the use of de-icing salts on exterior concrete flatwork, particularly during the first winter after construction,

will increase the likelihood of scaling. Even use of de-icing salts on nearby roadways, from where vehicle traffic can transfer them to newly placed concrete, can be sufficient to induce scaling. Typical quality control / quality assurance tests that are performed during construction for concrete strength, air content, etc., do not provide information with regard to the properties and conditions that give rise to scaling.

We understand that some municipalities require removal and replacement of concrete that exhibits scaling, even if the material was within specification and placed correctly. The contractor should be aware of the local requirements and be prepared to take measures to reduce the potential for scaling and/or replace concrete that scales.

In GROUND's experience the measures below can be beneficial for reducing the likelihood of concrete scaling. It must be understood, however, that because of the other factors involved, including weather conditions and workmanship, surface damage to concrete can develop, even where all of these measures were followed. Also, the mix design criteria should be coordinated with other project requirements including the criteria for sulfate resistance presented in the *Water-Soluble Sulfates* section of this report.

1) Maintaining a maximum water/cement ratio of 0.45 by weight for exterior concrete mixes.

2) Include Type F fly ash in exterior concrete mixes as 20 percent of the cementitious material.

3) Specify a minimum, 28-day, compressive strength of 4,500 psi for all exterior concrete.

4) Including 'fibermesh' in the concrete mix also may be beneficial for reducing surficial scaling.

5) Cure the concrete effectively at uniform temperature and humidity. This commonly will require fogging, blanketing and/or tenting, depending on the weather conditions. As long as 3 to 4 weeks of curing may be required, and possibly more.

6) Avoid placement of concrete during cold weather so that it is not exposed to freeze-thaw cycling before it is fully cured.

7) Avoid the use of de-icing salts on given reaches of flatwork through the first winter after construction.

We understand that commonly it may not be practical to implement some of these measures for reducing scaling due to safety considerations, project scheduling, etc. In such cases, additional costs for flatwork maintenance or reconstruction should be incorporated into project budgets.

Frost and Ice Considerations Nearly all soils other than relatively coarse, clean, granular materials are susceptible to loss of density if allowed to become saturated and exposed to freezing temperatures and repeated freeze – thaw cycling. The formation of ice in the underlying soils can result in heaving of pavements, flatwork and other hardscaping ("frost heave") in sustained cold weather up to 2 inches or more. This heaving can develop relatively rapidly. A portion of this movement typically is recovered when the soils thaw, but due to loss of soil density, some degree of displacement will remain. This can result even where the subgrade soils were prepared properly.

Where hardscape movements are a design concern, e.g., at doorways, replacement of the subgrade soils with 3 or more feet of clean, coarse sand or gravel should be considered or supporting the element on foundations similar to the structures and spanning over a void. Detailed guidance in this regard can be provided upon request. It should be noted that where such open graded granular soils are placed, water can infiltrate and accumulate in the subsurface relatively easily, which can lead to increased settlement or heave from factors unrelated to ice formation. Therefore, where a section of open graded granular soils are placed, a local underdrain system should be provided to discharge collected water. GROUND will be available to discuss these concerns upon request.

WATER-SOLUBLE SULFATES

The concentrations of water-soluble sulfates measured in selected samples retrieved from the test holes ranged from less than the detectable amount during testing (<0.01) to approximately 0.08 percent by weight (See Table 2). Such concentration of water-

soluble sulfates represents a negligible environment for sulfate attack on concrete exposed to these materials. Degrees of attack are based on the scale of 'negligible,' 'moderate,' 'severe' and 'very severe' as described in the "Design and Control of Concrete Mixtures," published by the Portland Cement Association (PCA). The Colorado Department of Transportation (CDOT) utilizes a corresponding scale with 4 classes of severity of sulfate exposure (Class 0 to Class 3) as described in the published table below.

REQUIREMENTS TO PROTECT AGAINST DAMAGE TO CONCRETE BY SULFATE ATTACK FROM EXTERNAL SOURCES OF SULFATE

Severity of Sulfate Exposure	**Water-Soluble Sulfate (SO_4) In Dry Soil** *(%)*	**Sulfate (SO_4) In Water** *(ppm)*	**Water Cementitious Ratio** *(maximum)*	**Cementitious Material Requirements**
Class 0	0.00 to 0.10	0 to 150	0.45	Class 0
Class 1	0.11 to 0.20	151 to 1500	0.45	Class 1
Class 2	0.21 to 2.00	1501 to 10,000	0.45	Class 2
Class 3	2.01 or greater	10,001 or greater	0.40	Class 3

Based on these data GROUND, makes no recommendation for use of a special, sulfate-resistant cement in project concrete.

SOIL CORROSIVITY

The degree of risk for corrosion of metals in soils commonly is considered to be in two categories: corrosion in undisturbed soils and corrosion in disturbed soils. The potential for corrosion in undisturbed soil is generally low, regardless of soil types and conditions, because it is limited by the amount of oxygen that is available to create an electrolytic cell. In disturbed soils, the potential for corrosion typically is higher, but is strongly affected by soil chemistry and other factors.

A preliminary corrosivity analysis was performed to provide a general assessment of the potential for corrosion of ferrous metals installed in contact with earth materials at the site, based on the conditions existing at the time of GROUND's evaluation. Soil chemistry and physical property data including pH, reduction-oxidation (redox) potential, and sulfides content were obtained. Test results are summarized on Table 2.

pH Where pH is less than 4.0, soil serves as an electrolyte; the pH range of about 6.5 to 7.5 indicates soil conditions that are optimum for sulfate reduction. In the pH range above 8.5, soils are generally high in dissolved salts, yielding a low soil resistivity (AWWA, 2010). Testing indicated pH values of approximately 8.8.

Reduction-Oxidation testing indicated negative potentials: -99 to -102 millivolts. Such low potentials typically create a more corrosive environment.

Sulfide Reactivity testing for the presence of sulfides indicated 'trace' results. The presence of sulfides in the site soils also suggests a more corrosive environment.

Soil Resistivity In order to assess the "worst case" for mitigation planning, samples of materials retrieved from the test holes were tested for resistivity in the in the laboratory, after being saturated with water, rather than in the field. Resistivity also varies inversely with temperature. Therefore, the laboratory measurements were made at a controlled temperature.

Measurements of electrical resistivity indicated values from approximately 7,650 to 8,365 ohm-centimeters in samples of the site earth materials.

Corrosivity Assessment The American Water Works Association (AWWA, 2010[3]) has developed a point system scale used to predict corrosivity. The scale is intended for protection of ductile iron pipe but is valuable for project steel selection. When the scale equals 10 points or higher, protective measures for ductile iron pipe are suggested. The AWWA scale (Table A.1 Soil-test Evaluation) is presented below. The soil characteristics refer to the conditions at and above pipe installation depth.

[3] American Water Works Association ANSI/AWWA C105/A21.5-05 Standard

Table A.1 Soil-test Evaluation

Soil Characteristic / Value	Points
Resistivity	
<1,500 ohm-cm	10
1,500 to 1,800 ohm-cm	8
1,800 to 2,100 ohm-cm	5
2,100 to 2,500 ohm-cm	2
2,500 to 3,000 ohm-cm	1
>3,000 ohm-cm	0
pH	
0 to 2.0	5
2.0 to 4.0	3
4.0 to 6.5	0
6.5 to 7.5	0 *
7.5 to 8.5	0
>8.5	3
Redox Potential	
< 0 (negative values)	5
0 to +50 mV	4
+50 to +100 mV	3½
> +100 mV	0
Sulfide Content	
Positive	3½
Trace	2
Negative	0
Moisture	
Poor drainage, continuously wet	2
Fair drainage, generally moist	1
Good drainage, generally dry	0

* If sulfides are present and low or negative redox-potential results (< 50 mV) are obtained, add 3 points for this range.

We anticipate that drainage at the site after construction will be good. With effective drainage, based on the values obtained for the soil parameters (10), the site soils do not appear to comprise a significant risk environment for metals with regard to corrosion.

Corrosive conditions can be addressed by use of materials not vulnerable to corrosion, heavier gauge materials with longer design lives, polyethylene encasement, or cathodic protection systems. If additional information is needed regarding soil corrosivity, the American Water Works Association or a corrosion engineer should be contacted.

Structure-specific soil corrosivity studies should be performed to evaluate the conditions in support of utility design. It should be noted, however, that changes to the conditions at a site conditions during construction, such as the import of other soils, or the intended or unintended introduction of off-site water, may alter corrosion potentials significantly. Additional testing may be appropriate during construction.

PROJECT EARTHWORK

The following information is for private improvements; public roadways or utilities should be constructed in accordance with applicable municipal / agency standards.

General Considerations: Site grading should be performed as early as possible in the construction sequence to allow settlement of fills and surcharged ground to be realized to the greatest extent prior to subsequent construction.

Prior to earthwork construction, vegetation and other deleterious materials should be removed and disposed of off-site. Relic underground utilities should be abandoned in accordance with applicable regulations, removed as necessary, and properly capped.

Topsoil present on-site should not be incorporated into ordinary fills. Instead, topsoil should be stockpiled during initial grading operations for placement in areas to be landscaped or for other approved uses.

Drainage During Construction

The contractor should take proactive measures to control surface waters during construction, to direct them away from excavations and into appropriate drainage structures. Wetting of foundation soils during construction can have adverse effects on the performance of a proposed facility.

Filled areas should be graded to drain effectively at the end of each work day.

Existing Fill Soils

Man-made fill was encountered in the test holes during drilling operations. Actual contents and composition of the man-made fill materials are not known; therefore, some

of the excavated man-made fill materials may not be suitable for replacement as backfill. The Geotechnical Engineer should be retained during site excavations to observe the excavated fill materials and provide parameters for its suitability for reuse.

Use of Existing Native Soils from the Site

The local native soils and excavated bedrock materials that are free of trash, organic material, construction debris, and other deleterious materials, are suitable, in general, for placement as compacted fill. Organic materials, including excavated lignite or coal if encountered, should not be incorporated into project fills.

Cobbles and fragments of rock (as well as inert construction debris, e.g., concrete or asphalt) up to 6 inches in maximum dimension may be included in project fills, in general. However, such materials should be placed as deeply as possible in the project fills. Such materials should be assessed on a case-by-case basis as they are identified during earthwork. The presence of cobbles in project fills may complicate drilled pier installation, however. Coarse cobbles and boulders, however, should not be incorporated into project fills.

Where excavated bedrock materials are placed as fill, the contractor should anticipate significantly more than typical efforts to moisture condition and compact the fill properly. The excavated material should be disked or otherwise processed until it is broken down into fragments no larger than 3 inches in maximum dimension and moisture-conditioned prior to compaction. Claystone/siltstone bedrock fragments should be reduced so as to achieve a soil-like mass. Adequate watering, and compaction equipment that aids in breaking down the material (e.g., a Caterpillar 825 compactor-roller), likely will be needed. Excavated bedrock may require additional moisture conditioning and processing in an open area outside prior to placement as backfill.

Imported Fill Materials

If it is necessary to import material to the site, the imported soils should be free of organic material, and other deleterious materials. **Imported material should consist of relatively impervious soils that have less than 30 percent passing the No. 200 Sieve and should have a plasticity index less than 15.** Representative samples of

the materials proposed for import should be tested and approved prior to transport to the site.

Imported Select, Granular Fill

Material to be imported to the site as select, granular fill should meet the criteria for CDOT Class 1 Structure Backfill. (These criteria are tabulated below.)

CDOT CLASS 1 STRUCTURE BACKFILL

Sieve Size or Parameter	Acceptable Range
2-inch	100% passing
No. 4	30% to 100% passing
No. 50	10% to 60% passing
No. 200	5% to 20% passing
Liquid Limit	$\leq$ 35
Plasticity Index	$\leq$ 6

Again, materials proposed for import should be tested and approved prior to transport to the site.

Fill Platform Preparation

Prior to filling, the top 8 to 12 inches of in-place materials on which fill soils will be placed should be scarified, moisture conditioned and properly compacted in accordance with the parameters below to provide a uniform base for fill placement. *If overexcavation is to be performed, then these parameters for subgrade preparation are for the subgrade* ***below the bottom*** *of the specified overexcavation depth.*

If surfaces to receive fill expose loose, wet, soft or otherwise deleterious material, additional material should be excavated, or other measures taken to establish a firm platform for filling. The surfaces to receive fill must be effectively stable prior to placement of fill.

Fill Placement

Fill materials should be thoroughly mixed to achieve a uniform moisture content, placed in uniform lifts not exceeding 8 inches in loose thickness, and properly compacted.

Soils that classify as GP, GW, GM, GC, SP, SW, SM, or SC in accordance with the USCS classification system (granular materials) should be compacted to **95 or more percent** of the maximum modified Proctor dry density at moisture contents within 2 percent of optimum moisture content as determined by ASTM D1557.

Soils that classify as ML, MH, CL or CH should be compacted to **98 percent** of the maximum standard Proctor density at moisture contents from 1 percent below to 3 percent above the optimum moisture content as determined by ASTM D698.

No fill materials should be placed, worked, rolled while they are frozen and/or thawing.

Care should be taken with regard to achieving and maintaining proper moisture contents during placement and compaction. Materials that are not properly moisture conditioned may exhibit significant pumping, rutting, and deflection at moisture contents near optimum and above. The contractor should be prepared to handle soils of this type, including the use of chemical stabilization, if necessary.

Compaction areas should be kept separate, and no lift should be covered by another until relative compaction and moisture content within the ranges are obtained. No fill materials should be placed, worked, rolled while they are frozen and/or thawing.

Care should be taken with regard to achieving and maintaining proper moisture contents during placement and compaction. Materials that are not properly moisture conditioned may exhibit significant pumping, rutting, and deflection at moisture contents near optimum and above. The contractor should be prepared to handle soils of this type, including the use of chemical stabilization, if necessary.

Compaction areas should be kept separate, and no lift should be covered by another until relative compaction and moisture content within the suggested ranges are obtained.

Use of Squeegee

Relatively uniformly graded fine gravel or coarse sand, i.e., “squeegee,” or similar materials commonly are proposed for backfilling foundation excavations, utility trenches (excluding approved pipe bedding), and other areas where employing compaction equipment is difficult. In general, GROUND does not suggest this procedure for the following reasons:

Although commonly considered "self-compacting," uniformly graded granular materials require densification after placement, typically by vibration. The equipment to densify these materials is not available on many job-sites.

Even when properly densified granular materials are permeable and allow water to reach and collect in the lower portions of the excavations backfilled with those materials. This leads to wetting of the underlying soils and resultant potential loss of bearing support as well as increased local heave or settlement.

It is GROUND's opinion that wherever possible, excavations be backfilled with approved, on-site soils placed as properly compacted fill. Where this is not feasible, use of "Controlled Low Strength Material" (CLSM), i.e., a lean, sand-cement slurry ("flowable fill") or a similar material for backfilling should be considered.

Where "squeegee" or similar materials are proposed for use by the contractor, the design team should be notified by means of a Request for Information (RFI), so that the proposed use can be considered on a case-by-case basis. Where "squeegee" meets the project requirements for pipe bedding material, however, it is acceptable for that use.

Settlements

Settlements will occur in filled ground, typically on the order of 1 to 2 percent of the fill depth. If fill placement is performed properly and is tightly controlled, in GROUND's experience the majority (on the order of 60 to 80 percent) of that settlement will typically take place during earthwork construction, provided the contractor achieves the compaction levels herein. The remaining potential settlements likely will take several months or longer to be realized, and may be exacerbated if these fills are subjected to changes in moisture content.

Cut and Filled Slopes

Permanent site slopes supported by on-site soils up to 10 feet in height may be constructed no steeper than 3:1 (horizontal : vertical). Minor raveling or surficial sloughing should be anticipated on slopes cut at this angle until vegetation is well re-established. Surface drainage should be designed to direct water away from slope faces.

EXCAVATION CONSIDERATIONS

The test holes for the subsurface exploration were excavated to the depths indicated by means of buggy-mounted, flight auger drilling equipment. We anticipate no significant excavation difficulties in the majority of the site with conventional heavy-duty excavation equipment in good working condition.

Temporary, un-shored excavation slopes up to 10 feet in height be cut no steeper than 1½:1 (horizontal : vertical) in the site soils in the absence of seepage. Sloughing on the slope faces should be anticipated at this angle. Local conditions encountered during construction, such as groundwater seepage and loose sand, will require flatter slopes. Stockpiling of materials should not be permitted closer to the tops of temporary slopes than 5 feet or a distance equal to the depth of the excavation, whichever is greater.

Should site constraints prohibit the use of the slope angles, temporary shoring should be used. The shoring should be designed to resist the lateral earth pressure exerted by building, traffic, equipment, and stockpiles.

Groundwater was encountered in the foundation-depth test holes at depths of approximately 10 feet below existing grades at the time of drilling. Test holes were backfilled immediately following drilling operations due to safety. Therefore, groundwater could potentially be a significant factor in excavations, and should be anticipated by the contractor. A properly designed and installed de-watering system may be required during the construction. The risk of slope instability will be significantly increased in areas of seepage along the excavation slopes. If seepage or groundwater is encountered during excavation, the Geotechnical Engineer should evaluate the conditions and provide additional parameters as appropriate.

Good surface drainage should be provided around temporary excavation slopes to direct surface runoff away from the slope faces. A properly designed drainage swale should be provided at the top of the excavations. In no case should water be allowed to pond at the site. Slopes should also be protected against erosion. Erosion along the slopes will result in sloughing and could lead to a slope failure.

Excavations in which personnel will be working must comply with all OSHA Standards and Regulations. The Contractor's "responsible person" should evaluate the soil

exposed in the excavations as part of the Contractor's safety procedures. GROUND has provided the information above solely as a service to the Client, and is not assuming responsibility for construction site safety or the Contractor's activities.

UTILITY PIPE INSTALLATION AND BACKFILLING

Pipe Support: The bearing capacity of the site soils appeared adequate, in general, for support of anticipated water lines. The pipe + water are less dense than the soils which will be displaced for installation. Therefore, GROUND anticipates no significant pipe settlements in these materials where properly bedded.

Excavation bottoms may expose soft, loose or otherwise deleterious materials, including debris. Firm materials may be disturbed by the excavation process. All such unsuitable materials should be excavated and replaced with properly compacted fill. Areas allowed to pond water will require excavation and replacement with properly compacted fill. The contractor should take particular care to ensure adequate support near pipe joints which are less tolerant of extensional strains.

Where thrust blocks are needed, they may be designed for an allowable passive soil pressure as indicated in the *Lateral Earth Pressures* section of this report.

Trench Backfilling: Some settlement of compacted soil trench backfill materials should be anticipated, even where all the backfill is placed and compacted correctly. Typical settlements are on the order of 1 to 2 percent of fill thickness. However, the need to compact to the lowest portion of the backfill must be balanced against the need to protect the pipe from damage from the compaction process. Some thickness of backfill may need to be placed at compaction levels lower than specified (or smaller compaction equipment used together with thinner lifts) to avoid damaging the pipe. Protecting the pipe in this manner can result in somewhat greater surface settlements. Therefore, although other alternatives may be available, the following options are presented for consideration:

Controlled Low Strength Material: Because of these limitations, the most conservative option consists of backfilling the entire depth of the trench (both bedding and common backfill zones) with "controlled low strength material" (CLSM), i.e., a lean, sand-cement

slurry, "flowable fill," or similar material along all trench alignment reaches with low tolerances for surface settlements.

If used, the CLSM used as pipe bedding and trench backfill should exhibit a 28-day unconfined compressive strength between 50 to 200 psi so that re-excavation is not unusually difficult.

Placement of the CLSM in several lifts or other measures likely will be necessary to avoid 'floating' the pipe. Measures also should be taken to maintain pipe alignment during CLSM placement.

Compacted Soil Backfilling: Where compacted soil backfilling is employed, using the site soils or similar materials as backfill, the risk of backfill settlements entailed in the selection of this higher risk alternative must be anticipated and accepted by the Client/Owner.

We anticipate that the on-site soils excavated from trenches will be suitable, in general, for use as common trench backfill within the above-described limitations. Backfill soils should be free of vegetation, organic debris and other deleterious materials. Fragments of rock, cobbles, and inert construction debris (e.g., concrete or asphalt) coarser than 3 inches in maximum dimension should not be incorporated into trench backfills.

If it is necessary to import material for use as backfill, the imported soils should be free of vegetation, organic debris, and other deleterious materials. Imported material should consist of relatively impervious soils that have less than 60 percent passing the No. 200 Sieve and should have a plasticity index of less than 20. Representative samples of the materials proposed for import should be tested and approved prior to transport to the site.

Soils placed for compaction as trench backfill should be conditioned to a relatively uniform moisture content, placed and compacted in accordance with the *Project Earthwork* section of this report.

Pipe Bedding: Pipe bedding materials, placement and compaction should meet the specifications of the pipe manufacturer and applicable municipal standards. Bedding should be brought up uniformly on both sides of the pipe to reduce differential loadings.

As discussed above, we suggest the use of CLSM or similar material in lieu of granular bedding and compacted soil backfill where the tolerance for surface settlement is low. (Placement of CLSM as bedding to at least 12 inches above the pipe can protect the pipe and assist construction of a well-compacted conventional backfill although possibly at an increased cost relative to the use of conventional bedding.)

If a granular bedding material is specified, it is our opinion that with regard to potential migration of fines into the pipe bedding, design and installation follow ASTM D2321. If the granular bedding does not meet filter criteria for the enclosing soils, then non-woven filter fabric (e.g., Mirafi® 140N, or the equivalent) should be placed around the bedding to reduce migration of fines into the bedding which can result in severe, local surface settlements. Where this protection is not provided, settlements can develop/continue several months or years after completion of the project. In addition, clay or concrete cut-off walls should be installed to interrupt the granular bedding section to reduce the rates and volumes of water transmitted along the sewer alignment which can contribute to migration of fines.

If granular bedding is specified, the contractor should not anticipate that significant volumes of on-site soils will be suitable for that use. Materials proposed for use as pipe bedding should be tested by a geotechnical engineer for suitability prior to use. Imported materials should be tested and approved by a geotechnical engineer prior to transport to the site.

SURFACE DRAINAGE

The site soils are relatively stable with regard to moisture content – volume relationships at their existing moisture contents. Other than the anticipated, post-placement settlement of fills, post-construction soil movement will result primarily from the introduction of water into the soil underlying the proposed structures, hardscaping, and pavements. Based on the site surface and subsurface conditions encountered in this study, we do not anticipate a rise in the local water table sufficient to approach grade beam or floor elevations. Therefore, wetting of the site soils likely will result from infiltrating surface waters (precipitation, irrigation, etc.), and water flowing along constructed pathways such as bedding in utility pipe trenches.

The following drainage measures should be incorporated as part of project design and during construction. The facility should be observed periodically to evaluate the surface drainage and identify areas where drainage is ineffective. Routine maintenance of site drainage should be undertaken throughout the design life of the project. If these measures are not implemented and maintained effectively, the movement estimates provided in this report could be exceeded.

1) Wetting or drying of the foundation excavations and underslab areas should be avoided during and after construction as well as throughout the improvements' design life. Permitting increases/variations in moisture to the adjacent or supporting soils may result in a decrease in bearing capacity and an increase in volume change of the underlying soils, and increased total and/or differential movements.

2) Positive surface drainage measures should be provided and maintained to reduce water infiltration into foundation soils.

   The ground surface surrounding improvements should ideally be sloped to drain away from the foundation in all directions. A minimum slope of 12 inches in the first 10 feet should be incorporated in the areas not covered with pavement or concrete slabs, or a minimum 3 percent in the first 10 feet in the areas covered with pavement or concrete slabs. Reducing the slopes to comply with ADA requirements may be necessary by other design professionals but may entail an increased potential for moisture infiltration and subsequent volume change of the underlying soils and resultant distress.

   In no case should water be allowed to pond near or adjacent to foundation elements, hardscaping, utility trench alignments, etc.

3) Drainage should be established and maintained to direct water away from sidewalks and other hardscaping as well as utility trench alignments. Where the ground surface does not convey water away readily, additional post-construction movements and distress should be anticipated.

4) In GROUND's experience, it is common during construction that in areas of partially completed paving or hardscaping, bare soil behind curbs and gutters,

and utility trenches, water is allowed to pond after rain or snow-melt events. Wetting of the subgrade can result in loss of subgrade support and increased settlements / increased heave. By the time final grading has been completed, significant volumes of water can already have entered the subgrade, leading to subsequent distress and failures. The contractor should maintain effective site drainage throughout construction so that water is directed into appropriate drainage structures.

5) On some sites, slopes may descend toward improvements locally. Such slopes can be created during grading even on comparatively flat sites. In such cases, even where the slopes as described above are implemented effectively, water may flow toward and beneath a structure or other site improvements with resultant additional, post-construction movements. Where the final site configuration includes graded or retained slopes descending toward the improvements, surface drainage swales and/or interceptor drains should be installed between the improvements and the slope.

   Where irrigation is applied on or above slopes, drainage structures commonly are needed near the toe-of-slope to prevent on-going or recurrent wet conditions.

6) Roof downspouts and drains should discharge well beyond the perimeter of the structure foundations (minimum 10 feet) and backfill zones and be provided with positive conveyance off-site for collected waters.

7) Based on our experience with similar facilities, the project may include landscaping/watering near site improvements. Irrigation water – both that applied to landscaped areas and over-spray – is a significant cause of distress to improvements. To reduce the potential for such distress, vegetation requiring watering should be located 10 or more feet from structure perimeters, flatwork, or other improvements. Irrigation sprinkler heads should be deployed so that applied water is not introduced near or into foundation/subgrade soils. Landscape irrigation should be limited to the minimum quantities necessary to sustain healthy plant growth.

8) Use of drip irrigation systems can be beneficial for reducing over-spray beyond planters. Drip irrigation can also be beneficial for reducing the amounts of water

introduced to foundation/subgrade soils, but only if the total volumes of applied water are controlled with regard to limiting that introduction. Controlling rates of moisture increase beneath the foundations, floors, and other improvements should take higher priority than minimizing landscape plant losses.

Where plantings are desired within 10 feet of a building/strucuture improvement, it is GROUND's opinion that the plants be placed in water-tight planters, constructed either in-ground or above-grade, to reduce moisture infiltration in the surrounding subgrade soils. Planters should be provided with positive drainage and landscape underdrains. As an alternative involving a limited increase in risk, the use of water-tight planters may be replaced by local shallow underdrains beneath the planter beds. Colorado Geological Survey – Special Publication 43 provides additional guidelines for landscaping and reducing the amount of water that infiltrates into the ground.

GROUND understands many municipalities require landscaping within 10 feet of structure perimeters. Provided that positive, effective surface drainage is initially implemented and maintained throughout the life of the facility and the Owner understands and accepts the risks associated with this requirement, vegetation that requires little to no watering may be located within 10 feet of the structure perimeter.

9) Inspections must be made by facility representatives to make sure that the landscape irrigation is functioning properly throughout operation and that excess moisture is not applied.

10) Plastic membranes should not be used to cover the ground surface adjacent to the structures as soil moisture tends to increase beneath these membranes. Perforated "weed barrier" membranes that allow ready evaporation from the underlying soils may be used.

    Cobbles or other materials that tend to act as baffles and restrict surface flow should not be used to cover the ground surface near the foundations.

11) North facing areas where drainage seeps into subsurface soils may be susceptible to frost heave, which can damage site improvements.

12) Maintenance as described herein may include complete removal and replacement of site improvements in order to maintain effective surface drainage.

PAVEMENT SECTIONS

A pavement section is a layered system designed to distribute concentrated traffic loads to the subgrade. Performance of the pavement structure is directly related to the physical properties of the subgrade soils and traffic loadings. The standard care of practice in pavement design describes the flexible pavement section as a "20-year" design pavement: however, most flexible pavements will not remain in satisfactory condition without routine maintenance and rehabilitation procedures performed throughout the life of the pavement. Pavement designs for the private pavements were developed in general accordance with the design guidelines and procedures of the American Association of State Highway and Transportation Officials (AASHTO).

Subgrade Materials

Based on the results of our field exploration and laboratory testing, the potential pavement subgrade materials classify as A-1-a to A-6 soil in accordance with the American Association of State Highway and Transportation Officials (AASHTO) classification system.

Based on our experience at similar sites, a resilient modulus value of 3,562 psi was estimated for the on-site materials. It is important to note that significant decreases in soil support have been observed as the moisture content increases above the optimum. Pavements that are not properly drained may experience a loss of the soil support and subsequent reduction in pavement life.

Anticipated Traffic

Traffic data for the proposed improvements was unavailable at the time of our report preparation. Based on our experience with similar projects equivalent an 18-kip daily load application (EDLA) value of 5 was assumed for the general parking areas. The EDLA value of 5 was converted to an equivalent 18-kip single axle load (ESAL) value of 36,500 for a 20-year design life. If anticipated traffic loadings differ significantly from

these assumed values, GROUND should be notified to re-evaluate the pavement sections below

Pavement Design

The soil resilient modulus and the ESAL values were used to determine the required design structural number for the project pavements. The required structural number was then used to develop the pavement sections. Pavement designs were based on the DARWin™ computer program that solves the 1993 AASHTO pavement design equations. A reliability level of 85 percent and a terminal serviceability of 2 were utilized for design of the pavement sections. A structural coefficient of 0.44 was used for hot bituminous asphalt and 0.12 was used for aggregate base course. The minimum pavement sections for a 20-year design are tabulated below.

Minimum Pavement Sections

Location	***Flexible Section*** *(inches Asphalt)*	***Composite Section*** *(inches Asphalt / inches Aggregate Base)*	***Rigid Section*** *(inches Concrete)*
General Parking Area	6	4 / 6	6

Additionally, trash collection area, as well as other pavement areas subjected to high turning stresses or heavy truck traffic should be provided with rigid pavements consisting of Portland cement concrete (see table above). Additionally, the owner should consider reinforced concrete in these areas. Concrete sections should be underlain by 6 inches of properly compacted aggregate base.

Asphalt pavement should consist of a bituminous plant mix composed of a mixture of aggregate and bituminous material. Asphalt mixture(s) should meet the requirements of a job-mix formula established by a qualified Engineer.

Concrete pavements should consist of a plant mix composed of a mixture of aggregate, Portland cement and appropriate admixtures meeting the requirements of a job-mix formula established by a qualified engineer. Concrete should have a minimum modulus of rupture of third point loading of 650 psi. Normally, concrete with a 28-day compressive strength of 4,000 psi should develop this modulus of rupture value. The concrete should

be air-entrained with approximately 6 percent air and should have a minimum cement content of 6 sacks per cubic yard. Maximum allowable slump should be 4 inches.

In areas of repeated turning stresses the concrete pavement joints should be fully tied or doweled. We suggest that civil design consider joint layout in accordance with CDOT's M Standards. Standard plans for placement of ties and dowels, etc., (CDOT M Standards) for concrete pavements can be found at the CDOT website: http://www.dot.state.co.us/DesignSupport/

If composite flexible sections are placed, the aggregate base material should meet the criteria of CDOT Class 6 aggregate base course. Base course should be placed in uniform lifts not exceeding 8 inches in loose thickness and compacted to at least 95 percent of the maximum dry density a uniform moisture contents within 3 percent of the optimum as determined by ASTM D1557 / AASHTO T-180, the "modified Proctor."

Subgrade Preparation

Provided the owner understands the risks identified above and accepts the potential for post-construction movement as discussed in this report, the subgrade under pavement areas can be processed to a depth of at least 12 inches, but will result in movements and subsequent distress to site improvements. These movements will likely be even more severe if surface drainage in not effective and maintained.

The Contractor should be prepared either to dry the subgrade materials or moisten them, as needed, prior to compaction. It may be difficult for the contractor to achieve and maintain compaction in some on-site soils encountered without careful control of water contents. Likewise, some site soils likely will "pump" or deflect during compaction if moisture levels are not carefully controlled. The Contractor should be prepared to process and compact such soils to establish a stable platform for paving, including use of chemical stabilization, if necessary.

Immediately prior to paving, the subgrade should be proof rolled with a heavily loaded, pneumatic tired vehicle. Areas that show excessive deflection during proof rolling should be excavated and replaced and/or stabilized. Areas allowed to pond prior to paving will require significant re-working prior to proof-rolling. Passing a proof roll is an additional requirement, beyond placement and compaction of the subgrade soils in accordance

with this report. Some soils that are compacted in accordance with the parameters herein may not be stable under a proof roll, particularly at moisture contents in the upper portion of the acceptable range.

Additional Observations

The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of the pavements. The subsurface and surface drainage systems should be carefully designed to ensure removal of the water from paved areas and subgrade soils. Allowing surface waters to pond on pavements will cause premature pavement deterioration. Where topography, site constraints, or other factors limit or preclude adequate surface drainage, pavements should be provided with edge drains to reduce loss of subgrade support. The long-term performance of the pavement also can be improved greatly by proper backfilling and compaction behind curbs, gutters, and sidewalks so that ponding is not permitted and water infiltration is reduced.

Landscape irrigation in planters adjacent to pavements and in “island” planters within paved areas should be carefully controlled or differential heave and/or rutting of the nearby pavements will result. Drip irrigation systems are suggested for such planters to reduce over-spray and water infiltration beyond the planters. Enclosing the soil in the planters with plastic liners and providing them with positive drainage also will reduce differential moisture increases in the surrounding subgrade soils. In our experience, infiltration from planters adjacent to pavements is a principal source of moisture increase beneath those pavements. This wetting of the subgrade soils from infiltrating irrigation commonly leads to loss of subgrade support for the pavement with resultant accelerating distress, loss of pavement life and increased maintenance costs. This is particularly the case in the later stages of project construction after landscaping has been emplaced but heavy construction traffic has not ended. Heavy vehicle traffic over wetted subgrade commonly results in rutting and pushing of flexible pavements, and cracking of rigid pavements. In relatively flat areas where design drainage gradients necessarily are small, subgrade settlement can obstruct proper drainage and yield increased infiltration, exaggerated distress, etc. (These considerations apply to project flatwork, as well.)

As noted above, the standard care of practice in pavement design describes the flexible pavement section as a “20-year” design pavement; however, most pavements will not remain in satisfactory condition without routine, preventive maintenance and rehabilitation procedures performed throughout the life of the pavement. Preventive pavement treatments are surface rehabilitation and operations applied to improve or extend the functional life of a pavement. These treatments preserve, rather than improve, the structural capacity of the pavement structure. In the event the existing pavement is not structurally sound, the preventive maintenance will have no long-lasting effect. Therefore, a routine maintenance program to seal cracks, repair distressed areas, and perform thin overlays throughout the life of the pavement is suggested.

A crack sealing and fog seal/chip seal program should be performed on the pavements every 3 to 4 years. After approximately 8 to 10 years, patching, additional crack sealing, and asphalt overlay may be required. Prior to future overlays, it is important that all transverse and longitudinal cracks be sealed with a flexible, rubberized crack sealant in order to reduce the potential for propagation of the crack through the overlay. Traffic volumes that exceed the values utilized by this report will likely necessitate the need of pavement maintenance practices on a schedule of shorter timeframe than that stated above. The greatest benefit of preventive maintenance is achieved by placing the treatments on sound pavements that have little or no distress.

GROUND’s experience indicates that longitudinal cracking is common in asphalt-pavements generally parallel to the interface between the asphalt and concrete structures such as curbs, gutters or drain pans. Distress of this type is likely to occur even where the subgrade has been prepared properly and the asphalt has been compacted properly. The use of thick base course or reinforced concrete pavement can reduce this. Our office should be contacted if these alternates are desired.

The assumed traffic loading does not include excess loading conditions imposed by heavy construction vehicles. Consequently, heavily loaded concrete, lumber, and building material trucks can have a detrimental effect on the pavement. An effective program of regular maintenance should be developed and implemented to seal cracks, repair distressed areas, and perform thin overlays throughout the life of the pavements

CLOSURE

Geotechnical Review

The author of this report should be retained to review project plans and specifications to evaluate whether they comply with the intent of the information in this report.

The geotechnical parameters and conclusions presented in this report are contingent upon observation and testing of project earthworks by representatives of GROUND. If another geotechnical consultant is selected to provide materials testing, then that consultant must assume all responsibility for the geotechnical aspects of the project by concurring in writing with the information in this report, or by providing alternative parameters.

Materials Testing

The client should consider retaining a Geotechnical Engineer to perform materials testing during construction. The performance of such testing or lack thereof, in no way alleviates the burden of the contractor or subcontractor from constructing in a manner that conforms to applicable project documents and industry standards. The contractor or pertinent subcontractor is ultimately responsible for managing the quality of their work; furthermore, testing by the geotechnical engineer does not preclude the contractor from obtaining or providing whatever services they deem necessary to complete the project in accordance with applicable documents.

Limitations

This report has been prepared for the City of Boulder as it pertains to the Boulder Civic Area Park Development as described herein. It may not contain sufficient information for other parties or other purposes. The owner or any prospective buyer relying upon this report must be made aware of and must agree to the terms, conditions, and liability limitations outlined in the proposal.

In addition, GROUND has assumed that project construction will commence by Summer/Fall 2016. Any changes in project plans or schedule should be brought to the attention of the Geotechnical Engineer, in order that the geotechnical parameters may be re-evaluated and, as necessary, modified.

The geotechnical conclusions and information in this report relied upon subsurface exploration at a limited number of exploration points, as shown in Figure 1, as well as the means and methods described herein. Subsurface conditions were interpolated between and extrapolated beyond these locations. It is not possible to guarantee the subsurface conditions are as indicated in this report. Actual conditions exposed during construction may differ from those encountered during site exploration.

If during construction, surface, soil, bedrock, or groundwater conditions appear to be at variance with those described herein, the Geotechnical Engineer should be advised at once, so that re-evaluation of the information may be made in a timely manner. In addition, a contractor who relies upon this report for development of his scope of work or cost estimates may find the geotechnical information in this report to be inadequate for his purposes or find the geotechnical conditions described herein to be at variance with his experience in the greater project area. The contractor is responsible for obtaining the additional geotechnical information that is necessary to develop his workscope and cost estimates with sufficient precision. This includes current depths to groundwater, etc.

The materials present on-site are stable at their natural moisture content, but may change volume or lose bearing capacity or stability with changes in moisture content. Performance of the proposed structures and pavement will depend on implementation of the conclusions and information in this report and on proper maintenance after construction is completed. Because water is a significant cause of volume change in soils and rock, allowing moisture infiltration may result in movements, some of which will exceed estimates provided herein and should therefore be expected by the owner.

ALL DEVELOPMENT CONTAINS INHERENT RISKS. It is important that ALL aspects of this report, as well as the estimated performance (and limitations with any such estimations) of proposed project improvements are understood by the Client, Project Owner (if different), or properly conveyed to any future owner(s). Utilizing these parameters for planning, design, and/or construction constitutes understanding and acceptance of conclusions or information provided herein, potential risks, associated improvement performance, as well as the limitations inherent within such estimations. If any information referred to herein is not well understood, it is imperative for the Client,

Owner (if different), or anyone using this report to contact the author or a company principal immediately.

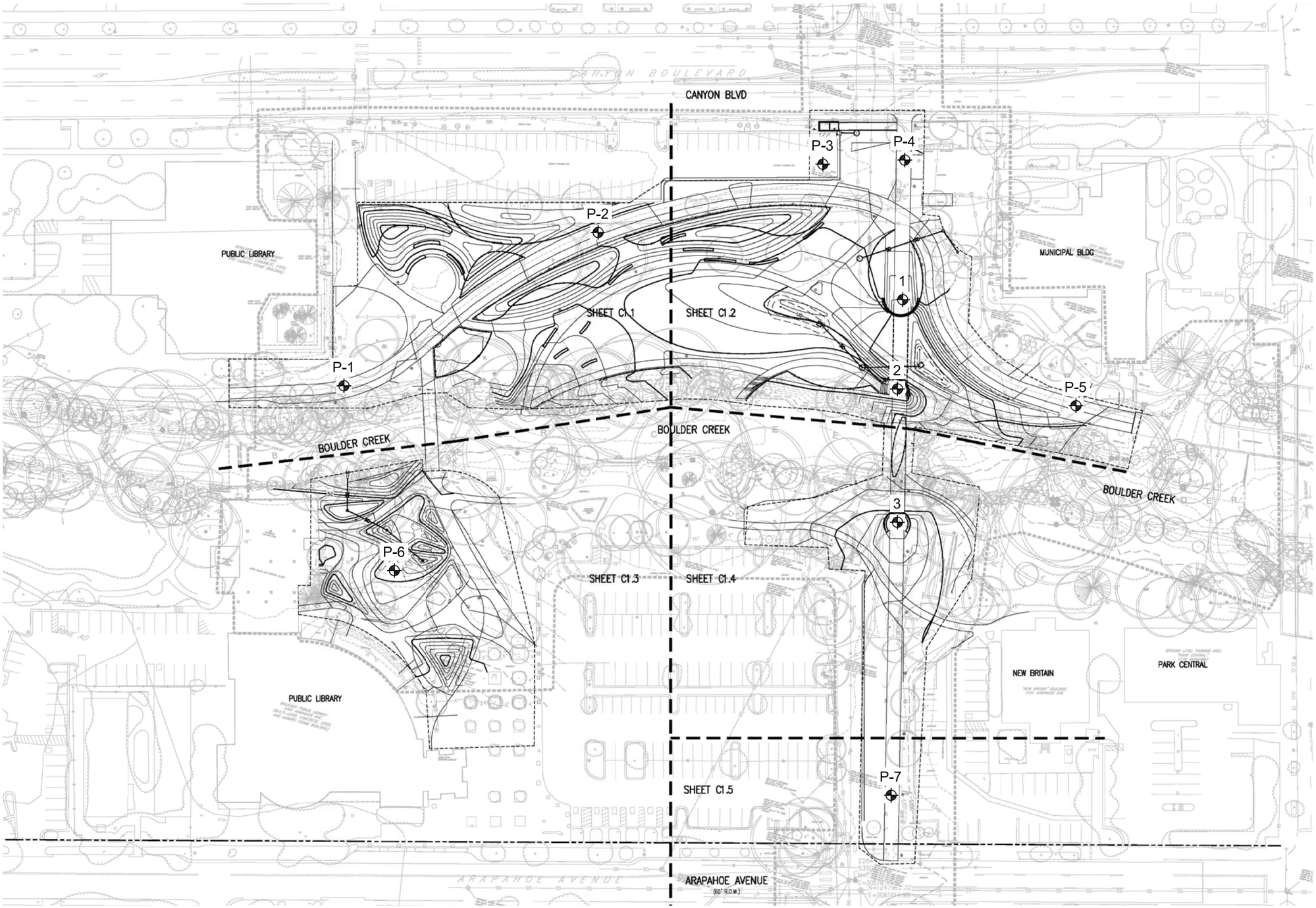
This report was prepared in accordance with generally accepted soil and foundation engineering practice in the project area at the date of preparation. Current applicable codes may contain criteria regarding performance of structures and/or site improvements which may differ from those provided herein. Our office should be contacted regarding any apparent disparity. GROUND makes no warranties, either expressed or implied, as to the professional data, opinions or information contained herein. Because of numerous considerations that are beyond GROUND's control, the economic or technical performance of the project cannot be guaranteed in any respect.

GROUND appreciates the opportunity to complete this portion of the project and welcomes the opportunity to provide the Owner with a cost proposal for construction observation and materials testing prior to construction commencement.

Sincerely,
GROUND Engineering Consultants, Inc.

Eric C. Mocko, P.E.

Reviewed by Jason A. Smith, REM, P.E.



SITE PLAN PROVIDED BY CLIENT

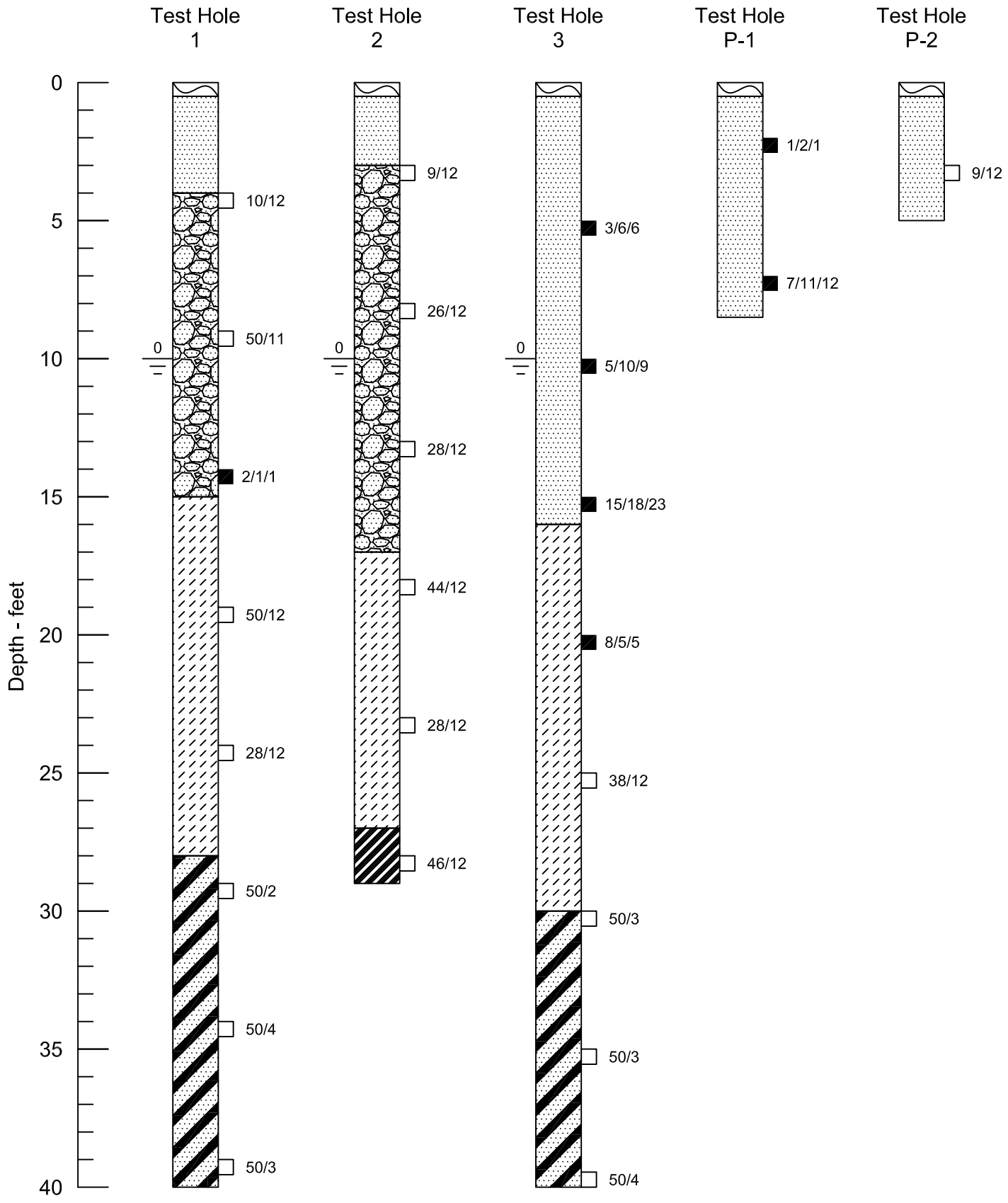
1
Indicates test hole number and approximate location.

(Not to Scale)

GROUND
ENGINEERING CONSULTANTS

LOCATION OF TEST HOLES

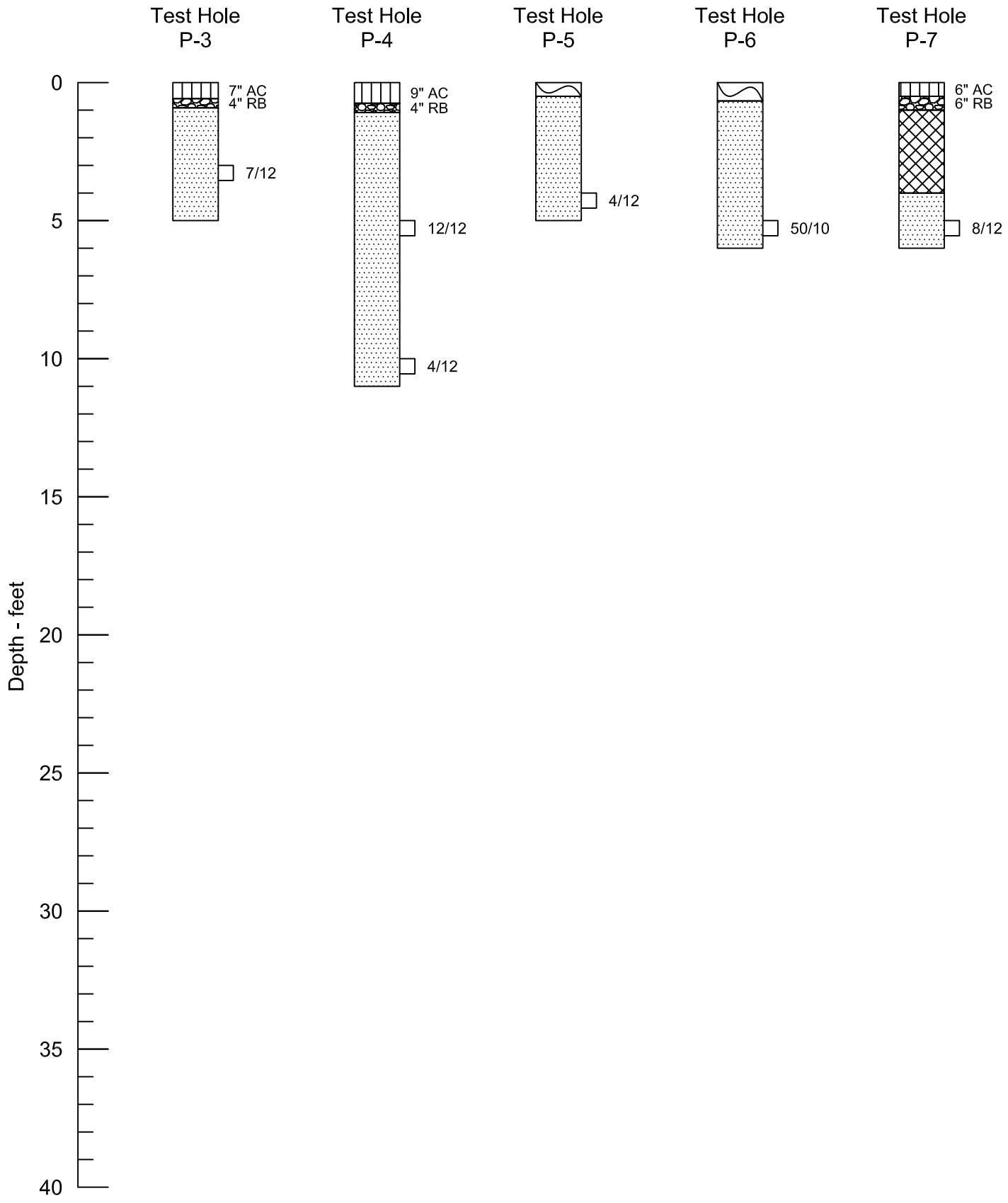
JOB NO.: 16-3524	FIGURE: 1
CADFILE NAME: 3524SITE.DWG	



GROUND
ENGINEERING CONSULTANTS

LOGS OF TEST HOLES

JOB NO.: 16-3524	FIGURE: 2
CADFILE NAME: 3524LOG01.DWG	



GROUND
ENGINEERING CONSULTANTS

LOGS OF TEST HOLES

JOB NO.: 16-3524	FIGURE: 3
CADFILE NAME: 3524LOG02.DWG	

LEGEND:

Topsoil

Asphalt

Road Base

Man Made Fill (Granular Overburden Materials): Sands and clays/silts with gravel, fine to coarse grained with occasional gravels, low to highly plastic, slightly moist to moist, and brown to gray/black in color.

Sands (Granular Overburden Materials): Silty/clayey, were fine to coarse grained with cobbles and boulders likely, non to moderately plasticity, very loose to very dense, slightly moist to wet, and tan to brown in color.

Sands and Gravels (Granular Overburden Materials): Interbedded and somewhat silty/clayey, were fine to coarse grained with cobbles and boulders likely, non to moderately plasticity, very loose to very dense, slightly moist to wet, and tan to brown in color.

Clay (Cohesive Overburden Materials): Silty, were fine to medium grained, low to moderately plastic, stiff to hard, slightly moist to wet, and brown in color.

Weathered Claystone (Comparatively Weathered Bedrock): Fine to medium grained, moderately to highly plastic, medium hard, slightly moist to moist, and olive to gray in color.

Claystone and Sandstone (Comparatively Unweathered Bedrock): Interbedded, fine to medium grained, moderately to highly plastic, very loose to very hard, slightly moist to moist, and olive to gray in color.

Drive sample, 2-inch I.D. California liner sample

23/12 Drive sample blow count, indicates 23 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 12 inches.

Drive sample, 1-3/8 inch I.D. standard sample

20/25/30 Drive sample blow count, indicates 20, 25, and 30 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 18 inches.

0 Depth to water level and number of days after drilling that measurement was taken.

GROUND
ENGINEERING CONSULTANTS

LEGEND AND NOTES

JOB NO.: 16-3524	FIGURE: 4
CADFILE NAME: 3524LEG01.DWG	

NOTES:

1) Test holes were drilled on 03/04/2016 with 4-inch diameter continuous flight augers.
2) Locations of the test holes were measured approximately by pacing from features shown on the site plan provided.
3) Elevations of the test holes were not measured and the logs of the test holes are drawn to depth.
4) The test hole locations and elevations should be considered accurate only to the degree implied by the method used.
5) The lines between materials shown on the test hole logs represent the approximate boundaries between material types and the transitions may be gradual.
6) Groundwater level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water level may occur with time.
7) The material descriptions on this legend are for general classification purposes only. See the full text of this report for descriptions of the site materials and related information.
8) All test holes were immediately backfilled upon completion of drilling, unless otherwise specified in this report.

GROUND
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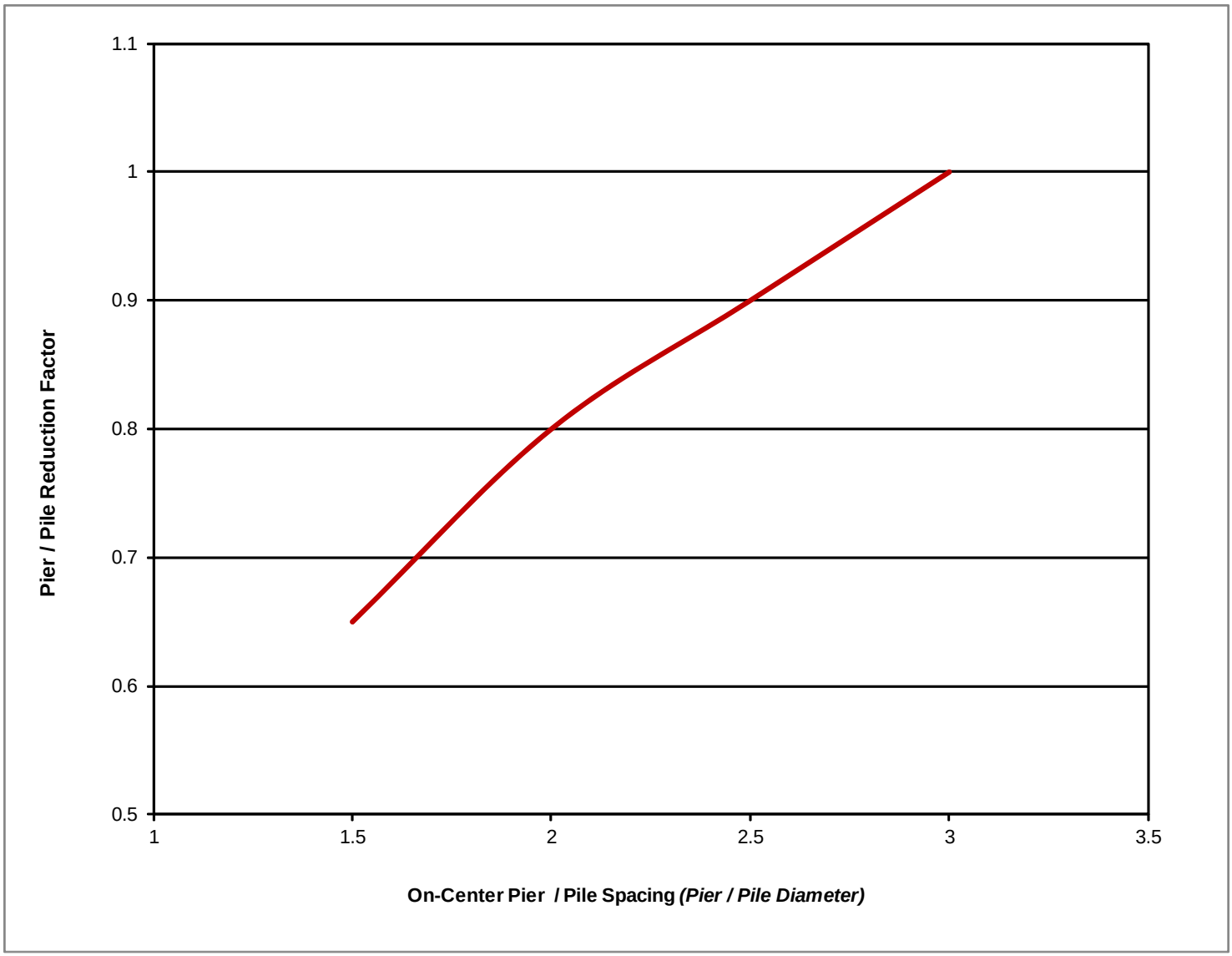
LEGEND AND NOTES

JOB NO.: 16-3524	FIGURE: 5
CADFILE NAME: 3524LEG02.DWG	



Axial Capacity Reductions as Functions of Closely Spaced Pier / Pile Elements.

The graph above provides estimated reductions in total axial capacity for closely spaced piers.

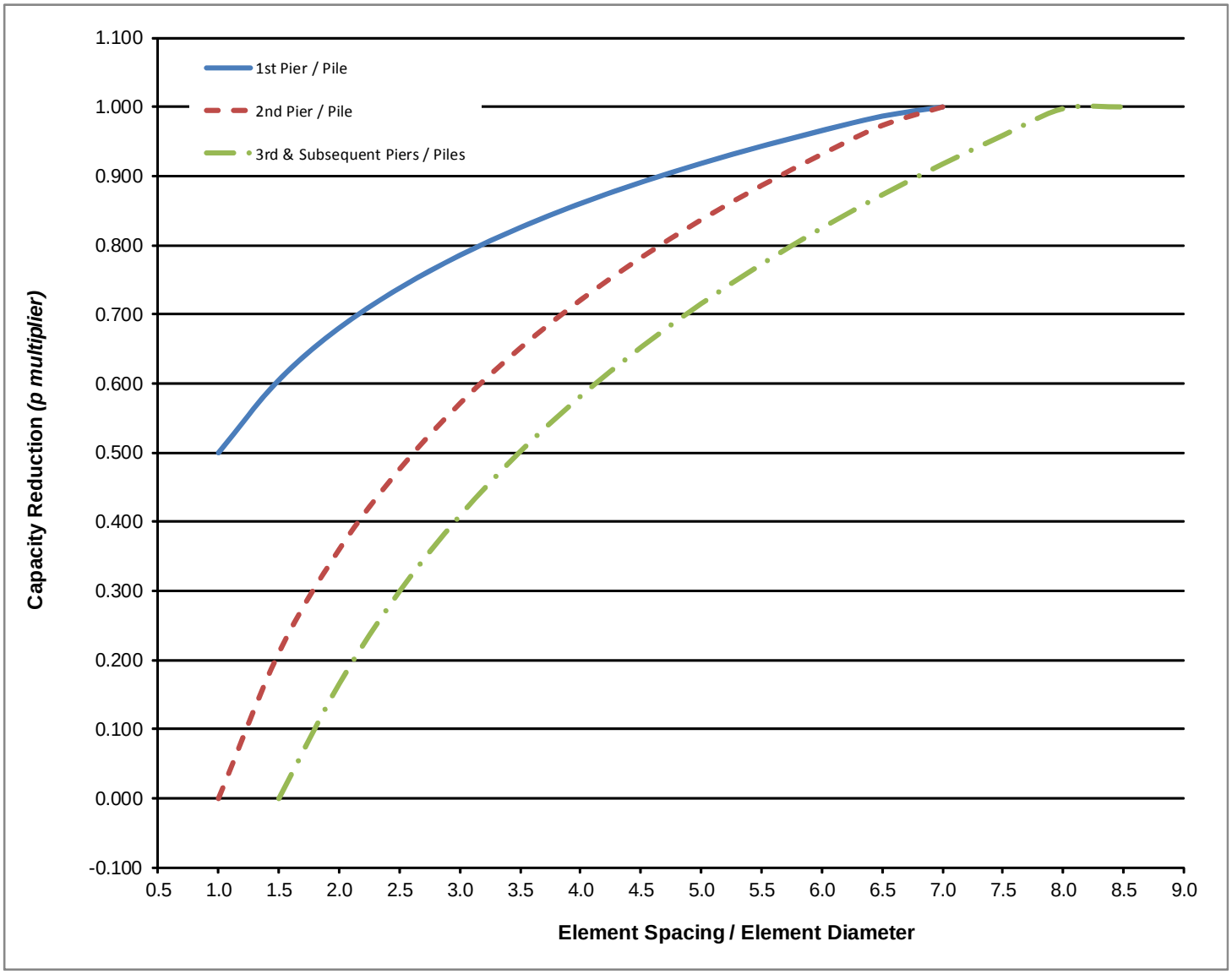
Pier / Pile reductions should be interpolated from the graph above.

GROUND
ENGINEERING CONSULTANTS

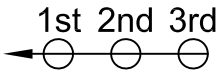
AXIAL CAPACITY
PIER REDUCTION FACTORS
FOR CLOSELY SPACED PIERS

JOB NO.: 16-3524	FIGURE: 6

CADFILE NAME: 3524APR.DWG



Lateral Capacity Reductions (p multipliers) as Functions of Closely Spaced Pier / Pile Elements



The "1st" or "lead" pier / pile is the element that leads movement in the direction that the lateral load will cause the piers to deflect, as shown .

For lateral loads oriented perpendicular to the row of piers / piles, use the 1st pier / pile p-multiplier.

Pier / Pile reductions should be interpolated from the graph above.

Figure to be reproduced in color for clarity.

GROUND
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LATERAL CAPACITY
PIER REDUCTION FACTORS
FOR CLOSELY SPACED PIERS

JOB NO.: 16-3524	FIGURE: 7

CADFILE NAME: 3524LLPR.DWG

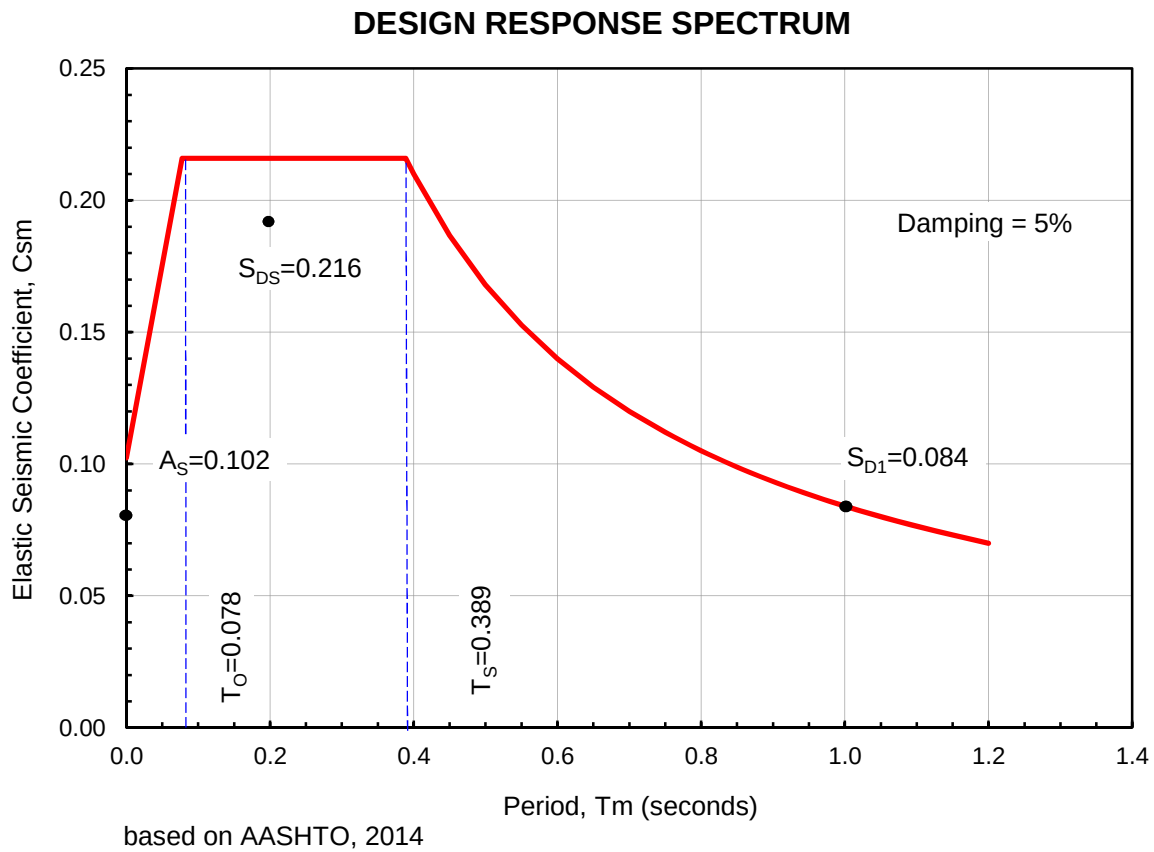
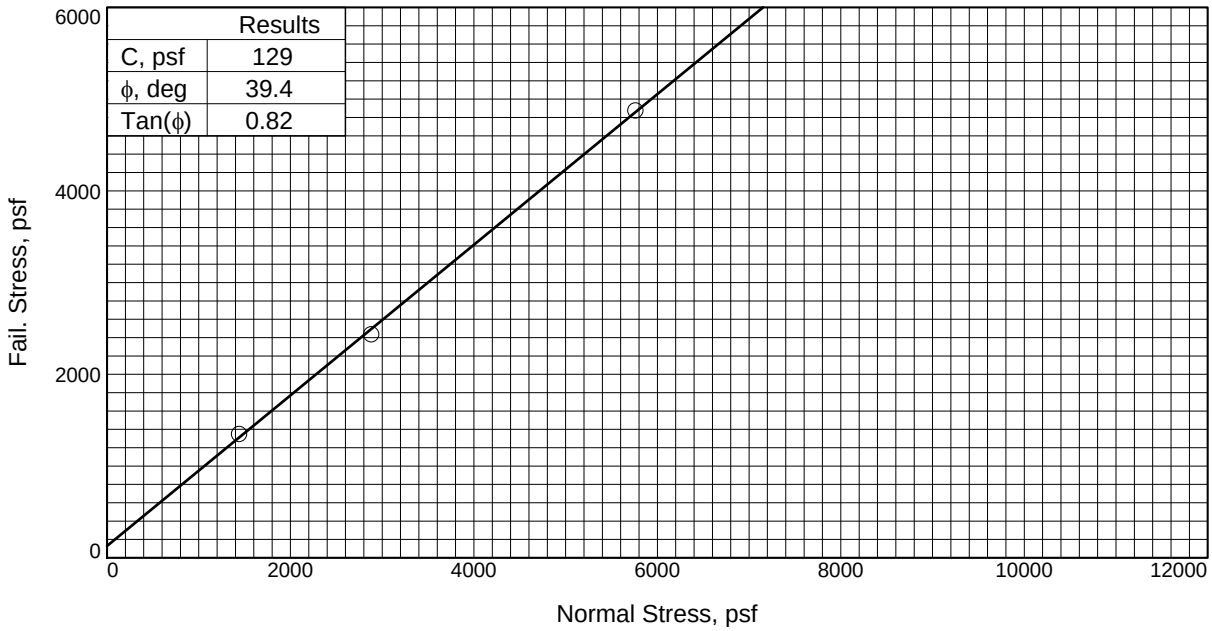
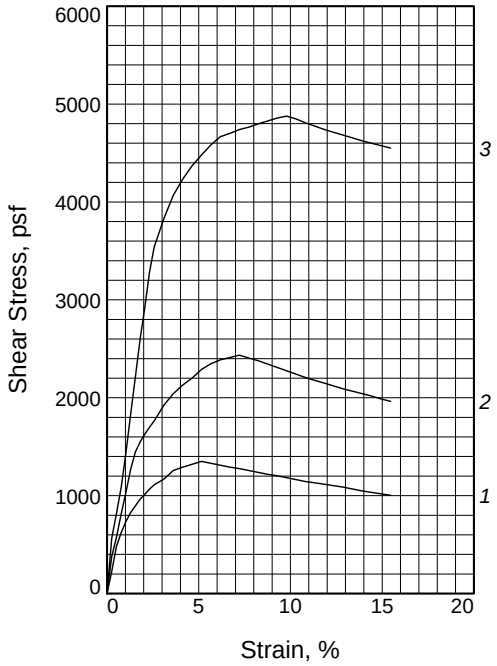

DESIGN RESPONSE SPECTRUM
Elastic Seismic Coefficient, Csm
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Period, Tm (seconds)
Damping = 5%
S_{DS}=0.216
A_S=0.102
S_{D1}=0.084
T_O=0.078
T_S=0.389
based on AASHTO, 2014

Figure 8





Sample No.		1	2	3
Initial	Water Content, %	14.5	16.2	15.0
	Dry Density, pcf	107.0	105.6	106.7
	Saturation, %	70.1	75.9	72.1
	Void Ratio	0.5465	0.5673	0.5503
	Diameter, in.	1.94	1.94	1.94
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	14.0	15.5	14.4
	Dry Density, pcf	108.4	109.2	111.5
	Saturation, %	70.4	79.8	78.7
	Void Ratio	0.5264	0.5151	0.4838
	Diameter, in.	1.94	1.94	1.94
	Height, in.	0.99	0.97	0.96
Normal Stress, psf		1440	2880	5760
Fail. Stress, psf		1349	2436	4876
Strain, %		5.2	7.2	9.8
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.01	0.01	0.01

Sample Type: Remolded

Description: Gravelly Poorly Graded SAND w/ Silt

LL= NV **PI=** NP

Assumed Specific Gravity= 2.65

Remarks: -#200 = 8%

Figure 9

Client: City of Boulder - Parks and Recreation

Project: Boulder Civic Area Park Development

Proj. No.: 16-3524 **Date Sampled:** 3/4/16

DIRECT SHEAR TEST REPORT

GROUND ENGINEERING CONSULTANTS, INC.
COMMERCE CITY, CO

Cursory interpretations provided require review by a professional engineer.

GROUND
ENGINEERING CONSULTANTS

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

Sample Location		Natural	Natural	Gradation		Percent	Atterberg Limits		Percent	Unconfined	Water			USCS	AASHTO	
Test Hole No.	Depth *(feet)*	Moisture Content *(%)*	Dry Density *(pcf)*	Gravel *(%)*	Sand *(%)*	Passing No. 200 Sieve	Liquid Limit	Plasticity Index	Swell (Surcharge Pressure)	Compressive Strength *(psf)*	Soluble Sulfates *(%)*	pH	Resistivity *(ohm-cm)*	Classifi-cation	Classifi-cation (GI)	Soil or Bedrock Type
1	9	5.0	108.1	63	34	3	NV	NP			<0.01	8.8	8,365	s(GP)	A-1-a(0)	Sandy Poorly Graded GRAVEL
1	19	15.0	114.3			79	43	17	-0.2 (2,000)	8,340				CL	A-7-6(14)	Lean CLAY
2	3	7.5	-	64	25	11	44	9			0.08	8.8	7,650	(GW-GM)s	A-1-a(0)	Well Graded GRAVEL w/ Silt and Sand
2	23	10.6	119.7			69	31	11		6,060				CL	A-6(6)	Lean CLAY
2	28	-	-			-	-	-		5,600				-	-	-
3	15	9.1	-	31	61	8	NV	NP						g(SP-SM)	A-1-a(0)	Gravelly Poorly Graded SAND w/ Silt
3	30	16.3	-			14	39	14		15,600				SC	A-2-6(14)	Clayey SAND
P1	7	9.0	-	34	59	7	NV	NP						g(SP-SM)	A-1-b(0)	Gravelly Poorly Graded SAND w/ Silt
P2	3	2.0	-	12	84	4	NV	NP						SP	A-1-b(0)	Poorly Graded SAND
P3	3	9.3	94.0	8	79	13	33	7						SM	A-2-4(0)	Silty SAND
P4	10	34.7	76.8	9	71	20	NV	NP						SM	A-2-4(0)	Silty SAND
P5	4	16.0	106.5			45	30	12						SC	A-6(2)	Clayey SAND
P6	5	42.4	89.0	42	55	3	NV	NP						g(SP)	A-1-a(0)	Gravelly Poorly Graded SAND
P7	5	17.3	115.2	5	70	25	38	11						SC	A-2-6(0)	Clayey SAND

Job No. 16-3524

GROUND
ENGINEERING CONSULTANTS

TABLE 2
SUMMARY OF SOIL CORROSION TEST RESULTS

Sample Location		Water Soluble Sulfates	pH	Redox Potential	Sulfides Content	Resistivity	USCS Classifi-cation	Soil or Bedrock Type
Test Hole No.	Depth *(feet)*	*(%)*		*(mV)*		*(ohm-cm)*		
1	9	<0.01	8.8	-102	Trace	8,365	s(GP)	Sandy Poorly Graded GRAVEL
2	3	0.08	8.8	-99	Trace	7,650	(GW-GM)s	Well Graded GRAVEL w/ Silt and Sand

Job No. 16-3524

SECTION 000100

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Section 01 29 76	Payment Procedures	01 29 76-1 through 3	05/02/16	
Section 01 31 00	Project Management and Coordination	01 32 00-1 through 14	05/02/16	-
Section 01 32 00	Construction Progress Documentation	01 32 00-1 through 11	05/02/16	-
Section 01 32 33	Photographic Documentation	01 32 33-1 through 4	05/02/16	-
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Section 01 40 00	Quality Requirements	01 40 00-1 through 8	05/02/16	-

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Section 01 77 00	Closeout Procedures	01 77 00-1 through 7	05/02/16	-
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Not Used.				
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DIVISION 07 – THERMAL AND MOISTURE PROTECTION				
Not Used.				
DIVISION 08 – DOORS AND WINDOWS				
Not Used.				
DIVISION 09 – FINISHES				
Not Used.				
DIVISION 10 – INTERACTIVE MEDIA				
Not Used.				
DIVISION 11 – EQUIPMENT				
Not Used.				
DIVISION 12 – FURNISHINGS				
Not Used.				

DIVISION 13 – SPECIAL CONSTRUCTION

Not Used.

DIVISION 14 – CONVEYING SYSTEMS

Not Used.

DIVISION 21 – FIRE SUPPRESSION

Not Used.

DIVISION 22 – PLUMBING

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Section 22 10 00	Plumbing Piping	22 10 00-1 through 1	05/02/16	-

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Not used.

DIVISION 25 – INTEGRATED AUTOMATION

Not Used.

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Systems

DIVISION 27 – COMMUNICATIONS

Not Used.

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Not Used.

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Section 31 23 17	Excavation and Embankment	31 23 17-1 through 6	05/02/16	-
Section 31 23 19	Water Control and Dewatering	31 23 19-1 through 3	05/02/16	-
Section 31 37 00	Riprap	31 37 00-1 through 5	05/02/16	-
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DIVISION 35 – WATERWAY AND MARINE				
Not Used.				

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SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.02 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of Contract.
3. Work phases.
4. Work under other contracts.
5. Products ordered in advance.
6. Owner-furnished products.
7. Use of premises.
8. Owner's occupancy requirements.
9. Work restrictions.
10. Specification formats and conventions.
11. Miscellaneous provisions.
12. Site visit.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Civic Area Park Development Plan

1. Project Location: Boulder Civic Area between Canyon Boulevard and Arapahoe and Broadway and the Boulder Library , Boulder, Colorado

B. Owner: City of Boulder, Boulder Parks and Recreation, 3198 Broadway, Boulder, CO 80304, Tel: 303-413-7233

C. Design Professionals

1. Tom Leader Studio, Inc., 1015 Camelia Street, Berkeley CA 94710, Tel: 510-524-3363

D. Construction Manager:

1.04 TYPE OF CONTRACT

A. See the Owner's contracting requirements included in these proposed Contract Documents.

1.05 WORK UNDER OTHER CONTRACTS

A. See CM Agreement.

1.06 PRODUCTS ORDERED IN ADVANCE

A. General: Owner reserves the right to negotiate purchase orders with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase orders to Construction Manager. Costs for receiving, handling, storage if required, and installation of material and equipment are included in the CM's GMP.

B. List of Products Ordered in Advance:

1. As indicated in Divisions 2 through 49

1.07 OWNER-FURNISHED PRODUCTS

A. Owner may furnish products for the Project. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Construction Manager.

2. Owner will arrange and pay for delivery of Owner-furnished items according to the Project Schedule.

3. After delivery, Owner will inspect delivered items for damage. Construction Manager shall be present for and assist in Owner's inspection.

4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.

5. Owner will arrange for manufacturer's field services.

6. Owner will furnish Construction Manager the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Construction Manager shall designate delivery dates of Owner-furnished items in the Project Schedule.

7. Construction Manager shall review Shop Drawings, Product Data, and Samples and return them to Owner noting discrepancies or anticipated problems in use of product.

8. Construction Manager is responsible for receiving, unloading, and handling Owner-furnished items at Project site.

9. Construction Manager is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.

10. If Owner-furnished items are damaged as a result of Construction Manager's operations, Construction Manager shall repair or replace them.

11. Construction Manager shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products:

1. As indicated in Division 2 through 49 Sections.

1.08 WORK RESTRICTIONS

A. On-Site Work Hours: As indicated in the CM Agreement.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted by the Owner with a maximum amount of advanced notice.

C. Nonsmoking Building: Smoking is not permitted within the building or on University grounds.

1.09 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents

2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Construction Manager. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Construction Manager or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence

or phrase.

1.10 PROHIBITED MATERIALS

A. Polychlorinated biphenyls (PCBs) and asbestos are not permitted in materials, systems or assemblies incorporated in the Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

1.01 ACTION SUBMITTALS

A. Substitution Request Form: CSI Form 13.1A.

B. Documentation:

1. Justification.
2. Coordination information.
3. Detailed comparison.
4. Product Data.
5. Samples.
6. Certificates and qualification data.
7. List of similar installations.
8. Material test reports.
9. Research reports.
10. Detailed comparison of Contractor's construction schedule.
11. Cost information.
12. Contractor's certification.
13. Contractor's waiver of rights to additional payment or time.

C. Architect's Action: If necessary, Landscape Architect will request additional information within 7 days of receipt of a request for substitution. Landscape Architect will notify Contractor of acceptance or rejection within 15 days of receipt, or 7 days of receipt of additional information.

1.02 SUBSTITUTIONS

A. Substitutions for Cause: Not later than 15 days prior to time required for preparation and review of submittals.

B. Substitutions for Convenience: Not allowed.

C. Substitutions for Convenience: Will be considered if received within 60 days after commencement of the Work.

END OF SECTION 01 25 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Section "Construction Progress Documentation" for preparing and submitting the Project Schedule.
2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.02 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Plans.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Information (RFIs).

1.03 DEFINITIONS

A. RFI: Request from Construction Manager seeking interpretation or clarification of the Contract Documents.

1.04 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONSTRUCTION MANAGER

A. Since the Contract Documents are complementary, before starting each portion of the Work, the Construction Manager shall carefully study and compare the various Plans and other Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner; shall take field measurements of any existing conditions related to that portion of the Work; and shall observe any conditions at the site affecting it.

1.05 CONTRACT DOCUMENTS

A. Listing of Plans does not limit responsibility of determining full extent of Work required by these Contract Documents.

B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the Plans or Specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete Work.

D. Plans are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or show every offset, pullbox, junction box fitting and component. The purpose of the Plans is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the construction man- ager shall provide all other components and materials necessary to make the systems fully complete and operational.

E. Information and components shown on riser diagrams, but not shown on plans, and vice versa, shall apply or be provided as if expressly required on both.

F. Data that may be furnished electronically by the Design Professional (on computer diskette, CD, or otherwise) is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not substitute for Design Professional's sealed or stamped construction documents.

G. Exact location of receptacles, light fixtures, hand holes, irrigation boxes, etc., shall be co- ordinated with the architectural Plans and with the Design Professional during construction. Placement shall not be determined by measuring locations indicated on any Plan.

1.06 DISCREPANCIES IN DOCUMENTS

A. Where Plans or Specifications do not coincide with manufacturer's recommendations or with applicable codes and standards, submit clarification request in writing before installation. Otherwise, make changes in installed Work required for compliance with manufacturer instruction or codes and standards within CM's GMP.

B. If the required material, installation, or Work can be interpreted differently from Plan to Plan, or between Plans and specifications, provide material, installation or Work that is of the higher standard.

C. The Contract Documents require provision of systems and components that are fully complete and operational and fully suitable for intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements. In these cases, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in

workman- like manner either concealed or exposed in accordance with the design intent.

D. In cases covered by Paragraph (C) above, where engineering guidance is needed, submit an RFI with a sketch requesting direction or proposing a solution if possible. Design Professional shall review and take appropriate action with respect to the RFI.

1.07 MODIFICATIONS IN LAYOUT

A. Plans are diagrammatic. They indicate general arrangements of civil, landscape, structural, architectural, mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and meet Design Professional's requirements.

B. In order to obtain the intended aesthetics in spaces used by building occupants, prior to installation of visible material and equipment (including access panels), review Plans for desired locations and where not definitely indicated, request information from Design Professional.

C. Check Contract Plans, as well a Shop Drawings, to verify and coordinate spaces in which Work will be installed.

D. Maintain maximum headroom at all locations. All mechanical and electrical systems and associated components are to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components needed to prevent conflict with Work of other trades and to coordinate according to Paragraphs A,B,C,D and above. Systems shall be run in a rectilinear fashion.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit to Design Professional a sketch of proposed resolution through the RFI process during mechanical coordination efforts.

1.08 COORDINATION

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

1. Installation of all systems within a given area must be coordinated prior to installation of the first system.

2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

3. Coordinate installation of different components to ensure maximum accessibility for required maintenance, service, and repair.

4. Make adequate provisions to accommodate items scheduled for later installation.

5. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical. Indicate maintenance clearances to access valves and other service points on the Coordination Plans.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate construction managers and contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other construction managers and contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of the Project Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

E. Salvage: Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.09 COORDINATION PLANS

A. A single set of coordination plans shall be prepared by Construction Manager with the in- put of the relevant Site Contracts, Subcontractors and Owner’s separate contractors.

B. The Construction Manager will cause to be prepared a complete set of background plans, showing structure, sheet metal layout and other information as needed for coordination. These will be the Coordination Plans.

C. Each trade including Electrical shall electronically add its work to these background plans with appropriate elevations and grid dimensions. Specialty trade information is requested for mechanical rooms, electrical rooms, and for spaces in and above ceilings where congestion of Work may occur such as corridors, and even entire floors. Coordination Plans shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.

D. Each trade shall sign and date Coordination Plans and return them to the Construction Manager, who shall route them sequentially to all trades.

E. Where conflicts occur with placement of materials of various trades, the Construction Manager will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade. The Construction Manager shall then final date and sign each Coordination Plan. If conflicts can- not be resolved, and (i) the conflict relates to a design issue, then an RFI will be issued to the Design Professional for final resolution, or (ii) if the conflict relates to coordination of the Subcontractors, the decision of the Construction Manager shall be final.

F. A Subcontractor who fails to promptly review and incorporate his work on the Coordination Plans shall assume full responsibility of any installation conflicts affecting his Work and of any schedule ramifications.

G. Construction Manager shall make copies of all Coordination Plans. Fabrication shall not start until such transparencies of completed Coordination Plans are received by the Design Professional and have been reviewed.

H. Review of Coordination Plans shall not diminish responsibility under the Contract Documents for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Civil, Electrical and other Work.

I. After Review:

1. After review of Coordination Plans, the method used to resolve interference not previously identified shall be as in “MODIFICATIONS IN LAYOUT” above.
2. All changes to reviewed Coordination Plans shall be in writing by the Design Professional prior to start of Work in affected areas.

J. Distribution of Coordination Plans:

1. The Construction Manager shall distribute the documents.

K. The main paths of egress and for equipment removal, from electrical rooms must be clearly shown in the Coordination Plans.

L. Coordination Plans shall include, but are not limited to:

1. Structure
2. Plumbing systems, piping and equipment, roof drain piping.
3. Sheet metal work, components and accessories (e.g. coils, terminal boxes) which shall show insulation dimensions.
4. Irrigation
5. Potable Water Connections
6. Landscape
7. Control systems.
8. Electrical distribution, systems and equipment.
9. Lighting systems and fixtures.
10. Electrical Equipment Room layouts.
11. Access panels.
12. Major electrical conduit runs, panelboards, feeder conduits and racks of branch conduit.
13. Conduit and junction boxes for all security system devices.
14. Cable tray, including the following:

    a. Vertical and horizontal offsets and transitions.
    b. Clearances for access above and to side of cable trays.
    c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
15. Environmental rooms and associated refrigeration/heating systems.

M. Construction Manager’s Use of Electronic Files From Design Professional and its Subconsultants:

1. At Construction Manager's written request to the Design Professional and/or a Subconsultant to Design Professional, the Design Professional or its Subconsultant, as the case may be, shall provide to Construction Manager copies of electronic files containing specific portions of the Project design requested by Construction Manager for Construction Manager's use in connection with preparing Coordination Plans (such electronic files are referred to in this Section as the “Electronic Files”).

2. Construction Manager may use the Electronic Files solely for the purpose of incorporating information from the Plans into the Coordination Plans. Construction Manager shall have no right or interest in the Electronic Files other that as expressly set forth in this Subparagraph O. 2. Ownership of the Electronic Files and all rights with respect thereto are as set forth in the agreement between Owner and Design Professional.

3. Construction Manager acknowledges and agrees that (a) the information contained on the Electronic Files may not include, and/or may be different than, in- formation contained in the Contract Documents; and (b) incompatibilities between computer operating systems and software could corrupt or alter the in-

formation contained on the Electronic Files. Accordingly, in preparing the Coordination Drawings, Construction Manager shall not be entitled to rely on the in- formation contained in the Electronic Files; the information in the Contract Documents controls.

1.10 SUBMITTALS

A. The Construction Manager shall utilize Owner's Primavera Contract Manager Project Management System (the "Project Management System") for the management and administration of all correspondence and communications on the Project. See CM Agreement for provisions relating to the Project Management System.

B. Coordination Plans: Prepare Coordination Plans to maximum utilization of space. For efficient installation of different components and if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Plans on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate required installation sequences.
c. Indicate dimensions shown on the Plans and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Design Professional for resolution of such conflicts.

2. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 40 inches.
3. Number of Copies: Submit electronically through the Project Management System.
4. Refer to individual Sections for Coordination Plans requirements for Work in those Sections.

1.11 KEY PERSONNEL

A. Throughout the Project, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to the Project.

1.12 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Design Professional of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute and post the meeting minutes to everyone concerned, including Owner and Design Professional, within five (5) days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting any significant phase or package of Work as agreed by the parties, at a time and place convenient to Owner and Design Professional. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Design Professional, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Safety
b. Tentative Project Schedule.
c. Phasing.
d. Critical Work sequencing and long-lead items.
e. Designation of key personnel and their duties.
f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFIs.
h. Procedures for testing and inspecting.
i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. LEED requirements.
m. Preparation of Project Record Documents.
n. Use of the premises and existing building.
o. Work restrictions.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Construction waste management and recycling.
s. Parking availability.
t. Office, work, and storage areas.
u. Equipment deliveries and priorities.
v. First aid.
w. Security.

x. Progress cleaning.
y. Working hours.

3. Minutes: Record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each significant installation as agreed by the parties.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Design Professional and Owner of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Safety
b. The Contract Documents.
c. Options.
d. Related RFIs.
e. Related Change Orders.
f. Purchases.
g. Deliveries.
h. Submittals.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility problems.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written recommendations.
o. Warranty requirements.
p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other Work.
x. Required performance results.
y. Protection of adjacent Work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Attendees: Representatives of Owner, Owner's Representative, Design Professional, Construction Manager, such Subcontractors and Suppliers as Owner and Construction Manager agree should attend, Owner's separate construction man- agers and contractors and other entities concerned with current progress or involved in planning, coordination, or performance of future activities shall be rep- resented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project. Review present and future needs of each entity present, including the following:

a. Safety
b. Interface requirements.
c. Sequence of operations.
d. Status of submittals.
e. Deliveries.
f. Off-site fabrication.
g. Access.
h. Site utilization.
i. Temporary facilities and controls.
j. Work hours.
k. Hazards and risks.
l. Progress cleaning.
m. Quality and work standards.
n. Status of correction of deficient items.
o. Field observations.
p. RFIs.
q. Status of proposal requests.
r. Pending changes.
s. Status of Change Orders and Unilateral Change Orders.
t. Pending claims and disputes.
u. Documentation of information for payment requests.

E. Project Schedule Meetings:

1. Attendees: At weekly meetings, representatives of Owner, and Construction Manager. At monthly meetings, representatives of Owner, Owner's Representative, Construction Manager, such Subcontractors and Suppliers as Owner and Construction Manager agree should attend, Owner's separate construction man- agers and contractors and other entities concerned with current progress or involved in planning, coordination, or performance of future activities.

2. Agenda: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to the Project Schedule. Determine how construction behind schedule will be expedited; se- cure commitments from parties involved to do so. Discuss whether schedule re- visions are required to ensure that current and subsequent activities will be completed within the requirements of the Project Schedule. Review schedule for next period.

3. Schedule Updating: Revise the Project Schedule after each Project Schedule meeting where revisions to the Project Schedule have been made or recognized. Issue revised Project Schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at periodic intervals as agreed by the parties as required for coordination of the Work. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings, Project Schedule Meetings and preconstruction and preinstallation conferences.

1. Attendees: Representatives of Owner, Design Professional, Construction Manager, such Subcontractors and Suppliers as Owner and Construction Manager agree should attend, Owner's separate construction managers and contractors and other entities concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

G. Commissioning Meetings: Commissioning (Cx) meetings will be held at several mile- stones during construction including a Kick-off meeting, Controls/ Balancing Coordination meeting, and Cx Progress Meetings. Cx Progress meetings will be held at varying intervals from quarterly during construction of the Project to monthly or bi-weekly during the acceptance and warranty phase of the Project.

1. Attendees: Representatives of Owner, Design Professional, Construction Manager, such Subcontractors and Suppliers as Owner and Construction Manager agree should attend, Owner's separate construction managers and

contractors and other entities concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda items for the meetings shall generally include:

   a. Review of previous meeting minutes
   b. Schedule update
   c. Action Items
   d. Update Cx Record
   e. New Issues
   f. Coordination and look ahead until the next meeting

3. CxA shall document minutes of the meeting and distribute per the management protocols agreed to in the Cx Kick-Off meeting

1.13 REQUESTS FOR INFORMATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, prepare and submit an RFI. Where an RFI is a request to resolve a conflict or an unclarity, or a request for additional detail, submit sketch or equivalent description of a proposed solution, if necessary.

1. RFI's shall originate with Construction Manager. RFI's submitted by entities other than Construction Manager will be returned with no response.

   a. Subcontractor RFI's shall be submitted to the Construction Manager for review and comment. The Construction Manager shall make reasonable efforts to research and answer Subcontractors RFI's. Subcontractor RFI's that cannot be answered by the Construction Manager may be submitted to the Design Professional, but must be re-prepared on the approved form.

2. RFI's that relate to work of the Design Professional's Subconsultants shall be submitted only to the Design Professional. The Design Professional will forward to the appropriate Subconsultant and will subsequently issue the formal response.

   a. Any RFI responses received directly from the Design Professional's Subconsultant, and without the Design Professional's action or written authorization shall be null and void. RFI responses that modify the scope of the Project will be issued with a Bulletin.

3. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Construction Manager's Work or Work of Subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Construction Manager.
4. Name of Design Professional.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Plan number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Construction Manager's suggested solution(s). If Construction Manager's solution(s) impact the Project Schedule or the CM's GMP, Construction Manager shall state impact in the RFI if known at that time.
10. Construction Manager's signature.
11. Attachments: Include plans, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary plans prepared by Construction Manager shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above. Submit and process RFI's through the Project Management System.

1. Attachments shall be Electronic Files in Adobe Acrobat PDF format.

D. Design Professional's Action: Design Professional will review each RFI, determine action required, and return it. Allow five (5) working days for Design Professional's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Project Schedule or the CM's GMP.
    e. Incomplete RFIs or RFIs with numerous errors.

2. Design Professional's action may include a request for additional information, in which case Design Professional's time for response will start again.

3. Design Professional's action on RFIs that may result in a change to the Project Schedule or the CM's GMP may be eligible for Construction Manager to submit a COR.

    a. If Construction Manager believes the RFI response warrants change in the Project Schedule or the CM's GMP, notify Owner and Design Professional in writing within three (3) days of receipt of the RFI response.

E. On receipt of Design Professional's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Design Professional within three (3) days if Construction Manager disagrees with response.

F. RFI Log: Prepared through the Project Management System, including the following information:

1. Project name.
2. Name and address of Construction Manager.
3. Name and address of Design Professional.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Design Professional's response was received.
8. Identification of related minor change in the Work, Bulletin, COR, Change Order or Unilateral Change Order, as appropriate.

PART 2 - PRODUCTS (Not Used) PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
2. Division 01 Section "Photographic Documentation" for submitting construction photographs.
3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Project Schedule.
2. Submittals Schedule.
3. Daily construction reports.
4. Special reports.

1.03 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: Project Schedule shall be cost-loaded on a summary level consistent with the Schedule of Values.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the net- work schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Construction Manager, but is a jointly owned, expiring Project resource available to both par- ties as needed to meet schedule milestones and Contract completion date.

2. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

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

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and ac- tivity relationships.

1.04 SUBMITTALS

A. Submittals: All submittals shall be made in accordance with the requirements specified in Section 01 33 00 – SUBMITTAL PROCEDURES. All construction-related submittals shall be made utilizing the Project Management System.

B. Submittals Schedule: Submit Project Schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of Subcontractors.
5. Description of the Work covered.
6. Scheduled date for Design Professional's final release or approval.

C. Project Schedule: Submit on Project Management System.

1. Approval of cost-loaded preliminary project schedule will not constitute approval of Schedule of Values for cost-loaded activities.

D. Preliminary Network Diagram: Submit on Project Management System the entire

network for the entire construction period. Show logic ties for activities.

E. Project Schedule: Submit on Project Management System the initial schedule for the entire construction period.

F. CPM Reports: Concurrent with CPM schedule, submit on Project Management System each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost loading at a summary level, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

3. Total Float Report: List of all activities sorted in ascending order of total float.

4. Earnings Report: Compilation of Construction Manager's total earnings from the Notice to Proceed until most recent Application for Payment.

G. Construction Photographs: Submit in accordance with Division 01 Section “Photographic Documentation”.

H. Monthly Construction Manager (CM) Report.

I. Daily Construction Reports: Submit on Project Management System at daily intervals.

J. Special Reports: Submit on Project Management System at time of unusual event.

1.05 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 48 hours of De- sign Professional’s request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the Project Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing work stages area separations interim mile- stones and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.

6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review submittal requirements and procedures.
11. Review procedures for updating schedule.

1.06 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities.

B. Coordinate the Project Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from par- ties involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit on Project Management System a schedule of submittals, arranged in chronological order by dates required by the Project Schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and the Project Schedule.

2. Initial Submittal: Submit on Project Management System concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit on Project Management System concurrently with the first complete submittal of the Project Schedule.

2.02 PROJECT SCHEDULE, GENERAL

A. Preparation: The Project Schedule shall be developed and maintained utilizing Primavera P6 (version 6.0 or later).

B. Time Frame: Extend schedule from date established in the Initial Notice through the date of Final Completion.

1. The Milestone Dates and dates required for Substantial Completion and Final Completion shall not be changed unless specifically authorized by Change Order or Amendment signed by Owner.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities with appropriate level of detail and time duration necessary to manage the Project.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in the Project Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 14 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Design Professional's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each con- tract.
3. Work by Owner: Include a separate activity for each portion of the Work per- formed by Owner as identified by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of pertinent Work restrictions on the Project Schedule.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.

e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Permanent space enclosure.
c. Completion of mechanical installation.
d. Completion of electrical installation.
e. Substantial Completion.

E. Milestones: Include Milestone Dates indicated in the Contract Documents in schedule, including, but not limited to, the date established in the Initial Notice, the dates for Substantial Completion and Final Completion and the Interim Milestones defined in the CM Agreement.

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

G. Computer Software: Prepare and maintain Project Schedule using Primavera P6 (version
6.0 or later).

2.03 PROJECT SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare the Project Schedule using a computerized, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Initial No- tice.

a. Failure to include any Work item required for performance of the Contract Documents shall not excuse Construction Manager from completing all Work within applicable completion dates, regardless of Owner’s approval of the Project Schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment re- quest dates.

3. Use "one workday" as the unit of time. Include list of nonworking days and holi- days incorporated into the Project Schedule.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Construction Manager's activities.
i. Testing and commissioning.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time- scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the time limits required for Substantial Completion and Final Completion in the CM Agreement.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Initial Issue of Project Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Construction Manager or Subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.

4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Approximate size of workforce.

E. Schedule Updating: The Project Schedule will be updated at a minimum of once a month; more frequent updates may be required if Owner deems necessary. The data date for monthly schedule updates shall be the 1st of the month. An updated Project Schedule shall be prepared and submitted by the 5th of each month during the duration of the Project to Owner or their authorized representative and shall include as a mini- mum the following:

1. Approved changes to the Contract.
2. Any "slippage" due to procurement delays, unforeseen conditions, weather and other delays.
3. Changes in activity sequencing or duration as modified from previous submittals.
4. A computer generated, detailed precedence diagram.
5. A current activity tabulation report, including at a minimum the following information for each activity in the Project Schedule:
   a. Preceding and succeeding activity ID's.
   b. Activity description and number.
   c. Estimated current duration of each activity.
   d. Earliest start date (by calendar date).
   e. Earliest finish date (by calendar date).
   f. Latest start date (by calendar date).
   g. Latest finish date (by calendar date).
   h. Scheduled float.
   i. Percentage of activity completed, or number of working days remaining (for updates only).
   j. Actual start date (by calendar date, for updates only).
   k. Actual finish date (by calendar date, for updates only).

6. Schedule activity analysis report, which shall be consistent with the information shown on the precedence diagram and which shall include the following:

   a. A network report sorted by early start.
   b. A network report sorted by total float.
   c. A network logic report indicating predecessor and successor activities.
   d. A six (6) week look ahead schedule based on early start sort.

7. A detailed narrative report, which shall include the following:

   a. A summary of progress for the period reported.
   b. A description of any special problems (with proposed solutions) or assumptions underlying the Project Schedule.
   c. A tabulation of all activities completed or partially completed, a discussion of all activities added or deleted, or changed in either

logic and/or duration during the report period.

d. A statement of the percentage of the Work actually completed as of the report date, and the progress along the critical path in terms of days ahead or behind the allowable dates.

F. Project Schedule Revisions: The Milestone Dates and dates required for Substantial Completion and Final Completion shall not be changed unless specifically authorized by Change Order or Amendment signed by Owner.

2.04 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of Subcontractors at Project site.
2. List of separate construction managers and contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Construction activities undertaken.
9. Unusual events or field conditions (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Services connected and disconnected.
12. Equipment or system tests and startups.
13. Partial completions and occupancies.
14. Substantial Completions authorized.

B. Monthly Construction Manager (CM) Reports: The Monthly CM Report should include the following:

1. Executive Summary

a. Contract Status
b. Contingency Status
c. Subcontractor Buyouts and Procurement
d. Cash Flow Trends
e. Critical Activities/Issues
f. Quality Control
g. Safety

2. Contract Summary

a. Contract Value, Change Orders, Unilateral Change Orders, Bulletins, Con- tract Expenditures
b. Allowances Status Report
c. CM Contingency Status Report
d. Owner Contingency Status Report

3. Project Schedule

   a. Critical Activities
   b. Summary

4. Project Quality Summary Report
5. Submittal Summary Report
6. RFI Summary Report
7. Progress Photographs
8. Monthly Safety Report
9. Other reports required by the CM Agreement

2.05 SPECIAL REPORTS

A. General: Submit special reports directly to Owner via the Project Management System within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Construction Manager's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.01 PROJECT SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

   1. In-House Option: Owner may waive the requirement to retain a consultant if Construction Manager employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
   2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Project Schedule Updating: At monthly intervals, update Project Schedule to reflect actual construction progress and activities subject to Owner’s approval. Issue Project Schedule one week before each regularly scheduled progress meeting.

   1. Revise Project Schedule (subject to Owner’s approval) immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated Project Schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and

finishes, and activity durations.

3. As the Work progresses, indicate Actual Completion percentage for each activity.

C. Distribution: Submit copies of approved Project Schedule via the Project Management System to Design Professional, Owner, separate construction managers, contractors, testing and inspecting agencies, and other parties identified by Construction Manager with a need-to-know schedule responsibility.

1. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting digital media As-Built Plans at Project closeout.
3. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.

1.02 SUMMARY

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

1. Preconstruction photographs and video.
2. Periodic construction photographs.
3. Final Completion construction photographs
4. Video recording of work progress

1.03 ALLOWANCE (Not used)

1.04 UNIT PRICES (Not Used)

1.05 SUBMITTALS

A. All submittals shall be made in accordance with the requirements specified in Section 01 33 00 – SUBMITTAL PROCEDURES. All construction-related submittals shall be made utilizing the Owner's Project Management System.

B. Qualification Data: Refer to Division 01 section "Construction Progress Documentation".

C. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and videotape. Indicate elevation or story of construction. Include same label information as corresponding set of photographs and videotape.

D. Construction Photographs: Submit digital prints of each photographic view within seven days of taking photographs.

1. Identification: For each digital file, provide the following information:

a. Name of Project.
b. Name and address of photographer.

c. Name of design professional and Owner.
d. Name of construction manager.
e. Date photograph was taken if not date stamped by camera.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier.

2. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, un- cropped.

1.06 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.07 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide access to the Project site.

1.08 USAGE RIGHTS

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

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels.

B. Videotape Format: Submit video recordings in digital video disk format acceptable to Owner.

1. Tape quality shall be adequate to create photographic prints to be made from individual frames.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified commercial photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in filename for each image.

2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Design Professional and Owner.

D. Preconstruction Photographs: Provide any preconstruction photographs to the Owner.

1. Flag the construction limits before taking construction photographs.

2. Take eight (8) different photographs to show existing conditions adjacent to property before starting the Work.

3. Take eight (8) different photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

E. Periodic Construction Photographs: Take twelve (12) color digital photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Owner-Directed Construction Photographs: From time to time, the Owner will instruct photographer about number and frequency of color digital photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

G. Final Completion Construction Photographs: Take eight (8) color digital photographs after date of Substantial Completion. Design Professional, Owner and Construction Man- ager will direct photographer for desired vantage points.

1. Do not include date stamp.

H. Additional Photographs: Design Professional and Owner may issue Bulletins requesting additional photographs, in addition to periodic photographs specified. No additional photographs will be taken unless a Change Order or Unilateral Change Order is issued.

1. Three days' notice will be given, where feasible.

2. In emergency situations, take additional photographs within 24 hours of request.

3. Circumstances that could require additional photographs include, but are not limited to, the following:

   a. Special events planned at Project site.
   b. Immediate follow-up when on-site events result in construction damage or losses.
   c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
   d. Substantial Completion of a major phase or component of the Work.
   e. Extra record photographs at time of final acceptance.
   f. Owner's request for special publicity photographs.

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Project Requirement
2. Division 01 Section Project Management and Coordination
3. Division 01 Section Construction Progress Documentation
4. Division 01 Section Quality Requirements
5. Division 01 Section Closeout Procedures
6. Divisions 02 through 49 Sections for specific requirements for submittals

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Design Professional's responsive action.

B. Informational Submittals: Written information that does not require Design Professional's responsive action. Submittals may be rejected for not complying with requirements.

C. Delegated Design Submittals: Written and graphic information that requires Design Professional’s review.

1.04 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

B. Submittals Schedule: Comply with requirements in 01 32 00 Construction Progress Documentation for list of submittals and time requirements for scheduled performance of related construction activities.

C. The Construction Manager shall utilize Owner’s Project Management System for the management and administration of all submittals including correspondence and

communications, on the Project. The generation of documents using the Project Management System will automatically create a document log so that the tracking of, and response to documents can be maintained electronically and should minimize mailing or overnight de- livery of paper documents. The Owner will arrange for training of Construction Manager's personnel in the use of the Project Management System.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Design Professional's receipt of submittal. No extension of any date in the Project Schedule will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow seven (7) working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Design Professional will advise Construction Manager when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow seven (7) working days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Design Professional's Subconsultants, Owner, or other parties is indicated, allow seven (7) working days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Design Professional and to Design Professional's Subconsultants, allow seven (7) working days for review of each submittal. Submittal will be returned to Design Professional before being returned to Construction Manager.

6. Extended Review: Allow fourteen (14) working days for initial review of the following submittals: Coordination Plans, testing and balancing reports, building automation/temperature control systems, and fire protection fabrication drawings.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Construction Manager's review and approval markings and action taken by Design Professional.

3. Include the following information on label for processing and recording action taken:

a. Project name.
b. Date.

c. Name and address of Design Professional.
d. Name and address of Construction Manager.
e. Name and address of Subcontractor
f. Name and address of Supplier.
g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number pre- ceded by the submittal number and followed by the revision number (e.g.: 0001-05120-0).

i. Number and title of appropriate Specification Section.
j. Plan number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

F. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.

1. Proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with Shop Drawings which flags the deviation to the attention of the Design Professional for appropriate action in accordance with the terms of the CM Agreement.

2. Approval of proposed deviations will be made at the discretion of the Design Professional.

G. Resubmittals: Make resubmittals in same form as initial submittal use the Project Management System for all resubmittals.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked "Approved" or “Approved as Noted."

H. Distribution: Furnish copies of final submittals to manufacturers, Subcontractors, Suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals with mark indicating "Approved" or “Approved as Noted" taken by Design Professional.

J. Submittal Cover sheet:

1. Submittals shall include a copy of the enclosed cover sheet completely filled out. Incomplete or incorrect cover sheet submittal shall constitute reason for rejection.

2. Submittals shall be prepared according to specification section with a separate

cover sheet completed for each submittal, whether or not supplied by one manufacturer or vendor.

3. Submittals shall each include a cover sheet in the form attached to this Section as Appendix A.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Submit electronic submittals using the Project Management System.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.
o. Operational ratings.

4. Submit Product Data before or concurrent with Samples.

5. Submit electronic copies through the Project Management System.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation plans.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size plans, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 36 by 48 inches (by 1000 mm).

3. Submit electronic copies through the Project Management System.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit four (4) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Design Professional will return two (2) copies of the submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, pre- pared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit three (3) sets of samples. Design Professional will retain two (2) sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project record Sample.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

E. Submittals Schedule: Comply with requirements specified in 01 32 00 Construction Progress Documentation.

F. Application for Payment: Comply with requirements specified in CM Agreement.

G. Schedule of Values: Comply with requirements specified in CM Agreement.

H. Coordination Plans Comply with requirements specified in 01 31 00 Project Management and Coordination and Division 2 through 50.

2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals.

1. Submit electronic copies through the Project Management System.

2. Certificates and Certifications: Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Project Schedule: Comply with requirements specified in 01 32 00 Construction Progress Documentation.

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names

and ad- dresses, names and addresses of design professional and owners, and other information specified.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed be- fore installation of product, for compliance with performance requirements in the Con- tract Documents.

L. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

M. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in 01 78 23 "Operation and Maintenance Data."

N. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

O. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

P. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

Q. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

R. Construction Photographs: Comply with requirements specified in 01 32 00 Construction Progress Documentation.

S. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Design Professional.

2.03 DELEGATED DESIGN SUBMITTALS

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Construction Manager by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Design Professional.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to

Construction Manager to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.01 CONSTRUCTION MANAGER'S REVIEW

A. Review each submittal and check for coordination with other Work and for compliance with the Contract Documents. Note corrections and field dimensions.

B. Approval Stamp: Prior to submitting a submittal to the Design Professional, stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Construction Manager's approval, and statement certifying that submittal has been reviewed and checked for compliance with the Contract Documents.

3.02 DESIGN PROFESSIONAL'S ACTION

A. General: Design Professional will not review submittals that do not bear Construction Manager's stamp and will indicate “not reviewed” in the Project Management System.

B. Action Submittals: Design Professional will review each submittal, make marks to indicate corrections or modifications required, and return it. Design Professional will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. APPROVED: Final unrestricted release. The Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance. This action only applies when there are no marks on the submittal.
2. APPROVED AS NOTED: Final-but-restricted release. The Work covered by the submittal may proceed provided it complies with both the Design Professional’s notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
3. APPROVED AS NOTED – RESUBMIT RECORD COPY: Final-but-restricted release. The Work covered by the submittal may proceed provided it complies with both the Design Professional’s notations and corrections on the submittal and the Con- tract Documents. Final acceptance will depend on that compliance. A revised or new submittal is required to be submitted to the Design Professional for record purposes.
4. REJECTED: The Work covered by the submittal may not proceed. A new submittal for a product that complies with the Contract Documents must be submit- ted to the Design Professional.

C. Informational Submittals: Design Professional will review each submittal and will not re- turn it, or will indicate “rejected” through the Project Management System, if it does not comply with requirements.

D. Partial submittals are not acceptable, will be considered non-responsive, and will not be reviewed and Design Professional will indicate “not reviewed” through the Project Management System.

E. Delegated Design Submittals: Any submittal not required by the Contract Documents will be treated as an Informational Submittal and therefore, will only be returned as “rejected“ if it does not comply with requirements.

APPENDIX A

SUBMITTAL COVER SHEET			
PROJECT:		SUBCONTRACTOR/ VENDOR:	
DIVISION NO.:		SECTION NO.:	
DESCRIPTION:			
CONTRACT DRAWING REFERENCE NO:			
SUBMISSION (CIRCLE ONE): FIRST, SECOND, THIRD, FOURTH			
DATE:			

1.	Construction Manager's Submittal Number			
2.	Are all specified or scheduled items included and match scheduled/specified items?	Yes	No	
3.	Is this item a substitution?	Yes	No	
4.	Are deviations clearly identified?	Yes	No	
5.	Does equipment fit space shown on contract documents, coordination drawings, and field conditions?	Yes	No	N/A
6.	Has support, erection, weights, and installation been co-ordinated with contiguous trades?	Yes	No	N/A
7.	Does the proposed installation void warranties and/or violate UL or code requirements?	Yes	No	N/A
8.	Does this material/equipment add unknown expense to other trades or project costs?	Yes	No	N/A
9.	Does equipment require interface with other trades? List divisions and specifics requiring coordination?	Yes	No	N/A
10.	Is control interface coordinated?	Yes	No	N/A
11.	Do electrical characteristics match contract documents?(Voltage/Phase/Hz/Amps)	Yes	No	N/A
12.	Is LEED submittal information required? If yes, is LEED submittal information included in this submittal? If no, when is LEED submittal information anticipated?	Yes	No	

END OF SECTION 01 33 00

SECTION 01 33 32 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submission of all shop drawings and product data as required by the Contract Documents for all equipment and materials to be furnished under this contract unless specifically indicated otherwise

1.2 RELATED SECTIONS

A. Section 01 33 00 Submittal Procedures

B. Section 01 45 00 Quality Control

C. Sections for Divisions 1 through 16 Required Submittals

1.3 SUBMITTALS

A. Shop Drawings - Drawings shall be presented in a clear and thorough manner:
   1. Identify details by reference to sheet and detail, schedule or room numbers shown on Contract Drawings
   2. Identify equipment by reference to equipment name and tag number shown on Contract Drawings
   3. Scale and Measurements: Make drawings accurate to a scale with sufficient detail to show the kind, size, arrangement and function of component materials and devices
   4. Minimum sheet size: 8.5" by 11"
   5. Fabrication drawing size: 11" by 17" or 24" by 36"

B. Product Data - Preparation:
   1. Clearly mark each copy to identify pertinent products or models submitted for review
   2. Identify equipment by reference to equipment name and tag number
   3. Catalog cut sheets: Cross-out or delete irrelevant data
   4. Show performance characteristics and capacities

C. Construction Schedule: Construction schedule must be produced using Microsoft Project, Suretrack, or P6(Oracle) project management software. Schedule to show a critical path that is completed within the confines of the contractual schedule. Designate in the construction schedule, or in a separate coordinated shop drawing schedule, the dates for submission and the dates that reviewed Shop Drawings and Product Data will be needed

D. Manufacturer's standard schematic drawings and diagrams:
   1. Modify drawings and diagrams to delete information which is not applicable to the Work by crossing out or omitting irrelevant data
   2. Supplement standard information to provide information specifically applicable to the Work

1.4 CONTRACTOR RESPONSIBILITIES

A. Review shop drawings and product data prior to submission for accuracy and completeness of each submission

B. Approve and stamp each submission before submitting it to Engineer

C. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Catalog numbers and similar data
   4. Conformance with specifications

D. Prior to each submission, carefully review and coordinate all aspects of each item being submitted

E. Verify that each item and the corresponding submittal conform in all respects with specified requirements of the Work and of the Contract Documents with respect to means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto

F. Make submissions promptly in accordance with Construction Schedule, and in such sequence as to cause no delay in the Work or in the work of any other Contractor

G. Limit requirement for accelerated submittal review by Engineer to no more than 10% percent of total number of submittals

H. Notify Landscape Architect in writing, at time of submission, of any deviations in the submittals from Contract Document requirements:
   1. Identify and tabulate all deviations in transmittal letter
   2. Indicate essential details of all changes proposed, including modifications to other facilities that may be a result of the deviation
   3. Include required piping and wiring diagrams

1.5 SUBMISSION REQUIREMENTS

A. Make submissions far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmissions, and for placing orders and securing delivery

B. In scheduling, allow 7 calendar days for review by Landscape Architect following receipt of submission in Landscape Architect’s office:
   1. Time required to mail submissions or resubmissions is not considered a part of review period

C. Consecutively number all submissions:
   1. Assign a unique number to include all shop drawings, product data and other information required for individual specification sections
   2. Each specification section may still have more than one submittal number for later submissions (i.e., Preliminary O&M Manuals, Final O&M Manuals, etc.)

D. Number of Submittals Required:
   1. Shop Drawings and Product Data: Submit a maximum of 2 copies for Contractor's use, plus a maximum of 3 copies which will be distributed by Landscape Archtect when approved. Do not submit more than 5 copies

2. Samples: Submit 3 of each sample unless specified otherwise in individual specification section

E. Accompany each submission with a letter of transmittal showing all information required for identification and checking. Submittals shall contain:
1. Submittal number
2. Date of submission and dates of any previous submissions
3. Project title and number
4. Owner Contract identification number if applicable
5. The names of
   a. Contractor
   b. Supplier
   c. Manufacturer
6. Identification of the product, with the specification section number
7. Field dimensions, clearly identified as such
8. Relation to adjacent or critical features of the Work or materials
9. Applicable standards, such as ASTM or Federal Specification numbers
10. Identification of deviations from Contract Documents
11. Identification of revisions on resubmissions
12. An 8" by 4" blank space for Contractor's, Landscape Architect, and Engineer's stamps
13. Stamp cover sheet of each submittal as identified in letter of transmittal
14. Contractor's stamp: Initialed or signed, certifying review and approval of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents. Use stamp to include wording similar to the following:

This submittal has been reviewed by [*Name of Contractor*] and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. [*Name of Contractor*] also warrants that this submittal complies with contract documents and comprises no deviations thereto: Section No:_____ Submittal No: Date:_____ By:

F. Submittal Log:
   1. Maintain an accurate submittal log for duration of the Work showing current status of all submissions
   2. Show submittal number, section number, section title, submittal description dates and disposition of submittal
   3. Make submittal log available to Landscape Architect for Landscape Architecture's review upon request

G. Unless specified otherwise, make submissions in groups to facilitate efficient review and approval:
   1. Include all associated items from individual specification sections to assure that all information is available for checking each item when it is received
   2. Submit a complete initial submittal including all components when an item consists of components from several sources
   3. Partial submittals may be rejected as not complying with provisions of the Contract
   4. Engineer will not be held liable for delays due to poorly organized or incomplete submissions
   5. Do not include items from more than one specification section for any one submittal number

H. Contractor may require subcontractors to provide drawings, setting diagrams and similar information to help coordinate the Work, but such data shall remain between Contractor and his subcontractors and will not be reviewed by Landscape Architect unless specifically called for within the Contract Documents

1.6 DISPOSITION OF SHOP DRAWINGS AND PRODUCT DATA

A. "No Exceptions Taken": Approved with No Corrections Noted
   1. One copy sent to Owner
   2. One copy sent to Resident Project Representative
   3. One copy retained in Landscape Architect's file
   4. Remaining copies returned to Contractor for his use
      a. One copy to be kept on file at Contractor's office at job site
      b. Remaining copies for Contractor's office file, suppliers, or subcontractors
   5. No corrections or comments noted on the submittal or on a Submittal Response Summary Sheet
   6. Issues or miscellaneous comments pertaining to other related items of the Work may be included in transmittal letter
   7. Resubmission not required

B. "Exceptions Noted": Approved with Corrections Noted
   1. One copy sent to Owner

2. One copy sent to Resident Project Representative
3. One copy retained in Landscape Architect's file
4. Remaining copies returned to Contractor for his use
   a. One copy to be kept on file at Contractor's office at job site
   b. Remaining copies for Contractor's office file, suppliers or subcontractors
   c. Copies of submittal data in operation and maintenance manuals to be revised according to corrections
5. Comply with corrections or comments as noted on the submittal or on a Submittal Response Summary Sheet
6. Resubmission not required

C. "Revise And Resubmit": Incorrect information provided or Significant Information Still Required
1. One copy sent to Resident Project Representative
2. One copy retained in Landscape Architect's file
3. All remaining copies returned to Contractor for revision and re-submittal
4. Copy of transmittal letter and/or Submittal Response Summary Sheet sent to Owner. A "No Exceptions Taken" or "Exceptions Noted" submittal it will be forwarded to Owner after review per above disposition requirements
5. Submittal is either: incorrectly annotated; specific comments need to be addressed and incorporated in re-submittal; and/or additional information may be required as noted on the submittal or on a Submittal Response Summary Sheet
6. Submitted information may not include or address specific item required per the specification as identified on the submittal or on a Submittal Response Summary Sheet
7. Specific information related to identified item may be required for final approval of submittal
8. Resubmission of entire submittal may be required or resubmission of specific item may be required as identified on the submittal or on a Submittal Response Summary Sheet

D. "Rejected": Returned for Correction
1. One copy sent to Resident Project Representative
2. One copy retained in Landscape Architect's file
3. All remaining copies returned to Contractor
4. Copy of transmittal letter and/or Submittal Response sent to Owner
5. Contractor required to resubmit complete submittal package in accordance with Contract Documents
6. Submittal does not comply with provisions of Contract Documents as noted on the submittal or on a Submittal Response Summary Sheet
7. Resubmission required

1.7 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in submittals required by Landscape Architect and resubmit until approved

B. Transmit each resubmission under new letter of transmittal. Use number of original submittal followed directly by a capital letter corresponding to the number of times a submittal is resubmitted (i.e., 1, 1A, 1B, etc.)

C. Shop Drawings and Product Data
1. Revise initial drawings or data and resubmit as specified for the initial submittal
2. Indicate any changes which have been made other than those requested by Landscape Architect

D. Samples: Submit new samples as required for initial submittal

1.8 LANDSCAPE ARCHITECT'S DUTIES

A. Review submittals with reasonable promptness and in accord with submission schedule provided that each submittal has been called for by the Contract Documents and is stamped by Contractor as indicated above
   1. No extensions of time are allowed due to Landscape Architect's delay in reviewing submittals unless all the following criteria are met:
      a. Contractor has notified Landscape Architect in writing that timely review of particular submittal in question is critical to the progress of the Work and Contractor has identified the requested submittal return date.
      b. Engineer has failed to return submittal within 7 days of receipt of the submittal or receipt of said notice, whichever is later
      c. Contractor demonstrates that delay in progress of the Work was directly attributable to Engineer's failure to return submittal within 7 days
   2. No extensions of time are allowed due to delays in progress of the Work caused by rejection and subsequent resubmission of data, including multiple resubmissions
   3. Engineer's review shall not extend to means, methods, techniques, sequences, operations of construction, and safety precautions and programs incidental thereto. No information regarding these items will be reviewed whether or not included in submittals
   4. In the event that Engineer will require more than 7 calendar days to perform review, Landscape Architect shall so notify Contractor

B. Review drawings and data submitted only for general conformity with Contract Documents
   1. Engineer's review of drawings and data returned marked No Exceptions Taken or Exceptions Noted does not indicate a thorough review of all dimensions, quantities, and details of material, equipment device or items shown
   2. Engineer's review does not relieve Contractor of responsibility for errors, omissions or deviations nor responsibility for compliance with the Contract Documents

C. Assume that no shop drawing or related submittal comprises a deviation to the Contract Documents unless Contractor advises Landscape Architect otherwise in writing which is acknowledged by Landscape Architect in writing:
   1. Consider and review only those deviations from the Contract Documents clearly identified as such on the submittal and tabulated on the Contractor's transmittal sheet.

D. Return submittals to Contractor for distribution or for resubmission

E. Transmit, unreviewed, to Contractor all copies of submittals received directly from suppliers, manufacturers and subcontractors

F. Transmit, unreviewed, to Contractor all copies of submittals not called for by the Contract Documents or which have not been approved by Contractor

G. Landscape Architect will not review uncalled-for shop drawings or product data except by special arrangement

H. Affix stamp and indicate approval for submittal or resubmission requirements with the following stamp:

[]NO EXCEPTIONS TAKEN []EXCEPTIONS NOTED []REVISE & RESUBMIT []REJECTED This review was performed only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Modifications or

comments made on the shop drawings and product data during this review do not relieve Contractor from responsibility for compliance with the requirements of the plans and specifications. Contractor is responsible for: dimensions and quantities; information that pertains solely to the fabrication processes or to the means, methods, of construction; coordination of the work of all trades.

Tom Leader Studio, Inc.

Date_____ By_____

1.9 SUBMITTAL SCHEDULE

A. Unless indicated otherwise, provide all submittals required by individual sections of the Contract Documents to establish compliance with the specified requirements.

B. Contractor to produce schedule of submittals for Landscape Architect review.

C. For equipment that is provided directly by manufacturer without specification provide:
   1. Shop drawings: Illustrate complete assembly of products; foundation, installation and anchor requirements; dimensions and total weights of each, electrical wiring diagrams
   2. Product data: Provide manufacturer's literature including general assembly, materials of construction, model and type, detailed data describing parts and accessories, sufficient data to verify compliance with specifications
   3. Manufacturer's installation instructions: Provide detailed connection requirements and startup instructions
   4. Manufacturer's field report: Indicate personnel present and actual start-up procedures that were performed by manufacturer's representative

PART 2 PRODUCTS
Not used

PART 3 EXECUTION
Not used

END OF SECTION 01 33 32

SECTION 01 35 13 - SPECIAL PROJECT PROCEDURES

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 special project procedures.

1. Owner testing of materials

B. Related Requirements:

1. NA

1.03 ACTION SUBMITTALS

A. Product Data, Samples and Material Safety Data Sheets: For each product to be tested by the Owner.

1. Include material descriptions for each product.

2. Samples are to be 3 to 6 inches square.

3. Any product know to contain or emit any of the following chemicals will not be accepted; sulphur dioxide, nitrogen dioxide, nitrogen oxide, organic acids, aldehydes, carbonyl sulphide, hydrogen sulphide or ozone.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Contractor's testing agency.

B. Action Plan: Proposed plan outlining steps to performed to execute the airtightness testing program. Indicate how plan will be implemented allowing the Architect and Owner to witness the testing and documentation of the results.

C. Material and Product Certificates: For each type of product

1. Submit a certification from the Manufacturer stating that none of the above mentioned substances are used in the formulation or production of the material or product and

that they assure that no changes to the formulation or production will be made between the time the sample was produced and delivery of the product.

D. SUBMISSION FORM

1. Submit all product data, samples, material safety data sheets and material/ product certifications with the enclosed submission form.

1.05 QUALITY ASSURANCE

A. Contractor's Testing Agency Qualifications: Qualified according to ASTM C 1021 ASTM C 1093 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC Standard 17025.

1.06 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency (or self perform the testing) to perform preconstruction testing on all materials intended to be incorporated as part of the Work throughout the project.

1. All materials shall be tested.
2. Only materials which have been tested by the Owner and approved (authorized) in writing may be incorporated into the Work.
3. Samples and product data shall be submitted to the Owner in compliance with the Owner's requirements and as specified under Division 01 Section "Submittal Procedures".
4. The Owner's testing process requires an additional 30 calendar days in addition to the submittal review process specified under Division 01 Section "Submittal Procedures".
5. SUBSTITUTION OF TESTED AND APPROVED MATERIALS IS STRICTLY PROHIBITIED.
6. Any discovered product installed, which has not been tested and approved, will be removed and replaced at no additional costs to the Owner.

PART 2 - PRODUCTS

(NOTUSED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION 01 35 13

SECTION 01 35 26 – GOVERNMENTAL SAFETY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. NOT USED

1.02 SUMMARY

A. This Section includes requirements for police details.

1.03 POLICE DETAILS

A. Where applicable, the Construction Manager shall provide the manpower necessary to direct vehicular and pedestrian traffic on city streets and sidewalks as required in the City's Street Opening Permit. Municipal police department personnel shall be used in municipal rights-of-way. City of Boulder Police shall be used in Owner's properties.

B. When Municipal Police are not available for detail, Construction Manager shall arrange for police details to be filled by other State or Municipal Police agencies.

C. When so directed, the Construction Manager shall make all arrangements for obtaining the necessary manpower. All invoices for policing will be made to the Construction Man- ager and the Construction Manager shall pay all expenses incurred, including the salaries of assigned personnel.

D. The intent is to insure public safety by police direction of traffic. Police being paid for by Owner are not to serve as watchmen to protect the Construction Manager's equipment and materials.

E. Nothing contained herein shall be construed as relieving the Construction Manager of any of his responsibilities for protection of persons and property under the terms of the CM Agreement.

F. The City of Boulder Police shall be paid for on a weekly basis in accordance with an invoice from the police departments, with payment sent directly to the police departments.

PART 2 – GENERAL

(Not Applicable)

PART 3 – GENERAL

(Not Applicable)

END OF SECTION 01 35 26

SECTION 01 35 29 - HEALTH AND SAFETY

PART 1 - GENERAL

1.01 GENERAL

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

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

C. Coordinate work with that of all other trades affecting or affected by the Work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK

A. The Contractor shall prepare and implement one global, all encompassing, site-specific Health and Safety Plan (H&SP) to protect the health and safety of all workers (including subcontractors) engaged in activities where exposure to fill soil is possible, as determined by a Qualified Health Professional (QHP) retained by the Contractor. One H&SP shall be prepared by the Construction Manager/General Contractor for the project that is applicable to all subcontractors, workers, etc. Individual H&SPs by subcontractors need to be coordinated. The H&SP shall also be designed to protect the general public and the environment during the course of the Work. The H&SP shall include, as a minimum, the following:

1. Procedures to protect worker and public health and safety from exposure to oil or hazardous materials that may originate from or be present at the project site, including procedures to contain oil and/or hazardous materials.
2. Procedures for monitoring, controlling, and mitigating fugitive dust, odors, and gases to protect worker and public health and safety.
3. Procedures to decontaminate vehicles and equipment to prevent the spread of fill soil from the Work area.
4. Procedures to secure on-site work areas.
5. Procedures to protect workers and the general public during all aspects of construction. These procedures shall address physical aspects of health and safety, as well.
6. Conduct a health and safety coordination meeting prior to commencement of excavation work at the site to inform workers of the site conditions and proposed health and safety contingency actions. Inform new workers of the site conditions and proposed health and safety contingency actions on a continuous basis.

B. The scope and detail of the H&SP shall be commensurate with the degree and nature of the risks posed to human (worker and public) and ecological populations by the Work as determined by the Contractor's QHP. Standardized health and safety plans may be appropriate for non-intrusive or routine activities conducted at the site.

C. The Contractor shall appoint an OSHA-qualified Health & Safety Supervisor/Coordinator who will be charged with overseeing site health and safety, instrument monitoring, personnel and equipment decontamination, control of equipment chick-out, dust monitoring, odor

monitoring, gas monitoring, and emergency response.

1.03 RELATED SECTIONS

A. Section 02 61 13 – Excavated Soil and Material Management Plan
B. Section 31 00 00 – Earthwork

1.04 DEFINITIONS

A. Owner: City of Boulder
B. Architect: Tom Leader Studio, Inc.
C. Engineer: JVA.
D. Qualified Health Professional (QHP): A person retained by the Contractor to prepare the Contractor's H&SP and for quality control as specified herein. The QHP shall have a minimum of 10 years' experience in this work, certification as a safety professional qualified by training and experience to act in this capacity, and certification as having completed the 40-hr OSHA health and safety training course, with current 8-hr refresher training and 8-hr OSHA manager's training. The QHP shall assume the role of Site Health and Safety Officer, as described below, or oversee the activities of the SHSO
E. Site Health and Safety Officer (SHSO) (may be the same as the QHP): A person retained by the Contractor to perform field testing for evaluation of environmental contaminants and compounds of concern in air, soil, and groundwater in accordance with the Contractor's H&SP and as directed by the QHP. The SHSO shall have a minimum of five years experience in this work, and certification as having completed the 40 hr. OSHA health and safety training course, with current 8-hr. refresher training and 8-hr. OSHA manager's training
F. EPA: U.S. Environmental Protection Agency
G. OSHA: Occupational Safety and Health Administration
H. PID: Photoionization Detector
I. H&SP: Health and Safety Plan

1.05 REFERENCE STANDARDS

A. NIOSH/OSHA/USCG/EPA: Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," DHHS/NIOSH Pub. No. 85-115, October 1985

B. OSHA: Part 29 CFR 19.10.134; 1910.1001-1046

C. EPA: Executive Orders 12223, 1440.2 and 1440.3

D. EPA: Executive Order 3100.1

E. ACED: "Health and Safety Guidelines for Hazardous Waste Site Investigations"

F. 29 CFR 1910: Safety and Health Regulations for General Industry, OSHA, as amended 10/86

G. 29 CFR 1926: Safety and Health Regulations for Construction, OSHA, as amended 1974

H. Protection Health and Safety at Hazardous Waste Sites: An Overview, USEPA, 9/85 EPA/625/9- 85/006

I. 105 CMR 670.000 and 441 CMR 21.00 (Right to Know)

1.06 PROJECT CONDITIONS

A. Prior to submitting a bid, the Contractor shall review and understand the subsurface information in the following documents. These documents are made available to the Contractor for information only. The subsurface and environmental conditions information presented in these documents, as applicable, are for information only and shall not be interpreted as a warranty of subsurface or environmental conditions whether interpreted from written text, boring logs, chemical test results, or other data.

1. Soil Precharacterization data prepared by Haley & Aldrich, Inc., dated January 2012 and May 2012, that is attached to Section 02 61 13.

2. Soil Precharacterization data that will be collected and compiled by Haley & Aldrich, Inc. in June 2012.

3. Geotechnical (soil sieve) data prepared by Haley & Aldrich, Inc., dated January 2012, that is attached to Section 31 00 00.

4. Hazardous Material Testings & Findings, by CDW Consultants, Inc. dated 3 December 2010 that is attached as Appendix D.

B. Management of excavated soils and collected water (from all natural and construction sources) shall be conducted in accordance with the requirements of this Section, Section 02 61 13, Section 31 23 19, the MCP, and the Contractor’s approved H&SP.

C. The nature of the materials present (e.g., asbestos) at the site may require use of special protective clothing and the possible use of respiratory protective equipment, which is intended to minimize worker exposure to known or suspected site hazards.

1. Levels of personal protection are established in reference standards and generally described for Levels C and D herein. It is anticipated that a majority of the Work to be performed on this project may be performed at Personnel Protection Level D.
2. The Contractor shall be responsible for determining the appropriate level of personnel protection that is required based on the criteria outlined in the Contractor's H&SP. If upgrading to Level C protection or higher is required, the Contractor shall suspend Work in the area identified as the "work zone" by the Contractor's SHSO and/or QHP until the Contractor is equipped to continue the Work, and has received approval from the Owner to continue the Work.

1.07 QUALITY CONTROL

A. The Contractor shall be solely responsible for exercising reasonable precaution to protect the health and safety of all on-site personnel, the general public, and the environment during the course of the Work. The Contractor shall comply with all applicable provisions of federal, state, and local health and safety and occupational health and safety statutes and codes.

B. The Contractor is required to notify all workers of the fill that is present, and to be alert for evidence of contaminated soils and groundwater. The Contractor shall notify the Engineer of

the presence of potentially hazardous conditions, if encountered.

C. Opinions of the Engineer or the Owner regarding anticipated site conditions do not relieve the Contractor of its responsibility to protect the health and safety of all on-site personnel, the general public, and the environment during the course of the Work.

D. Ambient Air Monitoring

1. If contamination is encountered, the Contractor, through its QHP, shall monitor air quality within the site and work areas for the compounds of concern (fugitive dust, odors, and gases) during those activities where exposure to contaminated soil or groundwater is possible using instruments as described in the Contractor's H&SP. The instruments shall be used in accordance with the procedures outlined in the Contractor's H&SP.
2. The Contractor shall not undertake any Work until the Engineer has approved the Contractor's H&SP.

E. If necessary, the Engineer will monitor air quality for the Engineer's employees, only, according to the procedures outlined in the Engineer's H&SP. The information obtained by the Engineer using the instruments will be made available to the Contractor upon request.

F. The Contractor shall retain a QHP to prepare the Contractor's H&SP and for quality control as specified herein. The QHP shall have a minimum of ten years experience in this work, certification as a safety professional qualified by training and experience to act in this capacity, and certification as having completed the 40-hr. OSHA health and safety training course, with current 8-hr. refresher training and 8-hr. OSHA manager's training. The QHP shall either assume the role of Site Health and Safety Officer (SHSO) as described below, or oversee the activities of the SHSO.

G. The Contractor shall retain a SHSO to implement the Contractor's H&SP. The SHSO may be the same as the QHP. If the SHSO is not the same person as the QHP, then the SHSO shall have a minimum of five years experience in this work, and certification as having completed the 40-hr. OSHA health and safety training course, with current 8-hr. refresher training and 8- hr. OSHA manager's training.

1.08 SUBMITTALS

A. Submit to the Engineer an H&SP prepared by the Contractor's QHP. The H&SP shall apply to all work to be conducted at the site, taking into consideration all workers on site, the general public, and the environment. Training will not be provided by the Owner or the Engineer. The plan shall include the following information:

1. A list of the Contractor's work tasks that may involve contact, and/or handling of fill soil.
2. Compounds of concern that may be encountered during the course of the Work and signs/symptoms of exposure.
3. Potential for worker exposure to fill.
4. Requirements for OSHA training for each work task and a record or schedule for training of Contractor and subcontractor workers in the use of personal protective equipment.
5. Work task specific levels of protection and a description of health and safety equipment, including protective clothing, and monitoring instruments.
6. Procedures for containing oil and/or hazardous materials such as decontamination of

heavy construction equipment and tools.

7. Procedures for monitoring, controlling, and mitigating fugitive dust, odors, and gases for each work task to protect worker and public health and safety, including descriptions of monitoring instruments and action levels triggering responses by the Contractor (e.g., donning personal protective equipment).
8. Emergency Response Plan.

B. The H&SP must be completed for discussion at the H&S coordination meeting scheduled by the Contractor and held at least 3 days prior to commencement of work relating to possible exposure to soils at the site. The Contractor shall provide written notice of this meeting to all interested parties at least 5 days before the meeting.

PART 2 - PRODUCTS

2.01 CLOTHING AND EQUIPMENT

A. All clothing and equipment must conform to the OSHA and EPA requirements, as indicated in the previous Reference Standards Section. Generally, protective clothing is considered disposable, but respiratory equipment is reusable. The items to be furnished by the Contractor under different levels of required protection for their own personnel and subcontractor's personnel include, but are not limited to, the following:

1. Level D Protection:

   a. Coveralls (cotton) or Tyvek
   b. Safety boots/shoes
   c. Safety glasses
   d. Hard hat with optional face shield
   e. Air purifying respirator (readily available, MSA Ultra-twin, or equal)

2. Level C Protection:

   a. Full facepiece air-purifying respirator (MSA Ultra-twin or equal)
   b. Chemical protective overalls and long-sleeved jacket or Coveralls (Saran coated Tyvek)
   c. Gloves, inner (disposable surgical type)
   d. Gloves, outer (Neoprene, Nitrile, Viton or Butyl)
   e. Boots, chemical protective, steel toe and shank (Neoprene or Nitrile)
   f. Booties, chemical protective (disposable PVC)
   g. Hard hat
   h. Face shield (optional)

3. Levels B and A represent increased levels of protection and are described in the Reference Standards.

PART 3 - EXECUTION

3.01 HEALTH AND SAFETY PLANNING AND IMPLEMENTATION

A. Prepare an H&SP that ensures the health and safety of all workers engaged in work at the

site and the general public at all times when exposure to fill soils, dust, odors, or gases is possible. Implement the plan throughout the execution of the work.

B. The Contractor shall monitor the excavation using the equipment described in the Contractor's H&SP.

C. Contractor's workers who will be engaged in work at the site that might result in exposure to fill soil shall attend the health and safety coordination meeting and any follow-up supplemental briefings.

D. Provide adequate health and safety training for all personnel who may come in contact with or be exposed to fill materials during the course of the work.

E. Provide personnel, including personnel for subcontractors, who are 40-hr OSHA trained with an 8-hr OSHA refresher course completed within the previous calendar year. These personnel and their training shall be provided at no additional cost to the Owner. The Contractor shall provide, at the Owner's request, certificates for each worker to demonstrate compliance with this requirement.

F. As necessary, provide personnel, including personnel for subcontractors, who are confined space entry trained to complete the Work specified herein and in other Sections. These personnel shall be current in all applicable and necessary refresher courses, as well. These personnel and their training shall be provided at no additional cost to the Owner. The Contractor shall provide, at the Owner's request, certificates for each worker to demonstrate compliance with this requirement.

G. Personnel who have not received training, and who are not equipped with the required protective clothing and equipment, shall not be permitted access to the site by the Contractor during the course of the work that may result in exposure to contaminated soil or groundwater.

3.02 ACCIDENT REPORTING REQUIREMENTS

A. The Contractor must comply with all accident and/or incident reporting requirements, including the following:

1. Should any unforeseen safety-related factor, hazard, or condition become evident during the course of the Work, the Contractor must immediately take prudent action to establish, maintain, and secure the site and working conditions. This shall be followed by immediate notice to the Owner.
2. If serious injury to a person or damage to property, environment, or natural resources results from an incident, the Contractor shall immediately report the incident to the Owner. The report shall be followed by a written document describing the incident, what hazards were created by it, and a detailed statement of what actions were taken to correct the problem. The Contractor will also include a description of why the actions taken were prudent.

3.03 DECONTAMINATION

A. Decontaminate all equipment and tools that have come in contact with fill soil in accordance with the approved Contractor H&SP.

B. Provide on-site facilities for Contractor personnel to decontaminate their protective clothing or other equipment.

C. Properly store and dispose of contaminated personal protection equipment.

PART 4 - MEASUREMENT AND PAYMENT

4.01 GENERAL

A. Health and Safety will not be measured, but will be paid for as part of the Base Contract Price. The Base Contract Price shall include furnishing all material, mobilization, OSHA trained and certified labor, confined space trained and certified labor, equipment, tools, subcontractors and testing agencies associated with on-site monitoring programs, and incidentals necessary to complete the Work specified herein.

END OF SECTION 01 35 29

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS AND SECTIONS

A. NOT USED

1.02 SUMMARY

A. This Section includes project quality administrative and procedural requirements.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.

1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit the Construction Manager's other Quality Control Services which facilitate compliance with the Contract Document requirements.

3. Requirements for Construction Manager to provide Quality Control Services required by Design Professional, Owner, or authorities having jurisdiction, are not limited by provisions of this Section.

C. Related Sections include the following:

1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.

2. Division 01 Section “Mockups”

3. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.

4. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

A. Quality Assurance Services: Tests, inspections and related actions and procedures performed to substantiate that proposed construction will comply, and that completed construction complies, with requirements. These services will be provided through the Design Professional, Owner’s Representative, Commissioning Agent and other consultants engaged by Owner.

B. Quality Control Services: Tests, inspections, procedures, and related actions performed before, during and after execution of the Work to evaluate that actual

products and labor incorporated into the Work and completed construction comply with Contract Document requirements. Construction Manager shall be responsible for developing, implementing and maintaining the Quality Control Plan. Quality Control Services do not include con- tract enforcement activities performed by Design Professional or other agents of the Owner.

C. Mockups: Full-size, physical assemblies that are constructed on or off site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged. Acceptance of mockups does not constitute approval of deviation from the Contract Documents contained in mockups, unless such deviation is specifically approved by Design Professional in writing.

D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as Testing Agency.

F. Owner’s Testing Agency: A Testing Agency engaged by Owner to perform specific tests as part of the Quality Assurance Services.

G. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter.” It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

H. Experienced: When used with an entity, "experienced" means having successfully completed a project similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Design Professional for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values

are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Design Professional for a decision before proceeding.

1.05 SUBMITTALS

A. Quality Control Plan: The Construction Manager will develop a comprehensive Quality Control Plan defining the procedures and processes to be followed to insure the Work will comply with the Contract Documents. The Quality Control Plan will address by Specification Section the steps to be taken prior to, during and after execution of the Work. The Quality Control Plan will be submitted to the Owner for review and approval prior to execution of the Work. The Owner may use the Design Professional, CxA or other entity for review of the Quality Control Plan and its execution.

B. Quality Control Documents: For Owner's records, Construction Manager shall submit copies (using the Project Management System) of permits, licenses, certifications, inspection reports, correspondence, records, test reports, field observations and all similar documents required by the Contract Documents or Laws for performance of the Work.

1.06 REQUIRED QUALIFICATIONS

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce requiredunits.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those per- formed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.07 QUALITY ASSURANCE

A. Owner Responsibilities: Where Quality Assurance Services are indicated as Owner's responsibility, Owner will engage a Testing Agency or other agency to perform these services.

1. Owner will furnish Construction Manager with names, addresses, and telephone numbers of Testing Agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. The Construction Manager shall coordinate with its Subcontractors and provide at least 24 hour advance notice to the Owner’s Representative and Owner’s Testing Agencies of Work required to be tested by Owner as part of the Quality Assurance Services.

3. Payment for Quality Assurance Services will be made by the Owner.

4. Costs for retesting and re-inspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Construction Manager.

1.08 QUALITY CONTROL

A. General: Quality Assurance tests and inspections not explicitly assigned to Owner are Construction Manager's responsibility. Construction Manager will implement the approved Quality Control Plan with adequate resources and diligence to insure the Work is in compliance with the Contract Documents. Unless otherwise indicated, provide Quality Control Services specified and those required by authorities having jurisdiction. Perform Quality Control Services required of Construction Manager by Laws and/or by authorities having jurisdiction, whether specified or not. Construction Manager’s responsibilities include the following:

1. Where services are indicated as Construction Manager’s responsibility and an in- dependent testing agency is required, engage a qualified, independent Testing Agency to perform these Quality Control Services.

a. Construction Manager shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify Testing Agencies at least 24 hours in advance of time when Work that re- quires testing or inspecting will be performed.

3. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager's responsibility.

4. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Preconstruction Testing: Where Testing Agency or other entity is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, Construction Manager's responsibilities include the following:

1. Provide test specimens representative of proposed products and construction.

2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

3. Provide sizes and configurations of test assemblies, Mockups, and Laboratory Mockups to adequately demonstrate capability of products to comply with performance requirements.

4. Build site-assembled test assemblies and Mockups using installers who will per- form same tasks for Project.

5. Build Laboratory Mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

6. When testing is complete, remove test specimens, assemblies, Mockups, and Laboratory Mockups; do not reuse products on Project.

C. Mockups: Before installing portions of the Work requiring Mockups, build Mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build Mockups in location and of size indicated or, if not indicated, as directed by Architect.

2. Notify Architect and Owner's Representative in a reasonable time (minimum of two weeks) in advance of dates and times when Mockups will be constructed and available for viewing.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Architect's and Owner's Representative's approval of mockups before starting work, fabrication, or construction.

   a. Allow a reasonable time (minimum 1 week) for initial review and each re-review of each Mockup.

5. Maintain Mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove Mockups when directed, unless otherwise indicated.

D. Manufacturer's Field Services: Where indicated, Construction Manager will engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Construction Manager's responsibility, provide Quality Control Services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Con- tract Documents.

F. Associated Services: Construction Manager shall cooperate with Testing Agencies per- forming required tests, inspections and similar Quality Control Services and Quality Assurance Services, and provide reasonable auxiliary services as requested. Construction Manager shall also provide the following:

1. Access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist Testing Agency in obtaining samples.

4. Facilities for storage and field curing of test samples.

5. Samples and other required materials to Testing Agencies.

6. Preliminary design mix proposed for use for material mixes that require control by Independent Testing Agency.

7. Security and protection for materials and for testing and inspecting equipment at Project site.

G. Coordination: Construction Manager will coordinate sequence of activities to accommodate required Quality Assurance Services and Quality Control Services to avoid delay and the necessity of removing and replacing construction to accommodate testing and inspecting.

1.09 TESTING AGENCY RESPONSIBILITIES

A. Testing Agency Responsibilities: Cooperate with Owner, Design Professional, Owner’s Representative and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections. In addition, the Testing Agency shall:

1. Notify Design Professional, Owner’s Representative and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and

similar Quality Control Service to Design Professional and Owner's Representative through Construction Manager. Owner's Testing Agencies shall submit reports directly to the Design Professional and the Owner's Representative, with a copy of Construction Manager.

5. Post each report in the Project Management System within 24 hours after completion of the test/inspection.

6. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

7. Do not perform any duties of Construction Manager.

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Design Professional and Construction Manager promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality- control service to Design Professional with copy to Construction Manager and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - EXECUTION

2.01 IMPLEMENTATION OF QUALITY CONTROL PLAN

A. The Construction Manager will employ qualified and adequate personnel to implement and monitor the Quality Control Plan. The Construction Manager's personnel will review and monitor the technical specifications, submittal documents, Contract Documents, Bulletins and change directives to insure the products and services are in compliance with the latest Contract Documents. In addition, the personnel will engage in routine and adequate field inspections to provide effective quality control to insure the Work complies with the Contract Documents.

2.02 QUALITY CONTROL RECORDS

A. Construction Manager shall maintain a log of Quality Control measures on the Project Management System and post changes and modifications as they occur.

2.03 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services,

Construction Manager shall repair damaged construction and restore substrates and finishes. In addition, Construction Manager shall:

1. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

2. Protect construction exposed by or for Quality Control Service and Quality Assurance Service activities.

B. Repair and Protection: Repair and protection are Construction Manager's responsibility, regardless of the assignment of responsibility for Quality Control Service.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. NOT USED

1.2 DEFINITIONS

A. "Approved": When used to convey Design Professional's action on Construction Manager's submittals, applications, and requests, "approved" is limited to Design Professional's duties and responsibilities as stated in the CM Agreement.

B. "Directed": A command or instruction by Design Professional. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

C. "Indicated": Requirements expressed by graphic representations or in written form on Plans, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

D. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

E. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

F. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

G. "Provide": Furnish and install, complete and ready for the intended use.

H. "Project site": To be determined by Owner and defined to Construction Manager.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar

with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

Table 1

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700

AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood	

	Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	

(800) 527-4723		
	www.ashrae.org	(404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industry International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCSC)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood-Preservers' Association www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963

BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International	(866) 797-4272

	(Formerly: IAS - International Approval Services) www.csa-international.org	(416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association www.esda.org	(315) 339-6937
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41-22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41-21 345 35 35
FM Approvals	FM Approvals www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000

FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49-228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Now GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369

ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA www.intertek.com	(972) 238-5591
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc.	(847) 480-9138

	www.maplefloor.org	
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, Extension 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094

NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International	(800) 673-6275

	(National Sanitation Foundation International) www.nsf.org	(734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841

SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings	(877) 281-7772

	www.sspc.org	(412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651

WCMA	Window Covering Manufacturers Association (Now WCSC)	
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	woodwork Institute of California; (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

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

Table 2

BOCA	BOCA International, Inc. (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICBO	International Conference of Building Officials (See ICC)	
ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533

ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
MBC	Massachusetts State Building Code	(617) 727-7775
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	
UBC	Uniform Building Code (See ICC)	

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

Table 3

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112

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

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

Table 4

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 43 39 – MOCKUPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Mockups are required for, but not limited to the following:

1. Concrete Paving with creek path striping
2. Colored or Textured Concrete Paving.
3. Brick Paving.
4. Metal Fabrications
5. Cord Wood Seatwall with Lighting
6. Joint sealants.
7. Salvaged Wood Benches.
8. Salvaged Seating Terrace Logs
9. Salvaged Vertical Posts
10. Bridge Panel with lighting
11. Steel Grating with lighting
12. 11th Street Spine Planting

B. General:

1. All mockups specified in this Section and under other Sections of the Specifications, and shown on the drawings will be reviewed and approved by the Landscape Architect. Replace or reconstruct unacceptable mockups in part or in total with the extent of the replacement or reconstruction at the discretion of the Architect. Contractor shall carry forth mockup replacement or reconstruction until acceptance by Architect is obtained. Include mockup costs in the Contract Sum, including as many replacements or reconstructions as necessary to gain Architect's acceptance.
2. Coordinate Work of trades and schedule elements to expedite the fabricating, furnishing and installation of multiple component mockups specified in this Section, in other Sections of the Specifications, and as shown on the Drawings.
3. Construct mockups where indicated or, if not indicated, in locations directed by the Landscape Architect.

C. Acceptance:

1. Acceptance of mockups does not constitute approval of deviation from the Contract Documents contained in mockups, unless such deviation is specifically approved by Architect in writing.
2. Retain mockups during construction as a standard for judging completed work. When directed, demolish mockups and remove from project site.

D. Related Sections include the following:

1. Division 01 Section “Special Project Procedures” for material selection guidelines.
2. Division 01 Section “Submittal Procedures” for shop drawings, samples and product data.
3. Division 03 Section “Cast-In-Place Concrete.”
4. Division 05 Section “Metal Fabrications.”
5. Division 32 Sections

PART 2 - PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

(Not Applicable)

END OF SECTION 01 43 39

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Division 01 Section "Execution" for progress cleaning requirements.
4. Divisions 02 through 49 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
5. Division 31 Section "Dewatering" for disposal of ground water at Project site.
6. Division 31 Section "Asphalt Paving" for construction and maintenance of asphalt paving for temporary roads and paved areas.
7. Division 32 Section "Concrete Paving" for construction and maintenance

1.2 SUMMARY

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

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Design Professional, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the CM's GMP. Allow other entities to use temporary services and facilities without cost, including, but not limited to Design Professional, occupants of Project**,** testing agencies, and authorities having jurisdiction.

1.5 SUBMITTALS

A. All submittals shall be made in accordance with the requirements specified in Section 013300 – SUBMITTAL PROCEDURES. All construction-related submittals shall be made utilizing the Owner's Project Management System.

B. Site Plan: Show temporary facilities, utility hookups, and staging areas.

1.6 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities", and NFPA 241.

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions. Comply with signed PLA.

2. Electric Service: Comply with Massachusetts State Building Code, NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Permits: Apply for and obtain all required permits from state and local regulatory agencies.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pavement: Comply with Divisions 32.

B. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD toprails.

C. Wood Enclosure Fence: Plywood, 8 feet (2.4 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4
m) apart.

D. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."

E. Gypsum Board: Minimum ½-inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

G. Paint: Comply with requirements in Division 09 painting Sections.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normalloading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack board.

3. Drinking water and private toilet.

4. Coffee machine and supplies.

5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).

6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

7. 1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Until the permanent HVAC system is available for use, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

3. Permanent HVAC System: For use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work and in accordance with the approved Project Mitigation Plan.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company and Owner, for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Coordinate service installation, materials and meters with authorities having jurisdiction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

1. Install electric power service underground, unless otherwise indicated.

2. Connect temporary service to Owner's existing power source, as directed by Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

2. Install lighting for Project identification sign.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install a minimum of one telephone line for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
b. Provide one telephone line(s) for Owner's use.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Construction Manager's home office.
d. Design Professional's office.
e. Engineers' offices.
f. Owner's office.
g. Principal subcontractors' field and home offices.

3. Provide DSL or T-1 line in primary field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Temporary shops and sheds shall comply with local codes.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Plans.

1. Provide dust-control treatment that is nonpolluting and nontracking.

Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas for parking areas for construction personnel. Refer to the approved Project Mitigation Plan and the approved Construction Management Plan.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

3. Provide filtration sedimentation system for disposal of excess water if required by agencies having jurisdiction.

F. Project Identification and Temporary Signs: Provide Project identification and other signs, subject to the approval of Owner. Install signs where indicated to inform public and individuals seeking entrance to Project, subject to the approval of Owner. Unauthorized signs are not permitted.

1. Provide temporary, directional signs for construction personnel and visitors.

2. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements. Comply with approved Project Mitigation Plan.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Elevator Use: Refer to Division 14 Sections for temporary use of new elevators.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other un- desirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

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

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm- water from heavy rains.

D. Pest Control: Provide pest control in accordance with Harvard’s Integrated Pest Management Program.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. Covered Walkway: Erect structurally adequate, protective, covered walkway for passage of individuals along adjacent public street(s) and within Harvard property as required to maintain safe passage. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.

2. Provide wood-plank overhead decking, protective plywood enclosure walls, hand- rails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.

3. Extend back wall beyond the structure to complete enclosure fence.

4. Paint and maintain in a manner approved by Owner and Design Professional.

G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

H. Develop a site-specific security plan based on the Construction Security Requirements document prepared by Owner's security consultant, which plan shall include (but not necessarily be limited to) requirements for fencing, lighting, enclosures, barricades and covered walkways, and which plan shall be approved by Owner.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Construction Manager. Owner reserves right to take possession of Project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary en- trances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
2. Division 01 Section “Submittal Procedures”
3. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 SUMMARY

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

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Construction Manager.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Plan numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate construction managers and contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including plans and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of design professionals and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
   i. Detailed comparison of Project Schedule using proposed substitution with products specified for the Work, including effect on the overall Project Schedule. If specified product or method of construction cannot be provided within the time required by the Project Schedule, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
   j. Cost information, including a proposal of change, if any, in the CM’s GMP.
   k. Construction Manager 's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for ap- plications indicated.
   l. Construction Manager 's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Design Professional's and Owner’s Action: If necessary, Design Professional and/or Owner will request additional information or documentation for evaluation within seven (7) working days of receipt of a request for substitution. Design Professional will notify Construction Manager of acceptance or rejection of pro- posed substitution within seven (7) working days of receipt of request.

a. Form of Acceptance: Change Order.

b. Use product specified if Design Professional and Owner cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit copies of each request for consideration using the Project Management System. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Plan numbers and titles.

1. Design Professional's and Owner's Action: If necessary, Design Professional and/or Owner will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Design Professional will notify Construction Manager of approval or rejection of proposed comparable product request within fifteen (15) working days of receipt of request, or seven (7) working days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."

b. Use product specified if Design Professional and Owner cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Construction Manager is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Construction Manager is responsible for providing products and construction methods compatible with products and construction methods of other construction managers.

2. If a dispute arises over concurrently selectable but incompatible products, Design Professional and Owner will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions forhandling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Construction Manager of obligations un- der requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by or incorporated into the Con- tract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications,

pre- pare a written document using appropriate form properly executed.

3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Where products are accompanied by the term "match sample," sample to be matched is Design Professional's.

4. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.

3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Com- parable Products" Article for consideration of an unnamed product.

7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Plans are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.

8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Plans and Specifications indicate sizes, pro- files, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.

9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Design Professional's sample. If Construction Manager determines that no such product is available, Construction Manager shall notify the Design Professional (which notification shall include information which will enable Design Professional to verify the unavailability of such product) and Design Professional shall specify an alternative product. Design Professional's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Design Professional will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Design Professional will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Conditions: Subject to the provisions of the CM Agreement, Design Professional and Owner will consider Construction Manager's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Design Professional and Owner will return requests without action, except to record noncompliance with the- se requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will pro- duce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect the Project Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one construction manager or con- tractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all construction managers or contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Subject to the provisions of the CM Agreement, Design Professional and Owner will consider Construction Manager 's request for Comparable Product when the following conditions are satisfied. If the following conditions are not satisfied, Design Professional and Owner will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and ad- dresses and names and addresses of design professionals and owners, if re- quested.
5. Samples, if requested.

B. Definition of Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated

qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

PART 3 - EXECUTION

(Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Cutting and Patching" for procedural requirements for cut- ting and patching necessary for the installation or performance of other components of the Work.
4. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the requirements specified in Section 013300 – SUBMITTAL PROCEDURES. All construction-related submittals shall be made utilizing the Owner's Project Management System.

B. Qualification Data: For land surveyor.

C. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

E. Certified Surveys: Submit copies signed by land surveyor.

F. Final Property Survey: Submit copies showing the Work performed and record

survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in Boulder Colorado and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning Work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Plans.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information. Refer to Division 1 Section “Project Management and Coordination” for RFI procedures.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Plans, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Design Professional and Owner promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Use provided by Owner benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

2. Establish dimensions within tolerances indicated. Do not scale Plans to obtain required dimensions.

3. Inform installers of lines and levels to which they must comply.

4. Check the location, level and plumb, of every major element as the Work progresses.

5. Notify Design Professional and Owner when deviations from required lines and levels exceed allowable tolerances.

6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Design Professional and Owner.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing control points.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent bench- marks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Design Professional and Owner. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Design Professional and Owner be- fore proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other Work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical Work plumb and make horizontal Work level.
2. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
3. Maintain minimum headroom clearance in accordance with the Contract Documents and the applicable code requirements.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Design Professional.

2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Project Schedule: Inform Owner of Construction Manager's preferred construction schedule for Owner's portion of the Work. Adjust Project Schedule based on a mutually agreeable timetable. Notify Owner if the construction progress falls behind the dates required by the Project Schedule.

2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 and fire department regulations for removal of combustible waste materials and debris.

2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove mal- functioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting

operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Section 013233 “Photographic Documentation” for submitting final completion construction photographic documentation.
2. Section 017300 “Execution” for progress cleaning of Project site.
3. Section 017823 “Operation and Maintenance Data” for operation and maintenance manual requirements.
4. Section 017300 “Execution” for progress cleaning of Project site.
5. Section 017823 “Operation and Maintenance Data” for operation and maintenance manual requirements.
6. Section 01 78 39 “Project Record Documents”

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. Certified as built grading and flood plain permitting.
3. Warranties.
4. 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. Satisfy all requirements for Substantial Completion as set forth in the CM Agreement.
2. 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.
3. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
4. Prepare as built grading plans and submit to the Owner for confirmation, approval and certification of the City’s Grading and Flood Plain permitting process.
5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
6. If requested by Owner, complete startup testing of systems.

7. If requested by Owner, submit test/adjust/balance records.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Advise Owner of changeover in heat and other utilities.
10. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Design Professional will either proceed with inspection or notify Construction Manager of unfulfilled requirements. Design Professional will notify Construction Manager of items, either on Construction Manager's list or additional items identified by Design Professional, that must be completed or corrected before certificate will be is- sued.

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. Life Safety Systems Certification of Completion.

1. Definitions

a. Life Safety Systems – Mechanical and electrical systems including:
1) Smoke Exhaust and Control Systems

2) Fuel Systems Feeding Emergency Power Systems

3) Fire Suppression Systems

4) Fire Notification (Alarm) and Detection Systems

5) Egress Signage and Lighting Systems

6) Emergency Power Systems

2. Complete – For a system to be complete the following shall be true:

a. No further Work is required to satisfy the requirements specified in plans, specifications and applicable codes and standards.
b. Systems are fully operational with power to components, valves open, status indicators in “Normal” condition and otherwise ready “as-is” to perform required functions.
c. Required product data, shop drawing submittals and test certificates have been submitted and returned with the “Approved or Approved As Noted” status.
d. Project visit report observations and “punch list” items have been ad- dressed and/or corrected.
e. “O&M” documentation and As-Built Plans have been submitted and re- turned with a “Reviewed” status.

3. Notification of Completion

a. Notify the Design Professional in writing that the life safety systems are complete at least five (5) working days prior to requesting final certification of completion ("affidavits") from the Design Professional. The notification shall be in the form of a single formal document endorsed by an individual charged with management responsibility associated with the life safety systems.
b. Schedule Work so life safety systems are complete in advance of other systems. This requirement is to allow the Design professional to conduct a final project visit and correction of issues found without affecting issuance of a Certificate of Occupancy by the authorities having jurisdiction.

1.4 BASIC REQUIREMENTS

A. Prior to Substantial Completion of Work, the Construction Manager shall provide 7 copies of the following: complete set of As-Built Plans as per Harvard University's Capital Pro- jects Closeout Requirements, Operations and Maintenance Manuals, Warranties and Guarantees, Directory of all major Subcontractors.

1.5 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Satisfy all requirements for Final Completion set forth in the CM Agreement.
2. Submit final completion construction photographs.
3. Satisfy all requirements for certification of grading and flood plain permitting.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Owner's personnel and Design Professional will either proceed with inspection or notify Construction Manager of unfulfilled requirements. The Owner's Representative will notify Construction Manager of construction that must be completed or corrected before final payment will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit using the Owner's Project Management System 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 Construction Manager that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Organize list of utilities, including water, sewer, drain, telephone, electric, gas and cable. Provide location information for each item.

4. Include the following information at the top of each page:

1.7 WARRANTIES

a. Project name.
b. Date.
c. Name of Design Professional.
d. Name of Construction Manager.
e. Page number.

A. Warranty:

1. All material, equipment, and workmanship shall be warrantied for a minimum of 12 months after the date of Substantial Completion. See various sections for specification for extended warranties beyond the one-year requirements.

2. If the equipment is used for ventilation, temporary heat, or other use prior to Substantial Completion, the Work shall include an extended period of warranty covering one year from the manufacturer. The warranty shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Design Professional's satisfaction and correct damage caused in making necessary repairs and replacements under warranty within CM's GMP. The foregoing warranty shall not limit the Construction Man- ager's warranty or duty to correct under the CM Agreement.

3. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.

4. Replace material and equipment that require excessive service during warranty period. Excessive service shall be defined as more than 3 service calls for the same material or equipment within a 6 month period.

5. Use systems for temporary services and facilities shall NOT constitute Final Acceptance of Work not beneficial use by Owner, and shall not institute warranty period. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during warranty period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise Design Professional in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Design Professional will suggest course of action.

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

C. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Construction

Manager.

D. Organize warranty documents into an orderly sequence.

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 (215-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 Construction Manager.

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

F. Post all Warranties on the Owner's Project Management System.

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. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even- textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective sur- faces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other dam- aged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily re- paired or restored or that already show evidence of repair or restoration.
   1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean ex- posed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. 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

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Section 013300 “Submittal Procedures” for submitting copies of submittals for operation and maintenance manuals.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. All submittals shall be made in accordance with the requirements specified in Section 013300 – SUBMITTAL PROCEDURES. All construction-related submittals shall be made utilizing the Owner’s Project Management System.

B. Initial Submittal: Submit draft copies of each manual at least fifteen (15) days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Design Professional will return copy of draft and mark whether general scope and content of manual are acceptable. For equipment and systems in which Cx tests are required initial O and M submittal shall be made thirty (30) days after approved shop drawings/submittals.

C. Final Submittal: Submit ten (10) hard copies of each manual in final form at least fifteen (15) days before final inspection. Design Professional will return copy with comments within fifteen (15) days after final inspection.

1. Correct or modify each manual to comply with Design Professional's comments. Submit copies of each corrected manual within fifteen (15) days of receipt of De- sign Professional's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate in- formation furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents. Including approved shop drawing, diagrams, exploded views, etc.. Training documentation (including sign in sheets, syllabus, agenda, factory authorized trainer, etc).
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Construction Manager.
6. Name and address of Design Professional.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280- mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.

5. Plans: Attach reinforced, punched binder tabs on plans and bind with text.

   a. If oversize plans are necessary, fold plans to same size as text pages and use as foldouts.

   b. If plans are too large to be used as foldouts, fold and place plans in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating plan titles, descriptions of contents, and plan locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Construction Manager is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification. Identification of Piping coding to be according to ASME A13.1-1996.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service

agent, and cross- reference Specification Section number and title.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Plans, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail

essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent. Include start dates and completion dates for service contracts.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated. Emergency Manual tab to be clearly identified (i.e. red, red and white strip, etc.) and located in the front of the manual.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem,

and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare in- formation for each system, subsystem, and piece of equipment not part of a sys- tem.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to in- formation not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Plans: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in As- Built Plans to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.

2. Comply with requirements of newly prepared As-Built Plans in Division 01 Section "Project Record Documents." Include electronic AutoCAD version of plans on CD. All external references are to be attached so that a complete functional plan of all components and systems are included. Include sleeves in Systems Manual for disks.

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

3.2 BULLETINS, MANUALS, AND OPERATING INSTRUCTIONS AND PROTECTION

A. Assemble literature in coordinated manuals with additional information describing combined operation of field assembled units, including as-built wiring diagrams. Manual shall contain names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment. Divide manuals into three sections or books as follows:

1. Directions for and sequence of operation of each item of the Mechanical and Electrical systems (e.g., air handling units, boilers, domestic water pump, generator). Sequence shall list valves, switches, and other devices used to start, stop and control system. Detail procedure to be followed in case of malfunctions. Include detailed approved flow diagrams of each system provided (e.g. temperature control, heating condensate, chilled water, condenser water.) Include approved valve directory showing each valve

number, location of each valve, and equipment of fixture controlled by valve.

2. Detailed maintenance and trouble-shooting manuals containing data furnished by manufacturer for complete maintenance. Include copy of balancing report.
3. Lubrication instructions detailing type of lubricant, amount, and intervals recommended by manufacturer for each item of equipment. Include additional instructions necessary for implementation of first class lubrication program. Include approved summary of lubrication instructions in chart form, where appropriate.
4. Provide framed and glazed charts as follows: Mount in location selected by the Owner:

    a. Flow diagrams from first part of manual as described above.
    b. Valve directory.
    c. Lubrication chart from third part of manual.
    d. Electrical power one line diagram.
5. Operating instructions: Upon completion of installation of when Owner accepts portions of building and equipment for operational use, instruct Owner's operating personnel in operation of systems. Instruction shall be performed by factory- trained personnel. Owner shall determine which systems require additional in- struction. Duration of instructions shall take equipment through complete cycle of operation (at least five working days). Make adjustments under operating conditions.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Related Sections include the following:

1. Section 017700 “Closeout Procedures” for general closeout procedures.
2. Section 017823 “Operation and Maintenance Data” for operation and maintenance manual requirements.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for “Project Record Documents”, including the following:

1. As-Built Plans.
2. Record Specifications.
3. Record Product Data.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the requirements specified in Section 013300 – SUBMITTAL PROCEDURES and Paragraph 4.9 of the General Conditions of the CM Agreement. All construction-related submittals shall be made utilizing the Owner’s Project Management System.

B. As-Built Plans: Comply with the following:

1. Number of Copies: Submit copies of As Built plans as follows:

a. Initial Submittal: Submit one set(s) of marked-up As-Built Plans. Design Professional will initial and date each and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Design Professional will return the marked-up As-Built Plans for organizing into sets, printing, binding, and final submittal.
b. Final Submittal: Submit marked-up As-Built Plans in accordance with City of Boulder Standards. Print each Plan, whether or not changes and additional information were recorded.

C. Record Specifications: Submit copies of Project's Specifications in accordance with City of Boulder guidelines, including addenda and contract modifications.

D. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

E. As built grading plans for confirmation and approval of the City's Grading and Flood Plain permitting process. Submittal shall confirm "no-rise" scenario as shown in the contract documents.

PART 2 - PRODUCTS

2.1 AS-BUILT PLANS

A. As-Built Plans: Maintain one set of blue- or black-line white prints of the As-Built Plans.

1. Preparation: Mark plans to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record da- ta, whether individual or entity is Installer, Subcontractor, or similar entity, to prepare the marked-up plans.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record 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. Give particular attention to accurately showing grading within a tolerance of ¼ inch or as governed by the flood plain and grading permitting process.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Plans.
b. Revisions to details shown on Plans.
c. Site grading including contour lines, spot grades, grade changes, slopes and drain inlets.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Locations of concealed internal utilities.
i. Locations of underground utilities and structures.
j. Changes made by Change Order, Unilateral Change Order or Amendments.
k. Changes made by Bulletins.
l. Details not on the original Plans.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the plans completely and accurately.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Plans.

B. Record CAD Plans: Immediately before inspection for Certificate of Substantial Completion, review marked-up As-Built Plans with Design Professional. When authorized, forward a complete marked up set of As-Built Plans to Design Professional for incorporation into CAD Plans in accordance with City Boulder Standards and requirements set forth for the certification of grading and flood plain permitting.

C. Format: Identify and date each As-Built Plan; include the designation "AS-BUILT PLAN" in a prominent location.

1. As-Built Plan: Organize As-Built Plans into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Record CAD Plans: Organize CAD information into separate electronic files that correspond to each sheet of the Plans. Name each file with the sheet identification. Include identification in each CAD file.

3. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT AS-BUILT PLANS."
d. Name of Design Professional.
e. Name of Construction Manager.

2.2 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

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, Unilateral Change Orders, Record Specifications, and As-Built Plans where applicable.

2.3 MISCELLANEOUS RECORD SUBMITTALS

A. 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.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for As-Built Plan purposes. Post changes and modifications to As-Built Plans in accordance with the CM Agreement as they occur; do not wait until the end of Project.

B. Underground Utilities: Provide a minimum of two (2) ties to fixed objects for all fittings, valves and structures. Include depth of cover, adjacent or crossing utility information and location to rock or ledge, if applicable.

C. Maintenance of As-Built Plans and Samples: Store As-Built Plans and Samples in the field office apart from the Contract Documents used for construction. Do not use Project As- Built Plans for construction purposes. Maintain As-Built Plans in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project As-Built Plans for Design Professional's reference during normal working hours.

3.2 AS-BUILT PLANS

A. As Work progresses and for duration of Contract, maintain complete and separate set of the Plans and Specifications at the job site at all times. Record Work completed and all changes from original Plans and Specifications clearly and accurately including Work in- stalled as a modification or addition to the original design. Include actual location of existing utilities if they differ from design documents. Record valve tags as they are in- stalled. Plans shall show record condition of grading, details, sections, diagrams, control diagrams, control sequences and installed equipment schedule information (i.e. manufacturer make model and performance data of installed equipment). The marked up documents shall then be used to prepare Project Record Documents.

B. At completion of Work, prepare a complete set of As-Built Plans and Record Specifications. Submit the following:

1. One copy of As-Built Plans in electronic format on CD_ROM disc. Prepare files in most current AutoCAD version format unless otherwise approved in writing. Files shall be clearly labeled “Record Set” in the title block section of each file. Plan files shall include a highlighted note certifying that the contents reflect as-built conditions. The As-Built Plans shall indicate changes and deviations from design by the use of revision clouds.

a. Copies of contract drawing computer files will be made available to serve as backgrounds for the As-Built Plans. The quantity of design drawing files that are made available shall in no way be interpreted as setting a limit to the number of drawing files necessary to show the required record information. A professional draftsperson shall transfer changes from field notes to the As-Built Plan computer files.

2. One hard copy set of contract specifications with all appropriate changes

marked in red. Specifications shall be signed by the Construction Manager to certify con- tent reflects as-built conditions. Certify As-Built Plans for accuracy.

3. Underground and utility Work shall be located on As-Built Plans by distances to landmarks (e.g. building foundations). Give actual dimensions of installed components including elevations and show elevations at each change in direction.
4. All “main air” pneumatic control piping routing locations shall be shown on the As-Built Plans.
5. Take photographs of all concealed equipment in gypsum board ceilings, shafts, underground (buried) piping routes and supports and other concealed, inaccessible Work. At completion of Work, make copies of photographs. Provide a writ- ten description of Work including the location shown on the back of each photo. These shall become part of the Project Record Documents.
6. When required by the authority having jurisdiction, submit the Project Record Documents including photographs for approval by the building department in a form acceptable to the department. Provide record information in format (e.g.

drawing size and scale) and all supplemental information required by the jurisdic- tion.

END OF SECTION 01 78 39

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

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. Commissioning consists of systematically documenting that specified components and systems have been installed and started up properly and then functionally tested to verify and document proper operation through all sequences of operation and conditions. In addition, training of the Owner's Operations Personnel will be verified and final project O&M Documents will be reviewed for completeness.

B. Related Sections:

1. Section 011000 – Summary
2. Section 012613 – Requests for Interpretation
3. Section 013200 – Project Documentation
4. Section 013233 – Photographic Documentation
5. Section 013300 – Submittals
6. Section 014000 – Quality Requirements
7. Section 017900 – Demonstration and Training
8. Section 017823 – Operation and Maintenance
9. Section 017700 – Substantial Completion Requirements
10. Section 018113 – Sustainable Design Requirements

1.3 SYSTEMS TO BE COMMISSIONED

A. Mechanical Systems:

1. Heating Steam and Water Distribution
2. Chilled Water Distribution
3. Ventilation Systems
4. Heat Recovery Systems

B. Plumbing Systems:

1. Sanitary Drain System

2. Storm Water Drain System

3. Domestic Water System

C. Electrical Systems:

1. Electrical Distribution System

2. Emergency Power System

3. Lighting Control System

4. Fire Alarm System

5. Security System

6. Structured Cabling System

D. Other Systems

1. Vertical Transport

1.4 DEFINITIONS

A. Basis of Design Document:

1. A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Authority:

1. An entity identified by the Owner who plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

C. Commissioning Plan:

1. Prepared and updated by the Commissioning Authority, the Commissioning Plan outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

D. Commissioning Process:

1. A quality-focused process for enhancing the delivery of a project. The Process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

2. Commissioning is typically abbreviated by “Cx”. Commissioning and Cx have the exact same meaning and will be used interchangeably throughout the Contract documents.

E. Commissioning Team:

1. The individuals who through coordinated actions are responsible for implementing the Commissioning Process.

F. Construction Checklist:

1. Documents prepared by the Cx Authority and issued to the Contractor early in the Construction Phase. The purpose of the Checklist is to verify that appropriate components are on site, correctly installed and functional & ready for Performance Testing.

G. Corrective Issue Report:

1. A report generated by the Cx Authority during Verification Testing documenting deficiencies found during the testing procedures.

H. Functional Performance Testing:

1. The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner’s Project Requirements.

I. Owner’s Project Requirements:

1. A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

1.5 COMMISSIONING TEAM

A. The Commissioning Team shall consist of a minimum of one (1) Representative for each of the following:

1. Owner.

2. Construction Manager.

3. Architect.

4. Engineer.

5. Contractor.

6. Commissioning Authority.

B. Each Commissioning Team Representative shall have at least five (5) years experience in construction administration along with a thorough understanding of construction project documentation procedures.

C. Each Cx Team Representative shall be familiar with ASHRAE Guideline 0 – The Commissioning Process.

PART 2 - PRODUCTS

2.1 VERIFICATION TESTING EQUIPMENT AND INSTRUMENTS

A. Contractor shall provide all tools, instruments, laptop computers, PDA,s, software programs and services required to perform system Functional Testing procedures. This includes providing the connection to systems to be tested, operation of the test equipment & instrumentation and generating test results as required.

PART 3 - EXECUTION

3.1 PROJECT SCHEDULE

A. The Commissioning Authority will provide to the Contractor a Schedule identifying the Cx Activities for the Project along with the related events from the Contractor's Master Project Schedule. The Contractor shall incorporate these Cx Activities into the Master Project Schedule. The Cx Authority will review and update Cx Activities along with the Contractor's Master Schedule Update. Refer to Section 013200 for procedures.

B. Cx Authority to receive a copy of the regularly updated schedule when submitted to the Architect/Owner.

3.2 SUBMITTALS / SHOP DRAWINGS

A. The Commissioning Authority will review Product Submittals and Shop Drawings within the same review period as the Architect. The Cx Authority will review the Submittals and Shop Drawings for Cx Process related information and issue review comments directly to the Architect. Refer to Section 013300 for procedures.

B. The Contractor shall provide one (1) copy of the approved Submittal Schedule to the Cx Authority. The Cx Authority will identify which Submittals are Commissioning related.

C. Contractor shall provide one (1) copy of each Commissioning related Submittal / Shop Drawing to the Cx Authority at the time of submission to the Architect.

3.3 REQUEST FOR INFORMATION

A. The Commissioning Authority will review each RFI for Commissioning related information and issue comments directly to the Architect. Refer to Section 012613 for procedures.

B. Contractor shall provide one (1) copy of each Request for Information to the Cx Authority at the time of submission to the Architect.

3.4 COMMISSIONING PROGRESS MEETINGS

A. The Commissioning Authority will conduct periodic Cx Progress Meetings throughout the construction phase of the project. Commissioning Team Members are required to attend these meetings. Refer to Section 013200 for Meeting Procedures.

B. The purpose of conducting Cx Progress Meetings separate from the regular job progress meetings is to focus on the Commissioning Process activities status, schedule and issues. Reference sample Cx Progress Meeting Agenda at the end of this Section.

C. Commissioning Team Meetings shall include, but not be limited to:

1. Controls Integration Meeting – 1 meeting

2. Commissioning Kick Off Meeting – 1 meeting

3. Commissioning Progress – as required throughout construction phase

4. Testing / Training – 2 meetings

5. 10th Month Warranty Review – 1 meeting

D. The Cx Authority will conduct these meetings, record meeting minutes and distribute the minutes to all attendees with copies to appropriate entities.

3.5 QUALITY ASSURANCE TESTING

A. Contractor Field Testing:

1. The Commissioning Authority will receive one (1) copy of ALL Test Reports from the Contractor and assemble for record into the Commissioning Systems Manual.

B. Independent Testing:

1. The Commissioning Authority will receive one (1) copy of ALL Independent Testing Reports from the Contractor and assemble for record into the Commissioning Systems Manual.

C. Witnessing of Testing by Cx Authority:

1. Commissioning Authority shall be notified in advance of any Field or Independent Testing being performed. Refer to Section 014000.

3.6 SUBSTANTIATING SYSTEM READINESS

A. The Commissioning Authority will prepare and issue to the Contractor a Construction Checklist Form for each system or major piece of equipment to be Commissioned. Reference sample Construction Checklist at the end of this Section.

B. The Contractor shall complete each Checklist as required in Section 013200.

C. The Commissioning Authority will monitor and track the completion of the Construction Checklist Forms.

3.7 OPERATION & MAINTENANCE DATA

A. The Commissioning Process has special requirements on compiling and submitting Operation and Maintenance Data. O&M Data are required to be submitted to the Cx Authority 14 days after receipt of the approved submittal from the Architect.

B. Operation & Maintenance data shall be distributed to facilities personnel at each training session.

C. The Cx Authority will compile this information into the Project “Systems Manual” which will be used during Training Sessions.

D. Refer to Section 017823 for requirements.

3.8 FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Authority will develop the Functional Performance Test Procedures to be used on the systems being Commissioned. The Test Procedures will be submitted to the Contractor in advance of scheduled Performance Testing to give the Contractor and Subcontractor’s time to review the Procedures and make comments or suggest revisions. Reference draft Functional Performance Test Procedures

B. The Commissioning Authority will oversee and document results of all Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

C. The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.9 CORRECTIVE ISSUE REPORT

A. The Commissioning Authority will document deficiencies discovered during Functional Performance Testing of systems on a Corrective Issue Report. The Cx Authority will then forward this form to the Contractor for action in correcting the deficiency.

B. When the deficiency has been corrected, the Contractor shall note action taken and return the Corrective Issue Report to the Commissioning Authority. Reference sample Corrective Issue Report at the end of this Section.

C. Corrective Issue Reports must be completed as a pre-requisite for Substantial Completion. Refer to Section 017700.

3.10 OWNER TRAINING

A. All training sessions shall be coordinated through the Commissioning Authority. The Cx Authority will prepare a Training Form for each Training Session required by the Contract Documents and issue to the Contractor. The Training Forms shall be used to schedule, perform and document the required training sessions. Reference sample form at the end of this Section.

B. After each Training Session is completed, the Cx Authority will issue an Evaluation Form to each of the Attendees. This feedback information will be provided to the Owner and Architect for review. Reference sample Evaluation Form at the end of this Section.

C. Refer to Section 017900 for Owner training requirements.

D. Training Instructors shall be a Manufacturer's Representative or Applications Engineer fully qualified in the operation, troubleshooting and maintenance procedures for the equipment or systems being covered. Sales Representatives or others possessing only general knowledge of the equipment or systems will not be acceptable.

E. The following format shall be used to schedule, perform, document and evaluate the required training sessions:

1. The Contractor shall submit a separate Training Form for each training session required by the Contract Documents to the Commissioning Authority. This form shall be submitted a minimum of fourteen (14) calendar days in advance of the proposed training session.

2. The Contractor shall complete the first section of the form including the proposed training session date, name of instructor(s), and proposed length (time) of the session(s). Also, attach an Agenda indicating the format of the training session and listing any handouts that will be provided.

3. The Commissioning Authority will then review the proposed training information with the Owner. If the submitted information is complete and the proposed dates meet the Owner's Operations Personnel schedule, the Commissioning Authority will respond to the Contractor to proceed with scheduling the subject training session.

4. During the training session, the Contractor shall have all in attendance sign in the third section of the Training Form. Attach additional pages if necessary. The Contractor shall then forward the Training Form to the Commissioning Authority.

5. Upon receipt of the Training Form, the Commissioning Authority will have each of the attendees complete the Evaluation Form to gain feedback on the value of the session

a. If the session meets the objectives and intent of the Contract Documents, the Commissioning Authority will approve the training form and return to the Contractor for Project Records.

b. If negative feedback is received, the Evaluation Forms will be reviewed with the Commissioning Team and if necessary, re-scheduling of the training may be required.

F. Operations & Maintenance Manuals and accurate As-built Drawings shall be submitted and approved by the Architect BEFORE any training sessions will be held. The As-built Drawings and O&M information will be reviewed and used as reference during training instructions.

END OF SECTION 01 91 13

SECTION 02 50 00 – SITE PREPARATION, DEMOLITION, AND CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

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

1.02 SUMMARY

A. Work of this Section consists of selective site demolition, removals, and other related work in preparation for earthwork and construction of this Project including the following as summarized.

1. Removal by qualified person(s) for salvage and/or relocation of existing items indicated including:
   a. Chain Link Fence
   b. Items of various utility systems including drain inlets, valves, utility boxes, manholes, vaults and the like as indicated or otherwise required.
   c. Stripping and removal of topsoil.
   d. Clearing, grubbing, removal and disposal of vegetation including stump removal.

2. Remove items of existing site elements, foundations and appurtenances, and structures to extent indicated, including demolition and excavation if required for removal. Removals further include:
   a. Removing or, as indicated, abandoning in place site utilities by qualified person(s) including disconnecting, capping, and sealing at points of connection to existing remaining utility services.
      1) Include obtaining services of a utility locator service to perform a full mark-out.

   b. Edgings and fence systems of various types.
   c. Paving systems.
   d. Concrete curbs, slabs, sub-slabs, footings, and walls.
   e. Setting bed materials from paving systems, complete.
   f. Debris and obstructions interfering with new work of the Project.
   g. Art sculptures and donor elements

3. Dispose of removed items and material not otherwise indicated to be salvaged and delivered to Owner.

4. Protection of existing improvements to remain.

5. Coordination with associated Construction Contracts.

B. Related Sections include the following:

1. Division 31 Section 31 13 00 Selective Tree Protection, Removal and Trimming
2. Other Division 32 & 33 Sections for retrofit and new utility installations of water distribution, storm drainage, electrical, and other services entering site or on site.

1.03 DEFINITIONS

A. Debris and/or Obstructions: Existing materials including but not limited to concrete slabs and foundations; pilings; paving materials; abandoned utilities pipes, duct banks, and structures; rubble material including bricks, ashes, wood, cinders, debris, aggregate, and masonry; catch basins and manholes; miscellaneous metal items; boulders; and any other below grade debris and obstructions of any size encountered within the required excavations regardless of the nature of the materials encountered, their geological definitions, the water contents thereof, and the means of excavation required.

B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

C. Remove, removal, and like terms: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.

D. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse. Store items indicated for removal and salvage to a location as approved by Construction Manager.

E. Playground Structures: Footings, foundations, retaining walls, slabs, curbs, utility and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

F. 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; reasonable free of subsoil, clay lumps, gravel, and other objects more than two-inched (2”) in diameter; and free of subsoil

1.04 SUBMITTALS

A. General: Refer to and comply with Division 1 Section 00 70 00 General Conditions, for procedures and other submittal criteria.

B. Work Plans and Schedules:

1. Schedule of Procedures and Operations: Submit prior to start of any site clearing, removal, or excavation work to show coordination and verifications for shut-off, capping, and discontinuation or continuation of utility services. Comply with additional related provisions specified in Division 1 Section 00 70 00 General Conditions.

2. Proposed Environmental-Protection, Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use,

proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined by Construction Manager to be inadequate.

C. Qualifications: Submit for firms and persons specified in Article “Quality Assurance” to demonstrate capabilities and experience for specific salvage and/or relocation work.

D. Data submitted for Information and Reference:

1. Permits and/or Permissions by Utility Authority: Submit for respective work on site utility structures and distribution systems.

2. For Transport and Disposal Off-site:

a. Copies of permits necessary to transport materials for disposal off site.
b. Location of legal disposal sites for waste and removed materials of this Project.

1.05 QUALITY ASSURANCE

A. Qualifications: Use person(s) with knowledge of and experience with the various utility services and materials and their application, preferably a qualified installer with respect to item, to perform cutting and removal of utilities and to supervise removal of items indicated for salvage and/or relocation.

B. Regulatory Requirements: Comply with safety, protection, and pollution controls of regulatory agencies or authorities having jurisdiction at Project location including federal, state, and local hauling and disposal regulations. In addition to the requirements of the Contract, safety requirements shall conform to ANSI A10.6 "Demolition Operations - Safety Requirements" and ANSI A10.11 “Safety Nets Used During Construction, Repair, and Demolition Operations”.

C. Construction Monitoring of Site Clearing Operations: During construction operations, the Landscape Architect and/or Construction Manager may be present at the site to observe site clearing and demolition operations and shall be permitted free and unrestricted access to the site and work.

D. Damage or loss, whether by reasons of fire, theft, or other casualty, or any other occurrence to the various items required to be demolished or salvaged, shall be at the risk of the Contractor from and after the date of the Contract, and no such damage or loss shall relieve the Contractor from any obligation under the contract to complete all demolition and removal work as specified.

E. Damage to Existing Work Not to be Removed: Existing items that are not to be removed shall not be disturbed or damaged in any way. If any such disturbance or damage occurs to the existing work, which is to remain, or which is to be salvaged and/or relocated, the Contractor shall promptly repair the damage and restore or replace the damaged items at no additional cost to the Owner.

1.06 PROJECT / SITE CONDITIONS

A. Surface and Subsurface Conditions:

1. Comply with additional provisions as specified in Division 1 Section 00 70 00 General Conditions.

2. Review available information and make an independent interpretation of the surface and subsurface conditions that may affect the work of the Contract.

3. The Contractor, by careful examination, shall become informed as to the nature and location of the Work, the nature of the surface and/or subsurface conditions; the location of existing utilities and other structures; the character of the equipment and facilities needed primarily to and during the execution of the Work; and facilities needed preliminary to and during the execution of the Work.

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

B. Existing Utilities and Services:

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

2. Maintain existing utilities indicated to remain in service and protect them against damage during on-site operations.

3. Verify that utilities have been disconnected and capped as approved before proceeding with Work.

4. Comply with additional provisions as specified in Division 1 Section 01700 “Execution Requirements”.

C. Traffic: Minimize interference with adjoining park areas roads, streets, walks, bikeways, and other adjacent occupied or used facilities during site-clearing operations. Hazardous or Contaminated Materials:

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

D. Materials Ownership:

1. General: Except for materials indicated to be salvaged, indicated for reuse on Project, or subsequently designated to remain Owner’s property, all excavated, demolished, and cleared materials shall become property of Contractor and shall be removed from the site in a legal manner.

2. Historic: Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, sculptures, and other items of interest or value to Owner that may be encountered during site clearing, demolition, or earthwork remain Owner's property.

a. Coordinate with Construction Manager who will advise or arrange establishment of any special procedures for removal and salvage.
b. As directed, Contractor shall carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

E. Sale or storage of removed items or materials on-site is not permitted.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide all materials, equipment and supplies as required to completely perform the demolition and site preparation work specified herein and as shown on the Drawings.

2.02 LAYOUT EQUIPMENT

A. Stakes and batter-boards shall be of size and quality necessary to execute the work. The Contractor shall use wire, non-stretching cord, or laser equipment to establish reference lines.

2.03 PROTECTION OF DRAINAGE / SEDIMENTATION CONTROL

A. Anti-erosion mulch or straw bales: Provide clean, weed-free straw as approved by the Landscape Architect or Civil Engineer.

B. Contractor shall confirm that materials conform to all applicable regulations of all Agencies having jurisdiction over drainage systems.

C. Maintenance of the erosion and sedimentation control devices shall be the responsibility of the Contractor.

2.04 CONSTRUCTION FENCES AND GATES

A. Refer to Section 32 31 13 Chain Link Fences and Gates

2.05 MATERIALS

A. Fill/Backfill: Comply with requirements of Division 31 Section 31 00 00 “Earthwork”.

B. Soil Materials
1. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section 31 00 00 “Earthwork” and Division 32 Section 32 91 13
a. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on site.

C. Utility Closures:

1. Plugs, Caps, and Flanges: As approved to suit, galvanized or cast iron thread plugs, welded caps, and/or flanges.
2. Concrete and/or Grout: Minimum 3000 psi type to suit.
3. Thrust Blocks: Minimum 2500 psi concrete type.

D. Storage Materials for Salvaged Items:

1. Provide wood cribbing for heavy and bulky items.
2. Furnish wood pallets of standard type and size for handling salvaged items such as cleats and other loose items of like kind collected together.
3. Furnish heavy-duty wire mesh to form pallet baskets and/or flat cable strapping for holding, in storage and during handling, loosely stacked items on pallet as conditions require and as approved by Construction Manager.
4. Tagging Materials: Inventory identification tagging shall be material including ink writing resistant to long-term weather exposure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine existing conditions and correlate with requirements indicated to determine the extent of site preparation, demolition, removals and other related work required.

B. Use a utility locator service and perform related utility “mark-out” before site clearing operations begin.

C. Verify items to be salvaged by Contractor for placement in Owner’s storage, inventory and record the condition of items to be removed and salvaged, and verify location of Owner’s storage location before relocation.

D. When unanticipated structural conditions or electrical or other utility elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report of conditions as found to the Construction Manager.

3.02 PREPARATION

A. Contractor shall furnish all services, labor, equipment, and materials required to perform clearing, selective demolition, and removal of this Section and to prepare site for subsequent work of this Contract. Accept actual conditions existing and as found at site.

1. The surface of required site prepared areas or subsequent excavations, removals, stripping, or grading work may expose soft grades during the course of the Work. Contractor shall take actions necessary, subject to concurrence and approval by Construction Manager, to allow the progress of the Work to continue and to make the site accessible to construction equipment. Conditioning of the site and subsequent removal shall be at the Contractor’s expense.
2. Use water, mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding and pollution.

B. Protection: Protective measures shall include temporary construction in addition to protection provisions specified in Division 1 Section 01 50 00, “Temporary Facilities and Controls” and Division 31 Section 31 00 00 “Earthwork”.

1. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during work operations that may cause damage.

   a. Protect adjacent trees and plants to remain from injury or damage. Do not stockpile soil or other material within drip line of trees.
      1) Protect existing trees to remain throughout construction by establishing a Protection-Zone Fencing.
      2) Orange plastic safety mesh and 4’ high minimum wood stakes shall be six (6) foot long by 1 inch by 1 inch square driven a minimum of two feet into the ground. Posts shall be spaced eight (8) feet on center, max.
      3) Consult with Landscape Architect or owner’s representative prior to staking out Protection-Zone Fencing
   b. Protect sidewalk paving and street curbs in addition to crossing traffic locations.
   c. Protect existing drainage systems from intrusion of debris and clogging.
   d. Protect adjacent surfaces and finishes including existing fences.
   e. When permitted by the Construction Manager, certain existing to remain but interfering items may be removed to a suitable, protected, storage location during work. These items shall be cleaned and reinstalled in their original locations after clearing, demolition, and excavation operations are complete.

2. Take precautions to guard against movement, settlement, or collapse of any adjacent conditions, sidewalks or street passages, adjoining property, and adjacent structures. Be liable for any such movement, settlement, or collapse. If such damage does accidentally occur, safeguard the public and repair promptly.

3. Protection of Persons:

   a. Provide temporary facilities including barricades and fencing to prevent entry to demolition areas by unauthorized persons. Access to demolition areas shall be prevented by temporary facilities such that the facilities cannot be circumvented or thwarted.
   b. The necessary temporary closures, guardrails, barricades, and other devices shall be provided so as to adequately protect workmen and employees, visitors, and inhabitants from possible injury.

4. Temporary Erosion and Sedimentation Control Measures
   a. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan, specific to the site, that complies with EP 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
   b. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
   c. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Layout and Field Survey Work:

1. See Division 1 Section 00 70 00 General Conditions and Division 31 Section 31 00 00 “Earthwork” for additional provisions.

3.03 REMOVALS FOR SALVAGE

A. Perform removals for salvage and salvage work in a systematic manner.

B. Salvage Materials and Items: Remove materials or items that are indicated by Contract Documents to be removed for salvage and that are to remain the property of Owner.

C. Procedures used are to be developed and optimized during removal and are dependent upon conditions encountered and results achieved. General procedures are indicated below for materials to be salvaged.

1. Clean salvaged items of dirt and demolition debris.
2. Evaluate materials for quality characteristics and inventory each unit and material or item type as they are prepared for storage.
3. Group like materials and material sizes together. Identify and group different cobblestone types.
4. Items cracked, broken, severely chipped, or otherwise considered damaged for future re-use shall be set aside for evaluation confirmation by Construction Manager. If confirmed unsuitable for future use, these units shall also be discarded.
5. Rejected and discarded materials shall be disposed of off-site.
6. Pack or crate items after cleaning. Identify contents of containers.
7. Tag each large unit or palletized grouping of material with identification related to inventory listing.
8. Store items in a secure area until re-installation or delivery to Owner.
9. As applicable, transport items to Owner’s storage area off-site as designated by Construction Manager.
10. Protect items from damage during transport and storage.
11. If to be re-installed on Project, make available to appropriate installer.

3.04 CLEARING, STRIPPING, AND GRUBBING

A. Do note remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

B. Remove existing grasses and other vegetation, paving and related base materials, debris, and/or obstructions before removing existing soil materials.

C. Completely remove stumps, roots, and related organic matter above and below surface to a minimum depth of 18 inches below exposed subgrade except as noted on drawings.

D. Use only hand methods for grubbing within tree protection zone.

E. Fill depressions cause by clearing and grubbing operation with satisfactory soil material unless further excavation or earthwork is indicated– see Division 32 Section 31 91 13 Planting Soils

F. Top Soil Stripping – See Division 31 Section 31 00 00 “Earthwork” and Division 32 Section 31 91 13 Planting Soils

3.05 DEMOLITION AND REMOVAL OPERATIONS

A. Remove, including demolition if required for removal, existing on and above grade elements and surface improvements not otherwise indicated to be salvaged. Conform to conditions shown for preparing site areas to accommodate new work.

1. Demolition of existing site elements and surface finishes shall be to level and extent indicated or, if not indicated, to invert elevations and lateral dimension required to complete removal of system or item.
2. Demolition includes the cutting out, destruction, and complete removal of the item or portion of item so designated.
3. Demolish concrete and asphalt in small sections. Cut in place material full depth at junctures with construction indicated to remain, using power-driven saw and remove between saw cuts. Breakup slabs before removal.
4. Typically remove existing pavement and walkway systems in their entirety. Where portions of pavements and other items are to be removed, cutting and removal shall result in neat, plumb, and square edges. Use power saw equipment for pavements, concrete slabs, and other solid materials with saw cuts along straight lines to a depth of not less than two (2") inches. Protect remaining portions from damage.
5. Masonry: Cut masonry at junctures with construction indicated to remain, using power-driven saw. Remove masonry between saw cuts.
6. Equipment, fixtures, and miscellaneous articles not designated for salvage, as well as debris which is found on the premises and which has been abandoned by the Owner, shall be removed from the work site by the Contractor.
7. Remove site furnishings as indicated
   a. Surrender to the City of Boulder site furnishings per their request. If not desired by the City of Boulder, dispose as necessary.
8. Use of explosives is not permitted.

B. On-Site Utilities and Services:

1. Verify location and status. Arrange disconnect as applicable.
2. Utility and Service Line Terminations, unless otherwise shown or approved by the Construction Manager, shall be as follows:

   a. Close open ends of abandoned underground utilities with sufficiently strong closures to withstand pressures, which may result after closing, and to suit type of utility or service line.

      1) Sewer: Cut and plug at nearest manhole.
      2) Water: Cut and plug at nearest main. Install thrust blocks at caps and plugs.
      3) Telephone: Comply with utility regulations.
      4) Electric: Comply with utility regulations and NEC.

b. Piping: Disconnect piping at unions, flanges, valves, or fittings.
c. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.
d. Close open ends of metallic conduit and pipe with threaded galvanized metal caps, 24" long concrete or plastic plugs, or other suitable method for the type of material and size of pipe. Do not use wood plugs.
e. Close open ends of concrete and masonry utilities with masonry bulkheads, constructed of unit masonry and mortar to completely and solidly fill the opening for a depth/length of 16" minimum.

3. Items abandoned and not removed shall be identified, located, and marked on Project survey documents for inclusion with “As Built” Survey Record Documents.

a. Record locations shall include invert elevation and location of capping or disconnect related to point of termination.

4. Protect utilities to remain. Include visibly marked location for identification by others subsequently performing work on-site and maintain at least until completion of earthwork.

C. Remove existing debris and obstruction materials that may occur at all areas of the site as indicated and as approved by the Construction Manager. Fill depressions caused by clearing and removal operations with specified fill material to suit design conditions, unless further excavation or earthwork is indicated.

D. Stockpiling of existing soil, gravel, debris, and/or obstruction materials within the contract limits of the job site is restricted to no more than the needs of what can be removed from site in a 24-hour period. Under no circumstances shall on-site stored material exceed a total of 50 cubic yards. Stockpiles should be no more than 6 feet in height.

1. Stockpile soil materials away from edge of excavation areas and Bulkhead line.
2. Cover temporary storage piles to prevent windblown dust and protect against erosion.

3.06 REPAIRS / RESTORATIONS

A. General: Promptly repair damage to adjacent construction caused by work operations.

B. Repair or replace existing off-site and to remain on-site improvements damaged during the conduct of this work with material of same or better kind, quality, and size as approved by the Construction Manager.

1. Where repairs to existing surfaces are required, patch surfaces to produce surface suitable for new materials.
2. Provide repairs or, if required, replacement of construction in a manner that eliminates evidence of patching and refinishing.

C. Re-install items removed for salvage and reuse and items removed at Contractors convenience or by error after or, as applicable to item, concurrent with completion of Project work. Include pick-up and delivery from storage back to site. Replace fasteners

and other components that may have been damaged during removal. Secure connections and comply with applicable specification for item.

3.07 CLEAN UP AND DISPOSAL

A. Remove and dispose of materials resulting from operations as work progresses.

B. Burning or burying of removed materials will not be permitted on the site.

C. Except for items or materials indicated to be salvaged, remove materials from demolition and removals, excess soils, debris and/or obstructions, waste/trash, off the Project site and legally disposed of.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

D. Before completion of Contract Work, remove temporary items and materials installed for use during site clearing, removals, and construction operations of subsequent Project work. See Division 1 Section 01 50 00 “Temporary Facilities” for additional provisions.

3.08 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition and removal operations. Return and maintain adjacent areas to condition that existed before start of clearing, demolition, and removal operations or to condition required for new work of Project.

B. Refer to Division 1 Section 00 70 00 General Conditions for maintenance cleaning and Section 01 70 00 “Contract Closeout” for final cleaning.

END OF SECTION 02 50 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies requirements for concrete cast-in-place on the site.

B. The work includes finish concrete pavements, walkway bases, foundations and structures.

C. Except for that specifically excluded below, furnish and combine material for all the work indicated on the Drawings or herein specified to be of plain or reinforced concrete, its installation with forms and reinforcement, its curing and finish. Shop drawings, tools, way, apparatus and equipment necessary for concrete production, installation, and finish are included. The work under this Section includes but is not limited to the following:

a. Salvaged wood footings
b. Cordwood Seatwall footings
c. Standard Concrete Pavement
d. Color or Textured Concrete Pavement
    i. Materials: Concrete, integral color, surface treatment.
    ii. Pressurized cleaning equipment
    iii. Concrete placement and finish
    iv. Surface treatment
    v. Sealer Application
e. Footings for site furnishings
f. Concrete stairs

1.02 RELATED SECTIONS

A. Related Sections include the following:
a. Division 32 Section 32 10 00 Base Courses (Pavement)
b. Division 32 Section 32 14 03 Brick Paver
c. Division 32 Section 32 18 16 Playground Protective Surfacing

1.03 REFERENCE STANDARDS

A. References herein are made in accordance with the following abbreviations and all work under this Section shall conform to the latest editions as applicable.

1. American Concrete Institute (ACI):

301	Specifications for Structural Concrete
305R	Hot Weather Concreting

306R	Cold Weather Concreting
325.9R	Guide for Construction of Concrete Pavements and Concrete Bases

2. ASTM International (ASTM):

A82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
A185	Standard Specification for Steel Welded Wire Reinforcement
A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C33	Standard Specification for Concrete Aggregates
C94	Standard Specification for Ready-Mixed Concrete
C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
C150	Standard Specification for Portland Cement
C171	Standard Specification for Sheet Materials for Curing Concrete
C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260	Standard Specification for Air-Entraining Admixtures for Concrete
C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C494	Standard Specification for Chemical Admixtures for Concrete
C1116	Standard Specification for Fiber-Reinforced Concrete

3. Concrete Reinforcing Steel Institute (CRSI):

Manual	Manual of Standard Practice.

4. United States Department of Justice - Americans with Disabilities Act (ADA):

ADA ADA Accessibility Guidelines for Buildings and Facilities; 28 CFR Part 36.

5. State Regulations regarding Accessibility.

6. City of Boulder construction specifications, standards and details.

1.04 QUALITY ASSURANCE

A. Work and materials for construction of the cement concrete walks shall conform to ACI 316R. Other cast-in-place concrete shall conform to ACI 301.

B. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features shown on the Drawings are approximate. Manufacturer's approved shop Drawings of equipment to be supported, anchored, or contained thereby shall be consulted for exact location, size, and details.

C. Perform work in accordance with ACE 301, Conform materials and installation to applicable portions of Colorado Department of Transportation and the City of Boulder construction specification, standards and details.

D. Installer Qualifications:
   a. The Installer shall provide a qualified foreman or supervisor who has a minimum of three years' experience with imprinted and textured concrete, and who has successfully completed at least five exterior sandblast concrete installations of high quality and similar in scope to that required.

E. The Landscape Architect will reject cast-in-place concrete that exhibits the following defects:
   a. Bulging: Concrete surfaces that bulge due to insufficiently secured formwork, undersized ties, or flat bar clamps.
   b. Wavy Concrete: Concrete surfaces that exhibit waves along plywood joints due to moisture migration into unsealed cuts of plywood sheets causing swellings.
   c. Spalling: Concrete spalling due to shale, alkali reactivity, rusting steel too close to the surface, carbonation, improper removal of formwork, expansion of cast-in steel during the welding process, or other reasons.
   d. Cracking and Crazing: Concrete cracking and crazing due to lack of control joints or high water/cement ratio above 0.50.
   e. Air holes: Air holes resulting from improper vibration and excessive heights of individual layers of pours between vibration. Air holes due to spreading of concrete with vibrators rather than moving buckets or hoses.
   f. Honeycombing: Concrete honeycombing including loss of fines from leaking formwork or other causes.
   g. Discoloration: Concrete discoloration, outside of typical concrete industry standards, caused by any reason, including inconsistent concrete mix, different sources of cement and aggregates, temperature variation between individual pour and curing phases, improper and inconsistent use of vibrators, variation of time span of concrete in formwork, form oils, and migration of plasticizer into concrete from exposed sealant beads on formwork and around cast-in items such as electrical outlet boxes.
   h. Visible Pour Joints: Visible pour joints in concrete resulting from leaking formwork due to lack of gaskets and insufficient overlap with old concrete preventing proper tightening of formwork. Placement of concrete layers in excessive heights and spreading concrete with vibrator.

i. Debris in Concrete: Concrete that includes debris, whether caused by insufficient cleaning of formwork or lack of cleanout and access doors at base of formwork.

F. The Contractor shall schedule a Concrete Preconstruction Meeting at least thirty days prior to placement of any concrete.

1.05 SUBMITTALS

A. Submit to the Designer shop drawings and product data. Submittals shall include at least the following:

1. Data for each concrete mix for each formulation of concrete proposed for use including:
   a. Mix identification designation (unique for each mix)
   b. Statement of intended use.
   c. Mix proportions, including all admixtures.
   d. Manufacturer's data and/or certifications verifying conformance of all mix, materials, including admixtures with specified requirements.
   e. Wet and dry unit weights.
   f. Entrained air content, ASTM C138.
   g. Design slump, ASTM C143.
   h. Required average strength qualifications data per ACI 301-3.9.1 and 3.9.2. Submit separate qualification for each production facility which will supply concrete to the project.
2. Technical data on all materials and components.
3. Material Safety Data Sheets (MSDS) for all concrete admixtures and curing agents.
4. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures," showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structure.
5. Color or Textured Concrete Pavement
   i. Submit samples, minimum 2'x2' as required showing color, finish and sealer. At minimum include the following samples
      1. Black Canyon, Sandscape from Colorado Hardscapes
      2. Sample 0413-01-1525, Sandscape from Colorado Hardscapes
   ii. Color chart for concrete
   iii. Product data for surface treatment and sealer materials
   iv. Concrete mix design.
6. On Site Mock-Up Multi-Use Creek Path Concrete Pavement: Provide field samples of surface colors textures and patterns specified for landscape architect approval prior to beginning work, minimum 60 inches by 60 inches in size illustrative paving finish:
   i. Finish areas of bike portion to be a Broom Finish per City of Boulder construction standards
   ii. Finish area of pedestrian to be a colored textured finish.
   iii. Do not proceed with remaining work until workmanship, color, and sheen are approved by Landscape Architect.
   iv. Refinish mock-up area as required to produce acceptable work.

B. Test Reports – Testing necessary to establish the concrete mixes shall be performed by and at the expense of the Contractor. Methods of Testing shall comply with the latest ASTM standards. Provide the following Test Reports:
1. Sieve Analysis of fine and coarse aggregates.
2. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water:cement ratio, type and manufacturer of cement and either a. or b. below:
a. Standard deviation data for each proposed concrete mix based on statistical records.
b. Water:cement ratio curve for each proposed concrete mix based on laboratory tests. Give average cylinder strength results at 7 and 28 days for laboratory concrete mix designs. Provide results of 14 day tests if available.

C. Certifications – Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

D. Provide standard test cylinders to determine the compressive strength of the concrete as mixed for the work, made by the contractor in the presence of the Designer at the site. In addition to furnishing the concrete for the test specimens, the Contractor shall furnish approved cylindrical molds (6” x 12”) and assist in sampling, fabricating, protecting and curing the specimens. Provide three (3) compressive strength test cylinders and one (1) slump test for every ten (10) cubic yards of concrete delivered to the site. The Contractor shall include the cost of test cylinders and slump tests in his base bid.

E. Test specimens shall conform to the requirements of Subsection M4.02.13 of the SSHB Standard Specifications.

1.06 TESTING

A. The Owner may employ an independent testing laboratory to inspect and test concrete paving and other cast-in-place concrete work.

B. Contractor shall prepare test specimens in accordance with ASTM C31, standard cylinder size 4-inch x 8 inch.

C. Testing of materials and installed work may occur at any time during progress of the work. Rejected materials and installed work shall be removed and replaced.

1.06 JOB CONDITIONS

A. Subgrade and base preparation, including material, shall be of proper approved quality as specified under other sections of these Specifications. Report to the Designer in writing all unacceptable conditions. Start of work under this Section shall constitute acceptance of the subgrade and base conditions to which this work is to be applied. Any defects in work resulting from such conditions shall be corrected under this section at no additional expense to the Owner.

B. Maintain base in satisfactory condition and properly drained until surface improvement is placed.

C. If subsequent testing on hardened concrete by the Owner determines that the concrete does not meet the specification requirement, the Contractor shall replace

any material or workmanship which is rejected and pay for the testing with no additional cost to the Owner.

D. Concrete mixed or placed when the air temperature is below 40 degrees F for the previous 24 hours will be considered cold weather concrete and will require special treatment in accordance with SSHB M4.02.12 and ACI 306R.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

A. Steel reinforcing bars shall conform to ASTM A615, Grade 60, deformed.

1. Bars employed as dowels shall be hot-rolled plain rounds.

B. Steel Wire: ASTM A82, plain cold drawn steel.

C. Welded Wire Fabric (WWF) Reinforcement: Welded wire fabric reinforcement shall conform to the applicable requirements of ASTM A185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

D. Supports for Reinforcement: Bolsters, chairs, and other devices for spacing, supporting, and fastening reinforcing bars, and welded wire fabric in place shall be wire bar-type supports complying with CRSI Manual.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI Class 1).

2.02 PORTLAND CEMENT CONCRETE

A. Portland cement concrete shall conform to the following:

1. Maximum water-cement ratio shall be 0.45 conforming to ACI 316R.

2. Concrete shall be air-entrained type conforming to ASTM C94. Air content by volume shall be 6 percent + 1 percent, tested in accordance with ASTM C260.

3. Slump of concrete shall not be less than 3 inches nor greater than 4 inches, determined in accordance with ASTM C143.

4. Cement for concrete shall be a Portland cement conforming to ASTM C150, Type I or II. Only one color of cement, all of the same manufacturer, shall be used for the work.

5. Fine and coarse aggregates for concrete shall conform to ASTM C33.

6. Concrete shall contain a water reducing agent to minimize cement and water content of the concrete mix at the specified slump. Water reducing agent shall conform to ASTM C494, Type A.

7. Concrete shall contain no calcium chloride or admixtures containing calcium chloride. No admixtures other than those specified shall be used in the concrete without the specific written permission of the Engineer.

2.02 COLOR OR TEXTURED CONCRETE

A. Preferred installer to be Colorado Hardscape, Inc. Please contact:
Colorado Hardscapes, Inc.
8085 E. Harvard Ave.
Denver, CO 80231
303-750-8200

B. Concrete Mix Design
a. Concrete shall have a minimum of 4000 psi (per ACI 318) or as required by local building codes or industry standards, whichever is higher
b. Portland Cement shall conform to ASTM C150, C595 or C1157 depending on soil conditions.
c. Aggregate shall conform to ASTM C33
d. Air entrainment shall conform to ASTM C260

C. Coloring, Texture and Sealing Material
a. The concrete shall be colored with the following *Sandscape*® color:
i. Black Canyon
ii. Sample 0413-01-1525
iii. Sample TBD
b. CHI 027 Surface Treatment will be used to achieve the desired texture
c. Slabs shall be sealed with a penetrating sealer in accordance with the manufacturer's recommendations. Submit sealer for approval.

2.03 CONCRETE AGGREGATES

A. Fine Aggregates: Fine aggregates shall conform to ASTM C33, part 6.

B. Coarse Aggregates: Coarse aggregates shall conform to ASTM C33, Parts 9 through 11 and Tables 2 and 3, with the following Class designations:

1. Class 1S: For footings and foundations not exposed to the weather.

2. Class 4S: For pavements, driveways, curbs, walkways, sidewalks, and retaining walls that are exposed to the weather.

3. Class 1N: For pavements, driveways, curbs, walkways, sidewalks, and retaining walls that are not exposed to the weather.

2.04 CURING MATERIALS FOR UNCOLORED CONCRETE

A. Curing shall be accomplished by the following methods:

1. Moist curing with burlap covering.

2. Curing paper, nonstaining, fiber reinforced laminated Kraft bituminous product conforming to ASTM C171. Four mil polyethylene sheeting may be substituted for curing paper.

3. Curing compound, a resin-base, white pigmented compound conforming to ASTM C309, Type 2.

2.05 EXPANSION JOINTS

A. Expansion joint filler shall be preformed, nonbituminous type conforming to ASTM D1752, Type II, similar to Sealtight Cork Expansion Joint Filler, manufactured by W.R. Meadows, Inc., Elgin, IL 60120, or approved equivalent.

1. Premolded filler shall be one piece for the full depth and width of the joint.

B. Smooth dowel shall be hot rolled plain steel dowel bonded at one end and operating in smooth close fitting sleeve (of same material) at the other end.

2.06 CONTROL JOINTS

A. Joint filler to be polyethylene foam with manufacturer's recommended sealant.

2.07 FORMS

A. Cylindrical Forms: Sonotube Fibre Forms, wax-impregnated strippable forms manufactured by Sonoco Products Company, General Products Division, ABS or PVC plastic reusable forms, or approved equivalent.

B. Forms for Exposed Finish: Plywood, metal, metal-framed plywood faced, or other acceptable panel materials. Plywood shall conform to U.S. Product Standard PS-1 and APA Graded B-B (Concrete Form) Class I Exterior Grade plywood or B-B or A-C Class I high density overlay concrete form plywood. Formwork materials shall produce smooth, continuous, straight and level surfaces.

C. Forms for Unexposed Finish: Plywood, lumber, or metal, with lumber dressed on at least two edges and one side.

D. Form Ties: Prefabricated, adjustable length galvanized steel snap-off ties, with brackets, cones, cornerlocks, and other accessories as necessary.

E. Form Release Agent: Commercial formulation compounds that will not bond with, stain or adversely affect concrete.

F. Imprinting Tools: Mats and tools used to stamp projecting texture and patterns onto plastic concrete surfaces and which shall be specifically designed with rigid back

supports to enable a clean, sharp, stamping image. Stamps for curb ramps shall be designed to meet ADA detectable warning requirements.

2.08 EXPOSED CONCRETE PROTECTIVE COATING

A. Protective Coating shall be silane-siloxane product.

2.09 REINFORCEMENT ACCESSORIED

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

1. Preferred dowel for concrete pavement joints:
Speed Dowel
Greenstreak
3400 Tree Court Industrial Blvd.
St. Louis, MO 63122
636 225-9400

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

A. The subgrade of areas to be paved shall be graded and compacted as specified in Section 32 11 00, BASE COURSES (PAVEMENTS).

B. 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, subbase, base, or pavement, subsequent backfill and compaction shall be performed as required by the Engineer and as specified in Section 31 00 00, EARTHWORK.

C. Materials shall not be stored or stockpiled on subgrade.

D. Prepared subgrade will be inspected by the Engineer. Subgrade shall be approved for installation of the gravel base course. Disturbance to subgrade caused by inspection procedures shall be repaired.

3.02 BASE COURSE

A. Base course for concrete paving shall be pavement subbase course or gravel base materials specified in Section 32 11 00, BASE COURSES (PAVEMENTS) as shown on the Drawings.

B. Width of base course shall extend beyond edge of the proposed pavement as shown on the Drawings.

C. Material shall be placed in lifts no more than 6 inches 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.

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 inch as measured by means of a 10 foot long straightedge shall be regraded and recompacted.

D. Base course shall be compacted at optimum moisture content to not less than 95 percent of maximum density as determined by ASTM D1557.

E. The base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with the base course material.

3.03 STEEL REINFORCEMENT

A. Before being placed in position, reinforcing steel 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 required.

B. Any bar showing cracks after bending shall be discarded.

C. Unless otherwise shown on the Drawings, reinforcing shall extend within 2 inches of formwork and expansion joints. Reinforcing shall continue through control joints. Adjacent sheets of fabric reinforcing shall lap 6 inches.

D. After forms have been coated with form release agent, but before concrete is placed, reinforcing steel shall be securely wired in the required position and shall be maintained in that position until concrete is placed and compacted. Chair bars and supports shall be installed in a number and arrangement approved by the Engineer.

3.04 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits.

1. Provide Class A tolerances for concrete surfaces exposed to view.

2. Provide Class C tolerances for other concrete surfaces.

B. Construct forms to provide for openings, offsets, sinkages, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, anchorages, and inserts, and other features required for the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and other features for easy removal.

C. Chamfer exposed corners and edges, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

D. Double stake form joints

E. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Re-tighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.05 PREPARING FORM SURFACES

A. Coat contact surfaces of forms with an approved, nonresidual, low-VOC form-coating compound before placing reinforcement.

3.06 STANDARD CONCRETE PLACING

A. Equipment, methods of mixing and placing, and precautions to be observed as to weather, and condition of base shall meet the requirements of ACI 316R.

B. The Engineer shall be notified of scheduled concrete placement sufficiently in advance of start of operation to allow preliminary inspection of the work, including subgrade, forms, and reinforcing steel.

C. Work shall not be performed during rainy weather or when temperature is less than 40°F. (4.4°C.).

D. Adjacent work shall be protected from stain and damage. Damaged and stained areas shall be replaced or repaired to equal their original conditions.

E. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.

F. Concrete which has set or partially set, before placing shall not be used. Retempering of concrete will not be permitted.

G. Concrete shall be thoroughly vibrated, or otherwise consolidated to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

H. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8 inch thick, shall be well scrubbed into the thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.07 FINISHING

A. Concrete surfaces shall be screeded and finished true to line and grade, and free of hollows and bumps. Surface shall be dense and smooth.

1. Finished concrete surface for concrete subbases shall be wood floated to a slightly rough surface. Surface shall not deviate more than 1/4 inch in 10 feet.

2. Finished concrete surfaces shall be wood floated and broom finished, to a uniform surface. Surface shall not deviate more than 1/8 inch in 10 feet.

B. Horizontal surfaces of concrete surfaces which will be exposed shall be given a light broomed finish, with direction of grooves in concrete surface perpendicular to length of concrete band, slab, or pad. After concrete has set sufficiently to prevent coarse aggregate from being torn from surface, but before it has completely set, brooms shall be drawn across the surface to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by brooming operation.

C. Immediately following finishing operations, arises at edges and both sides of expansion joints shall be rounded to a 1/4- inch radius. Control joints to be tooled shall be scored into slab surface with scoring tool. Adjacent edges of control joint shall at same time be finished to a 1/4-inch radius.

D. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

E. Sidewalks, walkways, accessible routes, and ramps shall be constructed and finished in accordance with the Americans with Disabilities Act (ADA) and state and local requirements. Provide protective coating in accordance with manufacturer's recommendations.

3.08 COLOR OR TEXTUED CONCRETE PAVEMENT INSTALLATION

A. The area to receive Sandscape® concrete shall have the sub-grade prepared as required as for any concrete slab on grade.

B. The formwork shall be installed in accordance with the drawings. Sandscape® concrete shall be 5" thick. Walls to be per structural engineer's recommendations.

C. Reinforcement shall include #4 rebar @18" o.c.e.w. and Fibermesh 300.

D. Control joints and/or isolation joints shall be provided in accordance with the drawings and the guidelines established by the American Concrete Institute. As with any concrete slab, Sandscape® concrete usually contains construction joints, control joints and expansion joints. The contractor shall advise and work with the architect/engineer to determine the best location for these joints to minimize the visibility of the joints and to minimize unsightly cracking.

E. All concrete flatwork shall be performed under the supervision of a craftsman who has completed the American Concrete Institute (ACI) Concrete Flatwork Finisher and Technician (ACICFFT) training and has five years of experience installing Sandscape®.

F. The concrete shall be placed and screeded to the finished grade, and floated to a uniform surface using standard finishing techniques.

G. All Sandscape® curb/wall work to be installed using smooth forms, stripped while concrete is workable and troweled smooth.

H. Surface Treatment will be applied and cleaned off with proper equipment.

I. After the initial curing period the surface of the slab shall be sealed.

J. Installation Tolerances

a. Uniformly finish the concrete surface
b. Uniformly apply the CHI 027 surface treatment
c. Install control joints in a timely manner to minimize random cracking.
d. Remove the surface down to the fine aggregate using pressurized equipment.
e. Care shall be taken to not leave any deep or shallow inconsistencies in the overall Sandscape®.
f. Evenly apply the recommended sealer

3.09 CURING

A. Concrete shall be kept continuously damp from time of placement until end of specified curing period or cured by other methods. Water shall not be added to surface during floating and troweling operations, and not earlier than 24 hours after concrete placement. Between finishing operations, surface shall be protected from rapid drying by a covering of waterproofing paper. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of a fog spray of water, applied as often as necessary to prevent drying, but not sooner than 24 hours after placing concrete. None of the water so applied shall be troweled or floated into surface.

B. Concrete surfaces shall be cured by completely covering with curing paper or application of a curing compound.

1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period, concrete surface shall be checked frequently, and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.

2. Concrete cured with a curing compound shall have the compound applied at a rate of 200 square feet per gallon, in two applications perpendicular to each other.

3. Curing period shall be seven (7) days minimum.

C. Only if additional protection is absolutely required, the surface should remain uncovered after the seven (7) day period for at least four (4) days, after which time new and unwrinkled non-staining reinforced waterproof Kraft curing paper may be used.

3.10 EXPANSION JOINTS

A. Expansion joints shall be 1/2 inch wide and located where shown on the Drawings. Expansion joints shall be troweled in the concrete to required width with preformed joint filler in place. Joint filler shall extend the full depth of the slab and full length of the expansion joint.

1. For concrete walks, pavements, and pads, depth of joint filler shall be placed to form a 1-1/4 inch deep recess for sealant and backer rod below finished concrete surface.

2. Use of multiple pieces to make up required depth and width of joint will not be permitted.

3.11 CONSTRUCTION JOINTS

A. Construction joints shall be placed whenever placing of concrete is suspended for more than 30 minutes.

1. Butt joint with dowels or use a thickened edge joint if construction joints occur at control joint locations.

2. Keyed joints with tie-bars shall be used if the joint occurs at any other location.

3.12 CONTROL JOINTS

A. Control joints shall be tooled into the concrete slab, with 3-inch wide border and troweled edges, in pattern as shown on the Drawings. If no pattern is shown, then pattern shall result in square shape with a maximum area of 36 square feet. Joints shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before slab has achieved its final set.

B. Scoring shall cut into slab surface at least 1 inch, but in no case not less than 25 percent of slab depth.

3.13 COLD WEATHER CONCRETING

A. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40°F. or is expected to fall to below 40°F. within 72 hours. The concrete, after placing, shall be protected by covering, heat, or both.

B. Details of handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Engineer. Procedures shall be in accordance with provisions of ACI 306R.

3.14 HOT WEATHER CONCRETING

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. Every effort shall be made to minimize delays which will result in excessive mixing of the concrete after its arrival on-site.

B. During periods of excessively hot weather (95°F., or above), ingredients in the concrete shall be cooled with cold mixing water to maintain the temperature of the concrete at permissible levels in accordance with the provisions of ACI 305R. Any concrete with a temperature above 95°F., when ready for placement, will be rejected.

C. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. Records shall include checks on temperature of concrete when delivered to Project site and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

3.15 PROTECTION OF CONCRETE SURFACES

A. Concrete surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently.

END OF SECTION 03 30 00

SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes structural steel and grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

C. Qualification Data: For qualified Installer and fabricator.

D. Welding certificates.

E. Mill test reports for structural steel, including chemical and physical properties.

F. Source quality-control reports.

1.4 QUALITY ASSURANCE

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

B. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.3 PRIMER

A. Primer: Comply with Division 09 painting Sections.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

2.6 SHOP CONNECTIONS

A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

A. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds.

B. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.

b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION OF 05 12 00

SECTION 05 31 00 – STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof deck.

1.2 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, special jointing, accessories, and attachments to other construction.

C. Product certificates.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Research/Evaluation Reports: For steel deck.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASC Profiles, Inc.
2. Canam Steel Corp.;The Canam Manac Group.
3. Consolidated Systems, Inc.
4. DACS, Inc.
5. D-Mac Industries Inc.
6. Epic Metals Corporation.
7. Marlyn Steel Decks, Inc.
8. New Millennium Building Systems, LLC.
9. Nucor Corp.; Vulcraft Division.
10. Roof Deck, Inc.
11. United Steel Deck, Inc.

12. Valley Joist; Division of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Weathered Steel Sheet: ASTM A 653A, Structural Steel (SS), Grade 33, G60 (Z180) zinc Coating.
   a. Color: Manufacturer's standard
2. Deck Profile: As indicated in structural drawings
3. Profile Depth: As indicated in structural drawings
4. Design Uncoated-Steel Thickness: As indicated in structural drawings

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, requirements in this Section, and as indicated.

B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

H. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).

3.2 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.3 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

END OF SECTION 05 31 00

SECTION 05 50 00 – METAL FABRICATIONS

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 SUMMARY

A. The Work includes labor, materials, equipment, and services required for completion of Work under this section as shown on drawings and as specified here.

B. This Section includes the following work of the General Contractor:
1. Cord Wood seat wall and post frame
2. Steel grating supporting beams, HSS, pipes, plates, angles, etc.
3. Column base plate leveling nuts and/or shim packs.
4. Column base plate non-shrink grout.
5. Steel plates, angles, etc. as indicated for the connection of items furnished under other sections.
6. Weathered Steel Bridge Panels

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:

1. Section 051200, STRUCTURAL STEEL FRAMING.
2. Section 057300, METAL FABRICATIONS METAL GRATINGS

B. The Contractor has sole responsibility for site safety. The fabricator and Erector shall review the contract documents and if the structure, as shown on those documents, is in conflict with the requirements of any safety regulations, the Fabricator shall notify the Structural Engineer of Record (SER) before commencing production of shop drawings. If the Fabricator and/or Erector fail to notify the SER, as stated above, they shall become responsible for all costs for correcting such conflicts with the requirements of any and all safety regulations.

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings of work showing size and thickness of each

member, type of material, method of connection and assembly. Show dimensions, clearances, anchorages, relationships to surrounding work, coatings, and other pertinent details of fabrication and installation.

1. Show profiles, reinforcing, fasteners, and any accessories.
2. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

B. Product Data: Provide manufacturer's product data, installation instructions, use limitations, and recommendations for each material used. Provide certifications that materials comply with requirements.

C. Calculations: Where installed metal fabrication work is indicated to comply with certain design loadings, provide professionally prepared calculations, material properties, certification, and other information required for structural analysis of performance of work.

D. Welders Certification: Provide certifications, signed by Contractor, certifying that welders employed at project comply with requirements specified under AWS D1.1 and AWS D1.3.

E. Weathering Steel. Match Landscape Architects desired sample – ASTM A588

1. Shapes, Plates and Bars: ASTM A588 “High-Strength Low-Alloy Structural Steel, up to 345 MPa Minimum Yield Point, with Atmospheric Corrosion Resistance”.
2. Sheet and Strip: ASTM A606 “Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance”.
3. Finishes: Exposed surfaces of components and assemblies shall be weathered to a consistent finish where all surfaces match in extent of color and finish.

1.5 QUALITY ASSURANCE

A. Engineering: Provide services of a professional engineer, registered in the State of Colorado to sign and certify that work of this Section meets or exceeds performance requirements specified. Include design requirements for steel column supports, equipment supports, and all other items indicated.

B. Shop fabricate work to greatest extent possible. Label each piece in shop to facilitate field assembly.

C. Welding: Perform welding in conformance with AWS D1.1, AWS1.2, and AWS D1.3, as applicable.

D. Exterior use and exterior applications, for the purposes of this Section, mean those materials or assemblies used in areas exposed to weather.

E. Pre-Construction Conference for Metal Fabrications: Contractor shall schedule a meeting to be attended by Contractor, Landscape Architect, fabricator, and galvanizer. Agenda shall include the following: Project schedule, scope of services, coordination between fabricator and galvanizer, finish of surfaces, application of coatings, submittals, and approvals.

F. Coordination Between Fabricator and Galvanizer:

1. Prior to fabrication and final submittal of shop drawings to Landscape Architect through the Contractor, direct fabricators to submit shop drawings to the galvanizer for all fabrications.
2. Direct galvanizer to review fabricator's shop drawings for suitability of materials for galvanizing and coatings and coordinate any required modifications to fabrications required to be done by the fabricator.

1.6 PRODUCT HANDLING AND STORAGE

A. Store work off ground and under cover. Protect from damage. Repair and clean work before erection.

1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

B. Do not permit use of ladders, guardrails, and other work until work is completely and fully installed and ready to assume intended design loads. Do not permit overloading of metal fabrication systems.

1.8 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing metal fabrications to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures 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.

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

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from

surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

1. Provide products and materials of new stock, free from defects, and of best commercial quality for each intended purpose.
2. Steel to be weathered steel finish
3. When the steel is to be welded, a welding procedure suitable for the grade of steel and intended use or service is to be utilized. \

B. Steel Plates, Shapes, and Bars: ASTM A 588.

C. Steel Tubing: ASTM A 588, hot or cold rolled, as required for design loading.

D. Steel Pipe: ASTM A 53, schedule 40, Type S (seamless), black except where galvanized is indicated, Grade A for cold-bending.

E. Seamless Steel Pipe: ASTM A106B.

F. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and to comply with performance requirements for structural aluminum; mill finish.

1. Extruded Bars, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).

a. Tubing: Minimum yield strength of 35,000 lbf/sq. in. (241 MPa) and minimum tensile strength of 38,000 lbf/sq. in. (262 MPa).

2. Cast Aluminum: ASTM B 179.

G. Steel Sheet: ASTM A 588, grade required for design loading.

H. Iron Castings: ASTM A 47, or A 48, grade and class are manufacturer's options.

I. Bolts and Fasteners: ASTM A 307 and A 325.

J. Concrete: Concrete fill is specified in Section 03300, CAST-IN-PLACE CONCRETE.

K. Inserts: Threaded or wedge type, galvanized ferrous castings; either ASTM A 47 malleable iron, or ASTM A 27 cast steel.

L. Provide anchors, bolts, sockets, sleeves, and other parts required for securing each item of work to other construction. Furnish inserts and sleeves to be set into concrete formwork and concrete under Section 03300, CAST-IN-PLACE CONCRETE.

1. Anchor bolts, bolts smaller than -- in., and fasteners shall be steel castings conforming to ASTM A 307. Bolts larger than -- in. shall conform to ASTM A 325.

M. Provide exposed fastenings of same material and finish as metal to which applied, unless otherwise noted.

N. Welding Rods: Conform to AWS Standards and recommendations of welding rod manufacturer.

O. Grout for Exterior Applications: Provide Factory-packaged, non-shrink, non-staining, hydraulic controlled expansion cement formulation for mixing with water at project site. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating. Provide Super Por-Rok, Erosion-Resistant Anchoring Cement, manufactured by Minwax Construction Products Division, or equal as approved by Landscape Architect.

Q. Fasteners and Accessories:

1. Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
2. Where fasteners are subject to loosening or turn-out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
3. Reinforce members as required to receive fastener threads.
4. Use exposed fasteners with countersunk Phillips screw heads.
5. Finish exposed portions to match framing system.
6. Use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer at movement joints.

2.2 FABRICATION - GENERAL

A. Fabricate work of this Section to be straight, plumb, level and square, and to sizes, shapes and profiles indicated on approved shop drawings. Ease exposed edges. Cut, reinforce, drill and tap metal work as required for proper assembly.

1. Fabricate miscellaneous supports, brackets, braces and the like required to fully complete the work.
2. Obtain loading requirements from suppliers of work to be supported. Design and support systems with a safety factor of at least 6 unless otherwise indicated.
3. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
   a. Temperature Change (Range): plus or minus 50 degrees F, total range 100 degrees F.
4. Shear and punch metals accurately. Remove burrs.
5. Ease exposed edges to a radius of approximately 1/32 in., unless indicated otherwise. Form bent corners to smallest radius possible without causing grain separation or impairing work.
6. Remove sharp or rough areas on exposed traffic surfaces.
7. Weld seams continuously. Spot welding is permitted for temporary welding only.
8. Weld corners and seams continuously to comply with the following:
   a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   b. Obtain fusion without undercut or overlap.
   c. Remove welding flux immediately.

d. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
e. All light pipe and guardrail splicing: weld pipes end to end and grind smooth, no double vertical and no sleeves.

B. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

C. Provide for anchorage of type shown; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support required loads.

D. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

E. Cut, reinforce, drill, and tap metal fabrications as shown to receive finish hardware, screws, and similar items.

F. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

G. Galvanizing: Hot-dip galvanize exterior metal fabrications, items located in exterior wall assemblies, on roof, and other items shown to be galvanized. Comply with galvanizing requirements of this Section.

1. Hot-dip galvanize exterior metal fabrications, items located in exterior wall assemblies, and other items indicated to be galvanized, in compliance with ASTM A 123, ASTM A 153, or ASTM A 386.
2. Provide minimum 1.5 oz./ft.^{2} zinc coating. Galvanize after fabrication.

H. Work Exposed to View: For work exposed to view, select materials with special care. Provide materials which are smooth and free of blemishes such as pits, roller marks, trade names, scale and roughness. Fabricate work with uniform hairline joints. Form welded joints and seams continuously. Grind welds flush to be smooth after painting. For exposed fasteners, use hex head bolts or Phillips head machine screws.

I. Aluminum Framed Guardrail System: Fabricate welded aluminum-framed guardrail conforming to size and arrangements shown and required. Comply with Wisconsin Building Code, except where more stringent requirements are specified. Provide for removable sections. Conform to approved shop drawings of system.

J. Miscellaneous Framing and Supports: Fabricate miscellaneous framing and supports to adequately support live and dead loads with a safety factor of 5. Provide necessary anchors, inserts, and fasteners. Fabricate support system to carry entire load of work being supported to structure above. Do not transfer any loads to ceiling systems.

1. Cut, drill, and tap units to receive hardware, hangers and similar items.

2. Coordinate loading and attachment requirements for miscellaneous framing and supports with manufacturers of items being supported.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorage devices, setting drawings, diagrams, templates, instructions, and directions for installation of concrete inserts, sleeves, anchor bolts, and miscellaneous items to be embedded or attached to concrete work, masonry work, or structural steel work.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners necessary for securing work of this Section to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors required.

1. Number and sizes of washers at each bolted connection appearing in the finished work shall be subject to review and approval by Landscape Architect.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of work of this Section.

E. Erect work square, plumb and true, accurately fitted, and with tight joints and intersections. All anchors, inserts and other members to be set in concrete or masonry shall be furnished loose by this trade to be built-into concrete and masonry by those trades. Avoid field cutting or drilling to greatest extent possible.

F. Brace work rigid and secure to surrounding construction. Provide temporary bracing or anchors where required.

G. Fit exposed connections accurately together to form hairline joints. Shop weld connections, except when work cannot be shop welded due to shipping size or galvanizing limitations.

H. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
5. Needle gun surfaces of welded connections which will be painted to restore surface profile.

I. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

J. Field Welding: Comply with AWS D1.1, AWS D1.2, and AWS D1.3 for procedures of manual metal-arc welding, appearance and quality of welds, and correction methods for defective welds.

K. Where members other than expansion bolts or inserts are fastened into concrete, set such members in proprietary-type expanding grout manufactured specifically for such purpose. Use grouts strictly in accordance with manufacturer's directions. Form to receive members with galvanized metal sleeves, or other approved method to provide at least 1/2 in. clearance around entire perimeter. At exposed applications, hold expanding grout back 1/2 in. from finish surface and fill voids with Portland cement grout to match color and texture of surrounding concrete surface.

L. Electrolytic Isolation: Where dissimilar metals are to come into contact with one another, isolate by application of a heavy coating of bituminous paint on contact surfaces in addition

to shop coat specified above. Do not permit the bituminous paint in any way to remain on surfaces to be exposed or to receive sealant.

3.3 INSTALLATION

A. Guardrails: Install guardrail systems as indicated on approved shop drawings. Adjust handrails and guardrails prior to final anchoring and grouting. Plumb posts and mesh infill panels in all directions. or as required to support specified loads. Provide for full coverage as indicated with mesh securely stretched and positioned as detailed. Mesh infill shall be plumb and level and free from distortion or creases, wrinkles, and other flaws. Completed installation shall be taut and secure.

1. Align and adjust various members forming a part of a complete structure before permanently fastening. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
2. Install to comply with ASTM F 567 and more stringent requirements specified.
3. Mesh Fabric: Apply fabric to enclosing framework.

B. Miscellaneous Items: Carefully review Drawings for miscellaneous metal items required by various trades but not specifically listed above, such as miscellaneous clip angles, miscellaneous steel bracketing, bracing, supports, and other miscellaneous metal items as indicated on Drawings, reasonably implied there from, or reasonably necessary for thorough completion of work.

3.4 REPAIRING, CLEANING, AND PROTECTION

A. Touch-Up and Repair: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.

1. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780. Galvanizing repair paint shall have 65 percent zinc by weight, ZiRP by Duncan Galvanizing, Tnemec 90-97 Zinc-Rich Primer, or approved equal. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or ASTM A 153, as applicable. Touch-up of galvanized surfaces with aerosol spray, silver paint, bright paint, or aluminum paints shall not be acceptable.

2. At factory-primed surfaces, touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from a distance of 2 ft.

END OF SECTION 05 50 00

SECTION 05 52 00 – DECORATIVE METAL RAILINGS

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. Section Includes:

1. Stainless-steel decorative railings.

B. Related Sections:

1. Section 01420 – Mock-Ups

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at walls either end of the bridge and or stair.

1.4 PERFORMANCE REQUIREMENTS

A. 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 ACTION SUBMITTALS

A. Product Data: For the following:

1. HSS tubes as shown on the drawings.

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

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

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. Welded connections.
3. Brazed connections.

1.6 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

B. Welding certificates.

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

D. Preconstruction test reports.

1.7 QUALITY ASSURANCE

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

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.

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

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

1. AWS D1.6, "Structural Welding Code - Stainless Steel."

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 mockups as shown on Drawings.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of railings with precaster. Furnish setting drawings, templates, and

directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to precaster in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Stainless-Steel Decorative Railings:

a. Architectural Metal Works.
b. Architectural Railings & Grilles, Inc.
c. Atlantis Rail Systems; Division of Suncor Stainless.
d. Blum, Julius & Co., Inc.
e. Blumcraft of Pittsburgh.
f. CraneVeyor Corp.
g. Livers Bronze Co.
h. Newman Brothers, Inc.
i. P & P Artec.
j. Pisor Industries, Inc.
k. Platers Polishing Company; a division of Rippel Architectural Metals.
l. Tri Tech, Inc.
m. Wagner, R & B, Inc.; a division of the Wagner Companies.
n. Wylie Systems.

2.2 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.

2.3 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 316L.

B. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 316L.

C. Bars and Shapes: ASTM A 276, Type 316L.

2.4 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Stainless-Steel Components: Type 316 stainless-steel fasteners.

2.5 MISCELLANEOUS MATERIALS

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

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

C. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

   1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

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.

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 connections that will be exposed to weather in a manner to exclude water. Provide

weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

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

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

I. Form changes in direction as follows:

1. As detailed, or
2. By bending to smallest radius that will not result in distortion of railing member.

J. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

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

L. Provide inserts and other anchorage devices for connecting railings to concrete. Coordinate anchorage devices with supporting structure.

2.7 GENERAL FINISH REQUIREMENTS

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.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.

2.8 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. Dull Satin Finish: No. 6.

E. Satin, Reflective, Directional Polish: No. 7.

F. Mirrorlike Reflective, Nondirectional Polish: No. 8.

G. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

H. Sputter-Coated Finish: Titanium nitride coating deposited by magnetic sputter-coating process over indicated mechanical finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

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. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
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 (5 mm in 3 m).

C. Adjust railings before casting into concrete to ensure matching alignment at abutting joints.

3.3 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.

3.4 CLEANING

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

3.5 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 the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 00

SECTION 05 53 00 – METAL FABRICATIONS - METAL GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Prefabricated heavy duty ADA compliant steel bar gratings.

B. Prefabricated Support Frames for gratings.

C. Miscellaneous installation hardware and accessories.

1.2 REFERENCES

A. ASTM A-240 Hot-Rolled Stainless Steel

B. ASTM A-304 Strip Hot-Rolled Stainless Steel

C. ASTM A-554 Stainless Steel Mechanical Tubing

D. ASTM A-276 Frame Slide and Reinforcing Stainless Steel

E. ANSI/NAAMM- MBG-532-09 Heavy Duty Metal Bar Grating Manual

F. US Dept of Justice Americans with Disabilities Act- 2010 Design Standards Section 302 for bar spacing and slip resistance. http://www.ada.gov/2010ADAstandards_index.htm

1.3 ACTION SUBMITTALS

A. Product Data: The contractor shall submit the manufacturer's catalog pages including load tables, anchor details and standard installation details.

B. Shop drawings: The contractor shall submit for approval shop drawings for the fabrication and erection of all gratings, based on construction drawings of current issue. Include plans, elevations, and details of sections and connections as required. Show type and location of all fasteners.

C. Samples of Grating and Anchorage system shall be submitted for approval.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualification: A company specializing in the manufacture of metal bar gratings with not less than 10 years of documented experience.

a. Castings will be squared and flat, free of burrs, slag, air pockets, blow holes, flashing and grinding or welding on exposed surfaces. Excessive warping or shrinkage is not acceptable.
b. All visible welds on installation frames to be ground smooth. Frames will be true to specified diameter.
c. Installer qualifications: 2 years minimum experience installing tree grates and support frames.

B. Fabrication tolerances shall be in accordance with applicable provisions and recommendations of ANSI/NAAMM 532-09 Metal Bar Grating Manual.

PART 2 PRODUCTS

2.1 SOURCE REQUIREMENTS:

Design is based upon use of gratings as manufactured by Ohio Gratings Inc. and terminology used herein may include reference to the specific performance or product of this manufacturer. Such reference shall be construed only as establishing the quality of materials, operational features and workmanship to be used under this Section and shall not, in any way, be construed as limiting competition.

2.2 MANUFACTURER

Acceptable Manufacturers include Ohio Gratings Inc. 5299 Southway St. SW, Canton, Ohio 44706, 800-321-9800 www.ohiogratings.com, or approved equal.

Urban Accessories, Inc. 4465 East Fifteenth Street, Tacoma, WA 98421 – PH: (253) 572-1112 or sales@urbanaccessories.com. Jamison

2.3 MANUFACTURED UNITS

A. Description: Grating:
B. Type 7-SGSS-4 3/16” Wheels n’ Heels® InVent Heavy Duty Weathered Steel Grating with ALGrip Surface and Mill finish. Fabricated by assembling tubular steel cross bars through round holes in 3/16” thick rectangular top surface bars space 7/16” on center and 3/16” thick rectangular top surface bars space 3-15/16” on center that are then permanently locked in place by swaging. Heavy duty main bearing bars are 4” on center inserted beneath and perpendicular to the top surface bars then fillet welded at each main bearing bar / heavy cross bar intersection.
1. Top surface bar Spacing: 7/16” on center.
2. Top surface bar depth is 1” and thickness is 3/16” to provide 1/4” space between bars.
3. Main Bearing Bars ¼” thick spaced 4” on center and their depth is to be based on loading requirements and the clear span shown on the drawings. Main bearing bars are perpendicular to top surface bars.
4. Heavy Duty Cross Bars 1-1/2” x 3/16” are flush with top surface and spaced 3-15/16” on center.

5. All Top Surface and Heavy Duty Cross bars shall have ALGrip Slip Resistant surface.
6. Finish: Weathered Steel or Raw Natural Finish
7. Or approved equal

C. "Jamison" Frame by Urban Accessories, material shall be high quality, 100% recycled, cast grey iron, per ASTM A48 class 35b or better; hardness 170-223 brinnell. Finish shall be Raw Natural Finish, or approved equal.

D. Fabrication: Load Band ends of grating with bars 3/16" thick welded flush with the top surface of the grating and ½" less than the overall depth of the grating as shown on the drawings. Include welded anchor blocks flush with the top surface with counter sunk hole to accept washer and attachment bolts.

E. Weathered Steel Frames: Weathered Steel ASTM A588 frames shall be provided as shown on the contract drawings to support and attach the gratings. Include anchors as shown for locking frame into concrete as shown on the plans.

F. Grout / Epoxy: Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. [Compressive strength per ASTM C 109: 8000 psi.]

G. Design Criteria:
   1. Loading: Unless shown otherwise on the contract drawings, gratings shall be designed and manufactured to meet the live load conditions of AASHTO HS 20 with 30% impact factor. Main Bearing bar depth shall be as shown on the contract drawings or as recommended by the manufacturer to meet the loading requirements, and clear span conditions.

   2. Slip Resistance: Walking Surfaces shall have a minimum slip resistant coefficient of friction (COF) of 0.8 to meet Americans with Disabilities Act (ADA) guidelines for Slip Resistance.

H. Materials: Main Bearing bars are Carbon Steel type ASTM A-572 grade 50. Banding bars, top surface bars and heavy duty cross bars are Carbon Steel ASTM A-1011 CS Type B. Steel Tube Cross Bars are type ASTM A-513. Frames are carbon steel type ASTM –A36.

I. Fabrication Tolerances shall be in accordance with ANSI/NAAMM MBG 532-09 Metal Bar Grating Manual.

J. Finish: Gratings shall be sand blasted and passivated per ASTM A123.

2.03 ACCESSORIES

Provide appropriate fasteners for type, grade, and class required for the approved anchorage system. Include lifting devices as shown on the drawings.

PART 3 EXECUTION

3.1 FIELD VERIFICATION

Contractor is to provide field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the work.

3.2 INSTALLATION

A. Prior to grating installation, contractor shall inspect supports for correct alignment and conditions for proper attachment and support of the gratings. Any inconsistencies between contract drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the Engineer, Architect or owner's agent prior to placement.

B. Install grating in accordance with shop drawings and standard installation clearances as recommended by ANSI/NAAMM MBG-532-09 Metal Bar Grating Manual.

3.02 GRATING ATTACHMENT

Use approved attachment system and fasteners to secure grating to supporting members as shown on plans.

END OF SECTION 05 53 00

SECTION 06 05 00 – SALVAGED WOOD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

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

1.02 SUMMARY

A. Work of this Section consists of selective salvaging of wood from felled trees on the site and reuse of the wood as shown and specified by Contract Documents, including, but not limited to:
   1. Salvaged Seating Terrace Logs
   2. Salvaged Wood Benches
   3. Salvaged Vertical Posts
   4. Cord Wood Seatwall
   5. Cord Wood Posts at 11th Street Spine

B. Related Sections include the following:

   1. Division 03 Section 03 30 00 Cast-In-Place Concrete
   2. Division 31 Section 31 13 00 Selective Tree and Shrub Removal and Trimming
   3. Division 05 Section 05 50 00 Metal Fabrications

1.03 REFERENCES

A. US Green Building Council.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

C. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials

D. UL 723 - Test for Surface Burning Characteristics of Building Materials.

E. Forest Stewardship Council - FSC Certified

F. ASTM A1008 - A 366 Cold Rolled Steel

G. ASTM A 606 - Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

1.04 SUBMITTALS

A. General: Refer to and comply with Division 1 Section 00 70 00 General Conditions, for procedures and other submittal criteria.

B. Qualification Data: For firms and persons specified in Article "Quality Assurance" herein and as specified in Division 1 Section 01400 "Quality Requirements" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

C. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials.
   1. Timber Preservative Inspection: Submit the inspection report of an independent inspection agency that offered timber products requiring preservative treatment comply with applicable AWPA Standards. Identify treatment on each piece by the quality mark of an agency accredited by the Board of Review of the American Lumber Standard Committee.

D. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Sealant: "Anchorseal" clear wax sealer, an aqueous wax sealer, as supplied by V-C Coatings, Buffalo, NY, (888-363-2628)

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) diameter, representing actual salvaged species used.

F. Mortar Color Sample Chart

G. Shop Drawings: Shop Drawings shall show all details including sizes, materials, quantities and methods of assembling and fastening of the various members, properly coordinated with the related work. Submit manufacturing/fabrication and installation details. Include plans, elevations, and sections to show the following as a minimum:
   1. Salvaged Wood benches:
      a. Details shall show all reinforcing, fastenings and attachments to other work. .
   2. Salvaged Seating terrace logs
      a. Details shall show all reinforcing, fastenings and attachments to other work.
   3. Salvaged Vertical Posts
      a. Details shall show all reinforcing, fastenings and attachments to other work.
   4. Cord Wood Seatwall
      a. Details shall show all reinforcing, fastenings and attachments to other work.
   5. Cord Wood Post at 11th Street Spine
      a. Details shall show all reinforcing, fastenings and attachments to other work.

H. Mock Ups of Cord Wood Seatwall: Upon approval of all materials, the Contractor shall construct sample wall on site in the minimum size indicated below. Each sample wall shall be large enough to display typical characteristics of each item and type of work. Construct sample wall concurrently to aid in review of all materials. The Landscape

Architect must approve the visual characteristics, quality of workmanship, and an installation method before final work is started. If the original sample is not approved, the Contractor shall provide additional samples, as required, at no cost to the Owner until an approved sample is obtained. The approved sample shall become the standard for the entire job. Sample wall 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. Contractor shall completely remove any wall elements not set in place as part of the final work from site upon final acceptance of work.

1. Cord Wood Seat wall: 6’ x 2’ minimum. Landscape Architect to determine portion of wall to sample. Refer to Drawings for types.

I. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic retreatment of water repellant and fire retardant

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store and stockpile all salvaged wood logs from felled trees on site until ready for installation.

1. Wood shall be stripped and peeled of all mark. Sand and smooth and significant splinters.
2. Wood shall be stored outside in a clean and dry area elevated from contact with the ground for a minimum drying period of 9 months or till reaching specified moisture content. Protect from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.
3. Stockpile wood organized by species and diameter log size. Refer to Drawings for size ranges.

1.06 PROJECT CONDITIONS

A. Measurements: Verify seatwall, post and log dimension by measurements before tree removal, final cutting and fabrication, and indicate measurements on Shop Drawings.

B. Coordinate wood cuts to final length before air drying period.

C. Coordinate drying period and fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide all materials, equipment and supplies as required to completely perform the work specified herein and as shown on the Drawings.

2.02 RECLAIMED WOOD

A. General:

1. Source: Reclaimed wood from select tree removal on site. Strip and peel all bark, sand and smooth surface to avoid significant splinters.
2. Species: Varies between Silver Maple, Cottonwood, and Green Ash.
3. Density: No limitation on Grain Density.
4. Hardness: Medium – soft, typical with Species.
5. Grain: Unlimited mixture of grain patterns.
6. Color: As found surfaces ranges from silver-grey to light and dark browns with sometimes dark grey with blacks mixed in. All colors are from natural aging with no chemicals or paints having ever been on wood.
7. Knots: Unlimited sound tight knots allowed, with some surface unevenness from chipped or open knots.
8. Texture: Face of material will have varying textures from weathered rough sawn to heavy weathering on rough sawn. All products can be ripped edged, milled for installation purpose and will show "bright wood on those milled.
9. Checks: Checks allowed as long as log will install for purpose intended.
10. Moisture Content: Moisture content is between 15 to 25 percent, naturally air dried.

2.03 SALVAGED SEATING TERRACE LOGS

A. Shall be air dried salvaged wood from a mix of Cottonwood, Willow and Green Ash.

B. Lengths of Various dimensions as shown on drawings.

C. Diameter widths between 12 and 36 inches

D. Bark shall be peeled from log and free of any bark.

E. Wood logs shall be smooth and free of branches, stem protrusions and splinters.

F. Maintenance of the erosion and sedimentation control devices shall be the responsibility of the Contractor.

G. Fasteners and Anchors
1. General: Of size and type to suit application and as shown on drawings; stainless steel.

H. Sealant: “Anchorseal” clear wax sealer, an aqueous wax sealer, as supplied by V-C Costings, Buffalo, NY (888-363-2628) or approved equal to be applied to all end grain of wood.

2.04 SALVAGED WOOD BENCHES

A. Shall be air dried salvaged wood from Silver Maples.

B. Lengths of +/-4 feet, 6 feet and 8 feet.

C. Diameter widths between 12” and 24”

D. Bark shall be peeled from log and free of any bark.

E. Wood logs shall be smooth and free of branches, stem protrusions and splinters.

F. Fasteners and Anchors
   1. General: Of size and type to suit application and as shown on drawings; stainless steel.

G. Sealant: “Anchorseal” clear wax sealer, an aqueous wax sealer, as supplied by V-C Costings, Buffalo, NY (888-363-2628) or approved equal to be applied to all end grain of wood.

2.05 SALVAGED VERTICAL POSTS

A. Shall be air dried salvaged wood from a mix of Cottonwood, Willow and Green Ash.

B. Lengths between 4-6 feet.

C. Diameter widths between 6 and 8 inches

D. Bark shall be peeled from log and free of any bark.

E. Wood logs shall be smooth and free of branches, stem protrusions and splinters.

F. Fasteners and Anchors
   1. General: Of size and type to suit application and as shown on drawings; stainless steel.

G. Sealant: “Anchorseal” clear wax sealer, an aqueous wax sealer, as supplied by V-C Costings, Buffalo, NY (888-363-2628) or approved equal to be applied to all end grain of wood.

2.06 CORD WOOD SEATWALL

A. Wood
   1. Shall be air dried salvaged wood from a mix of Cottonwood and Green Ash
   2. Cord wood lengths shall be 2 feet, reference drawing
   3. Diameter widths range between 10 inch max and 1.5 inch minimum
   4. Bark shall be peeled from log and free of any bark.
   5. Wood logs shall be smooth and free of branches, stem protrusions and splinters.

B. Mortar
   1. Mortar shall be Portland Cement Mortar mix with a Cement Retarder:
      a. Plastiment by Sika Corporation or
      b. Daratard-17 by WR Grace
   2. Mortar mix shall be 10 parts Sand, 3 parts lime (hydrated builders lime) and 2 parts Portland Cement
   3. Bonding Agent
      a. Acryl 60 or
      b. DAP Bonding Liquid
   4. Mortar Color: TBD

C. Silicone Sealer
   1. Cabot Waterproofing Silicone Sealer for end grain.

D. Steel Frame

1. General: Provide weathered steel frame, bases and straps of structural capacity, type, and size indicated on the Contract Drawings and as follows:

    a. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
2. Weathered Steel: Steel sheet complying with ASTM A 653/A653M, G60 (Z180) coating designation and comply with additional fabrication requirements of Division 5 Section 05500 “Metal Fabrications”.
3. Anchor into concrete shall be stainless steel adhesive anchor bolts. Clearly identify type and location on shop drawings submitted.

2.07 METAL ANCHOR COMPONENTS

A. General: Provide hot-dip galvanized steel framing anchors, bases and straps of structural capacity, type, and size indicated on the Contract Drawings and as follows:
1. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc coated steel sheet complying with ASTM A 653/A653M, G60 (Z180) coating designation and comply with additional fabrication requirements of Division 5 Section 05500 “Metal Fabrications”.

C. Anchor into concrete shall be stainless steel adhesive anchor bolts. Clearly identify type and location on shop drawings submitted.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examination: Examine conditions of work in place before beginning work; report defects.

B. Measurements: Take field measurements; report variance between Contract Drawings and field dimensions.

C. Coordination: Relate to and arrange wood benches and wall together with other trade work.

3.02 INSTALLATION, GENERAL

A. Cut, peel bard, stockpile and dry wood prior to proceeding with installation.

B. Prepare wood surfaces using a 4500 RPM Circular sander clearing wood of any bark remnants, rough surfaces and splinters.

C. Cord Wood Seat wall
1. Dip wood log ends in Silicone Sealer
2. Dry mortar mix 10 parts sand, 3 parts lime (Hydrated Builders' Lime) and 2 parts Portland cement.
3. Mix it in the cadence 3-1-1, 4-1-1, 3-1-0. Mix it in a wheelbarrow with a spade, then create a crater and mix in water. Mortar mix shall be stiff and stone-like, not goopy.
4. Add 3 oz of cement retarder with water.
5. Place logs with 1" joint minimum between log ends
6. Turn any checks in the logs facing down
7. Logs shall have a 1/4 inch reveal and no more than 1/2 inch
8. After rough mortar set, use a bent, un-serrated butter knife to smooth mortar and push mortar up tight to wood rounds.
9. Install steel frame, connectors, anchors and accessories as indicated on the approved Shop Drawings
10. Install wood slats with galvanized steel screws, predrilled to prevent splitting.

D. Other Salvaged wood
1. Apply wax sealer to end grain
2. Install connectors, anchors, and accessories as indicated on the approved Shop Drawings,

E. Boring Holes:
1. Bore holes for drift pins and dowels with a bit 1/16 inch less in diameter than the pin or dowel.
2. Bore holes for bolts with a bit 1/16 inch larger in diameter than rod or bolt.
3. Bore holes for lag screws in two parts. Make lead hole for shank the same diameter as shank. Make lead hole for the threaded portion approximately two thirds of the shank diameter.
4. Bore holes in small timbers for boat or wire spikes with a bit of the same diameter or smallest dimension of the spike to prevent splitting.
5. Counterbore for countersinking wherever smooth faces are indicated or specified.

3.03 ADJUSTING

A. Repair damaged surfaces after completing erection. Replace damaged decking if repairs are not approved by the Landscape Architect.

END OF SECTION 06 05 00

SECTION 22 05 00 – COMMON WORK RESULTS FOR PLUMBING

1.01 WORK INCLUDED

A. The work included by this division of the specifications includes furnishing all labor, materials, equipment, and services, including minor items omitted but necessary to construct and install the complete systems described by the Contract Documents and specified below. "Contractor" refers to the Mechanical Contractor. The general conditions of the specifications apply and are included in this part of this section.

1. Domestic cold water systems

1.02 CODES AND REGULATIONS

A. Comply with state and local codes, and utility company regulations. Final interpretations will be made by the local inspection authority. The Contractor to verify the governance of the following Codes, including any local amendments and supplementary codes such as the Codes of the National Fire Protection Association:

1.	Building Code:	2012 International Building Code
2.	Plumbing Code:	2012 International Plumbing Code
3.	Mechanical Code:	2012 International Mechanical Code
4.	Fire Code:	2012 International Fire Code
5.	Gas Code:	2012 International Fuel Gas Code
6.	Energy Code:	2012 International Energy Code
7.	Electrical Code	2014 National Electrical Code

1.03 EQUIPMENT AND MATERIALS STANDARDS

A. Equipment and materials shall be new, UL-listed for the use intended, and free from damage or defect. They shall comply with the latest industry standards.

1.04 CONTRACT DRAWINGS

A. Illustrate the general design and extent of performance required. All dimensions and locations shall be taken from the Architectural drawings. Consult with Architectural plans and locate all ceiling equipment where indicated on reflected ceiling plans

1.05 SHOP DRAWINGS

A. Submit products data and/or shop drawings as required by the Architect for the following:

1. Insulation
2. Valves
3. Plumbing fixtures and appurtenances.

B. Quality of specific equipment is established by manufacturer's catalog number. Alterations caused by any Substitution shall be accomplished at no additional expense to the Owner.

C. Manufacturers not listed may submit for acceptance as an "approved equivalent." Requests for an "equivalent" means "approved equivalent". Four copies of such submittal must be received by the Engineer seven (7) working days prior to bid date.

1.06 WARRANTY

A. The Contractor shall be responsible for the successful operation of mechanical systems, equipment, and materials installed under this Contract for a period of one year from the date of final acceptance. Defective equipment or materials shall be repaired or replaced at no expense to the Owner. Provide four complete service and maintenance calls spaced at equal intervals during the warranty period.

1.07 PRODUCT HANDLING AND CLEAN UP

A. Equipment shall be left clean and undamaged, to the satisfaction of the Owner. The General Conditions take precedence.

1.08 CUTTING AND REPAIRING

A. The contractor shall be responsible for all cutting, drilling, welding, and repair required for his portion of the work. Coordinate with the Architect. The General Conditions take precedence.

1.09 OPERATING AND MAINTENANCE DATA

A. Provide the Owner with operating and maintenance instructions (four copies) required for operation of all mechanical systems. Bind the written instructions in a notebook. The General Conditions take precedence. The manuals shall include the following items:

1. Operating manual and spare parts list for each piece of equipment.
2. Preventive maintenance schedule for lubricating and checking each piece of equipment.
3. Instructions on who to call for service during the warranty period.

1.10 PERMITS

A. The contractor shall pay for all fees, taxes, secure permits, licenses, and inspections required for the project.

1.11 TEMPORARY SERVICES

A. Provide temporary water service for construction, as required by the General Contractor.

1.12 COORDINATION

A. Coordinate outlet device and equipment locations with the Architectural Plans and work of other trades. Locate on horizontal and vertical lines to avoid interference and to provide functional use of all equipment. Verify electrical power characteristics before ordering equipment.

B. Electrical work performed by this contractor will conform to the standards of Division 26-28. Mechanical equipment motors and controls shall be furnished, set in place, and wired according with the following schedule unless otherwise noted or specified. MC = Division 21-23 EC = Division 26-28

Item	Furn By	Set By	Power Wiring	Control Wiring
Combination starters	MC	EC	EC	MC
Equipment motors	MC	MC	EC	--
Motor starters & O.L. relays	MC	EC	EC	MC
Disconnect switches	EC	EC	EC	MC
Thermal overload heaters (1)	EC	EC	EC	--
Variable Speed Drives	MC	EC	EC	MC
Control relays/transformers	MC	MC	EC	MC
Temperature control panels	MC	MC	EC	MC
Temp. Controls conduit/wiring	MC	MC	--	MC
Actuator and solenoid wiring	MC	MC	--	MC
Pushbuttons & pilot lights	MC	MC	--	MC
Room thermostats	MC	MC	--	MC
Thermostats: line voltage	EC	EC	EC	--

C. The general guideline for the division between control (by MC) wiring and power wiring (by EC) is that power wiring carries the current which energizes a motor, control wiring does not. Control wiring may be 120V, which would be the responsibility of the MC. Control motors are wired by the MC.

D. Examine the site and become aware of existing conditions, utilities, and other issues affecting the satisfactory completion of the project.

1.13 DELIVERY, STORAGE, HANDLING

A. Provide necessary hauling and hoisting equipment. Protect the materials of this Division before, during, and after installation.

1.14 AS-BUILT DRAWINGS

A. Keep a current set of "as-built" drawings on site. Upon completion of the work, furnish engineer with a reproducible prints showing the "as-built" installation.

1.15 PROJECT/SITE CONDITIONS

A. Visit the site to become familiar with location and the various conditions affecting the work, including existing utilities.

1.16 PLAN VERIFICATION

A. After completion of the bidding and selection process, prior to awarding the contract, the contractor must review and verify the contract documents in their entirety, including those of other trades. At this time, discrepancies, conflicts, omissions, etc in the contract documents must be documented. Alterations to the contract will be made at that time to include such items, as well other modifications which might be made by the Owner. After award of the contract, change orders caused by discrepancies, conflicts, omissions in the contract documents will not be allowed.

1.17 EXPANSION JOINTS, GUIDES, AND ANCHORS

A. Provide expansion joints or loops, guides, and anchors in piping to allow for expansion and contractions. Expansion joints shall be bellows type.

1.18 VALVES

A. Gate valves 2" and smaller shall be cast bronze, rising stem, solid disc, 200 PSI WOG
B. Ball valves 2" and smaller shall be cast bronze, full port, stainless steel ball, teflon sets, 400 PSI WOG.
C. Butterfly valves 2" and smaller shall be cast bronze, stainless steel disc, surrounding fluorelastomer seal, 350 PSI WOG.
D. Check valves shall be horizontal, swing-cast bronze, bronze disc, 200 PSI WOG.
E. Valves shall be domestically manufactured by Milwaukee, Powell, Nibco, or equivalent.

1.19 RELIEF VALVES

A. Relief valves shall be all-bronze A.S.M.E. rated valves with external test levers, sized in accordance with the instructions of the appropriate manufacturer. Pipe discharge outside or to floor drain where possible and per code. Valves shall be manufactured by Watts or equivalent.

1.20 FLEXIBLE CONNECTORS

A. Connectors in piping shall be made with molded teflon or neoprene and nylon bellows, metal reinforcing rings, flanged ends and control rods, suitable for 40F to 200F temperature range and 125 lbs. pressure. Alternative shall be stainless steel inner hose with braided exterior sleeve for steel pipe or bronze inner hose with braided exterior sleeve for copper piping. Metra-flex Company, or equivalent.

1.21 SPECIALTIES

A. P/T Plugs: 1/4" diameter, brass with Nordel core, Sisco or equivalent.
B. Pressure Gauges: 4 1/2" dial type, aluminum housing. Ashcroft 1010 or equivalent.
C. Thermometers: 7" red reading mercury type. Palmer Instruments or equivalent.

1.22 ELECTRICAL

A. Lugs: Lugs for wiring connections shall be rated for copper and aluminum, nad shall have a minimum rating of 75C.

B. Electric motors shall be rated for the appropriate application: wet location (TEFC); submersible; explosion proof, VFD's, etc.

1.23 ACCESS PANELS

A. The Mechanical Contractor shall furnish and install access panels where required for access to equipment. Access panels shall be adequately sized, of a type approved by the Architect and shall be fire or smoke-rated as required.

1.24 EXCAVATION AND BACKFILLING

A. Provide excavating and backfilling for Mechanical Work. Backfill in 12" layers, mechanically tamp to 95% proctor standards. Protect according to OSHA standards. The General Conditions take precedence. Verify the location of underground utilities before excavation; the contractor is responsible for any damage to underground utilities. Restore existing paving, curbs, sod, bushes, etc to match surroundings.

1.25 START-UP PROCEDURES

A. Follow manufacturer's recommended procedures in starting up the equipment; damage caused during start-up shall be replaced at no expense to the owner.

1.26 PIPING INSTALLATION

A. Install piping plumb and straight, parallel with walls and partitions. Conceal piping within structure whenever practical. Provide drain valves at all low points, vents at all high points, to allow complete drainage.

B. Material and methods per ASME, ASTM, ASA, AWS, and National Plumbing Code Handbook

C. Provide unions or flanges in piping connections to each valve, device, or item of equipment. Install each union or flange to permit the removal of parts and equipment for inspection or cleaning, without disconnecting any piping, except unions or flanges.

D. Piping on the roof will be supported above the roof on roof pads. The pads shall be approximately 6"Wide by 6" high by the length as required. They shall be made of recycled rubber, rated for 500lbs/ft loading each. The pads will have galvanized steel "C" channel attached to the top, which can accommodate pipe clamps to secure the piping. This configuration of individual piping pads may be expanded to include two pads supporting a trapeze style support where multiple pipes are racked together. The pads are C-series manufactured by Cooper B-line, Erico, or approved equivalent.

1.27 HANGERS AND SUPPORTS

A. Support piping and equipment from the structure to prevent sagging, pocketing, swaying, and vibrations, and arranged to provide for expansion and contraction. Brackets, clamps, and hangers shall be steel, except copper hangers will be used with copper piping. Hangers supporting vibrating equipment shall be provided with spring isolators. Chain, perforated iron or wire hangers are not permitted. Hangers will be of a type acceptable to the Engineer, and shall have a capacity and spacing as required by code.

1.28 SLEEVES AND PLATES

A. Provide sleeves and inserts for all mechanical piping. The contractor shall be responsible for the cost of cutting and patching required for piping where sleeves and inserts were not installed or where incorrectly located. Sheetrock joint compound may be used to seal openings in non-rated walls(insulation to be continuous through walls.

B. Drill holes as required for the installation of hangers required for the mechanical work.

C. Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be made completely water-tight.

D. Seal all piping passing through fire-rated construction with approved material to maintain air-tight, fire-rated integrity, with a U.L. listed assembly compatible with the wall or floor assembly being penetrated.

1.29 PIPING TESTING

A. All piping systems shall be tested and witnessed by the Owner prior to concealment. Protect equipment and fixtures or equipment, isolating them during the test. DWV system shall be sealed and hold water without leaks for 24 hours. Domestic water and hydronic piping shall be air tested at 150 PSIG; natural gas piping shall be air tested at 30 PSIG. Air tests shall be held for one hour without loss of pressure.

1.30 CLEANING AND STERILIZATION

A. After testing, water piping systems shall be filled, operated for a sufficient length of time to completely remove all foreign material, and flushed.

B. Sterilize the domestic hot and cold water piping in accordance with the local health authority standards. Flush the systems with clear water until the residual chlorine content is equal to that of clear water.

C. Where there is no water treatment contractor sterilize piping system with chlorine for 24 hours to 50 PPM. Completely flush to less than 1 PPM. Local health authority standards take precedence.

1.31 FLEXIBLE PIPE CONNECTIONS

A. Provide flexible pipe connection suitable to connect to adjoining piping as specified for pipe joints. Use sized pipe units. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation.

1.32 PIPE IDENTIFICATION

A. After completion of the piping or insulation, paint stenciled descriptive abbreviations, including directional arrows, on piping at equipment and approximately every 25'.

END OF SECTION 22 05 00

SECTION 22 10 00 – PLUMBING PIPING

1.01 WATER SERVICE

A. Connect to existing cold water service per plans.

1.02 DOMESTIC WATER SYSTEM PIPING

A. Domestic cold, hot, and recirculating hot water piping may be either copper or HDPE, as noted below:
   1. Copper piping:
      a. Above grade, piping shall be Type L, hard-drawn copper tubing with wrought copper fittings. Solder shall be lead-free.
      b. Below grade, piping shall be Type K, soft-drawn copper tubing with fittings only where specifically allowed by the architect. Where required, the fittings will be wrought copper. Solder shall be 95/5 tin/antimony, except underground, where it will be silver solder.
   2. HDPE Tubing:
      a. Tubing shall be PE3408/PE3608 High Density Polyethylene with a cell classification of 345464C/E. Tubing shall meet AWWA C906 and NSF 61 standards for potable water. The tubing shall be rated for 110 PSI at 200F, and shall be manufactured according to ASTM F 714.
      b. All joints shall be butt-fusion welded per manufacturer's specific instructions, no fittings are allowed below grade.
      c. Stub outs to be copper with brass shutoff valves. Stub outs to be properly secured to wall.
      d. Tubing in return air plenums, or other areas designed as air handling plenums, shall be installed to a flame rating of 25/50 according to ASTM E84, whether by spacing, insulation or other approved method.
      e. Tubing shall be as manufactured by JM Eagle or equivalent.

1.03 PLUMBING FIXTURES AND TRIM

A. Provide plumbing fixtures as specified on the plans. Provide carriers, trim, bolts, caps, etc according to the manufacturer's instructions and as required for a complete installation. All fittings and appurtenances (p-traps, connections, etc) shall be brass; chrome plated brass where visible.

B. Provide carriers for wall hung or mounted fixtures such as water closets, lavatories, urinals, sinks, etc. The carriers shall be designed to fit in the wall structure available, and shall transmit the load to the floor. Fixtures will not be supported by the wall structure unless specifically indicated.

1.04 DOMESTIC WATER SYSTEM

A. Provide drip cocks so that the entire system may be drained. Provide manual air vents at high points in the system where air may be trapped. Provide stops for all fixtures and appliances. Provide a full size ball valve on each branch serving a hose bib.

B. Provide swing or swivel joints on connections as required to prevent noise or vibration of the piping. Provide fixture stops at all fixtures, hose bibbs, wall hydrants, and Owner-furnished fixtures. Run all piping on warm side of building insulation. Pipe insulation is not considered freeze protection. Provide water hammer arrestors where required. Locate to be accessible or provide access panel.

END OF SECTION 22 10 00

BOULDER CIVIC AREA PARK
Boulder CO

ELECTRICAL AND LIGHTING SPECIFICATIONS

SECTION 26 00 00

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 PROVISIONS

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

1.2 DESCRIPTION

A. Furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on drawings and/or listed below and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete installation, including all accessories and appurtenances required for testing the system. It is the intent of Drawings and Specifications that all systems be complete and ready for operation.

1.3 WORK INCLUDED

A. New electrical systems for (3) event power panels, pedestrian lighting, specialty lighting, monument lighting, and turtle electrical panel as shown on the plans.

B. All work shown on the drawings and described in the specifications is the responsibility of the electrical contractor.

C. Certain labor, materials and/or equipment may be furnished under other Sections. Unless otherwise noted, all labor, materials, and/or equipment for complete installation of electrical work shall be provided under this Division.

1.4 DEFINITIONS

A. Instructions such as "reinstall" shall mean the same as though the words "This Contractor shall" preceded each such instruction. "Provide" shall mean "Furnish, install and connect".

1.5 STANDARDS FOR MATERIALS

A. All materials shall conform to the current applicable industry standards. Workmanship and neat appearance shall be as important as electrical and mechanical operation. Defective or damaged materials shall be replaced or repaired prior to final acceptance in a manner meeting approval of Engineer and at no additional cost to Owner.

B. The latest editions of the following standards are minimum requirements.

1. Underwriters' Laboratories, Inc. (UL)

2. National Electrical Manufacturer's Association (NEMA)

3. American National Standards Institute (ANSI)

4. Insulated Cable Engineer's Association (ICEA)

5. Institute of Electrical and Electronic Engineers (IEEE)

6. Association of Edison Illuminating Companies (AEIC)

7. Illuminating Engineering Society of North America (IESNA)

1.6 SUBSTITUTION OF EQUIPMENT AND MATERIALS

A. There will be no prior approvals with the exception of light fixtures. All equipment shall be by one of the manufacturers listed in the contract documents except for light fixtures. Alternate light fixtures may be submitted for prior approval if received 7 days prior to the bid and only if deemed to be equal.

1.7 CODE COMPLIANCE

A. All work and materials shall comply with codes and regulations, including but not limited to the following: OSHA, National Fire Codes of National Fire Protection Association (NFPA) and the 2014 National Electrical Code.

B. Code compliance is mandatory. The Drawings and Specifications shall not permit work that does not conform to these codes.

1.8 DRAWINGS

A. Drawings indicate general arrangement of circuits and outlets, locations of switches, panel boards and other work. Drawings and specifications are complementary each to the other, and what is called for by one shall be binding as if called for by both. Data presented on drawings is as accurate as planning can determine, but accuracy is not guaranteed and field verification of all dimensions, locations, voltages, etc. to suit field conditions is directed. Review all drawings, and adjust all work to conform to all conditions shown therein. Discrepancies between different drawings or between drawings and specifications or regulations and codes governing installation shall be brought to the attention of the Engineer.

B. Contractor shall keep a redline copy drawing of all changes in actual routing of raceway or any other changes directed or allowed by the agency having jurisdiction or the Field Engineer. Submit the redline drawings to the Engineer at the completion of the project for incorporation into the As-built drawing set issued to the owner.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment and materials installed shall be new and UL approved unless otherwise specified. Existing systems or partial systems to be reused shall be tested and working properly prior to making modifications.

PART 3 - EXECUTION

3.1 CONDITIONS AT SITE

A. A visit to the site is required of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions, and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not. The electrical contractor shall be totally liable for damages caused by his or her cutting, digging or performance of any other related work in walls, ceilings, floors or underground.

B. Lines of other services that are damaged as a result of this work shall promptly be repaired at no expense to Owner to complete satisfaction of Engineer.

3.2 LICENSE, FEES, AND PERMITS

A. Arrange for required inspections for all license, permit and inspections. Furnish a certificate of final inspections and approval from the City of Boulder Colorado.

B. The electrical contractor shall call the Project Management 24 hours before all inspections or before covering up or concealing any electrical work.

3.3 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

A. Only quality workmanship by qualified Journeyman Electrician will be accepted. A journeyman to apprentice ratio of 1:1 must be maintained. Haphazard or poor installation practice will be cause for rejection of work.

B. Provide a competent foreman in charge of this work at all times.

C. Where specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall at all times be kept in job superintendent's office and shall be available to Engineer's and/or Owner's representative.

3.4 SUBMITTALS

A. Submit shop drawings and product data in accordance with provisions of City of Boulder Standard Specifications.

B. Prior to submission, shop drawings, material lists and catalog cuts or manufacturer's printed data shall be thoroughly checked for compliance with contract requirements, compatibility with equipment being furnished by the Contractor or Owner, accuracy of dimensions, coordination with work of other trades, and conformance with sound and safe practice as to erection of installation. Each submittal shall bear Contractor's signed statement evidencing such checking.

C. Clearly mark each shop drawing as follows for purposes of identification:
Shop Drawing with date
Equipment Identification Used on Contract Drawings
Name of Project
Branch of Work
Engineer's Name
Contractor's Name

D. Clearly mark printed material, catalog cuts, pamphlets or specification sheets, and shop drawings with the same designation shown on the contract document schedules. Identify specific item proposed, showing catalog number, recess openings, dimensions, capacities, electrical characteristics, etc. Submittals which are incomplete will be returned to the Contractor without review.

E. Contractor agrees that submittals processed by the Engineer are not change orders; that the purpose of submittals is to demonstrate to the Engineer that the Contractor understands the design concept; and that the Contractor demonstrates this understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

F. Contractor shall be responsible for dimensions (which he shall confirm and correlate at the job site), fabrication processes and techniques of construction, and coordination of his work with that of other trades. The Contractor shall check and verify all measurements and review shop drawings before submitting them. If any deviations from the specified requirements for any item of material or equipment exist, such deviation shall be expressly stated in writing and incorporated with the submittal.

G. Maintain one copy of shop drawings at the project field office until completion of the project, and make this copy available, upon request, to representatives of the Engineer and Owner.

H. No equipment or materials shall be installed or stored at the jobsite until submittals for such equipment or materials have been given review action permitting their use.

I. Shop drawings and manufacturer's published data shall be submitted for:

Service Disconnects
Fusible Disconnects
In-Grade Splice Boxes
Wiring and Wiring Devices
PVC Conduits

3.5 TESTS

A. The right is reserved to inspect and test any portion of the equipment and/or materials during the progress of its erection. This contractor shall test all wiring and connections (whether new or existing) for continuity and grounds before connecting any equipment.

B. The Contractor shall test the entire system in the presence of the Engineer or his engineer when the work is completed to insure that all portions are free from shorts or grounds.

3.6 DELIVERY AND STORAGE OF MATERIALS

A. Make provisions for delivery and safe storage of all materials. Deliver materials to job at such stages of the Work as will expedite Work as a whole. Carefully mark and store all materials. Carefully check materials furnished for installation, and furnish a receipt acknowledging acceptance of delivery and condition of materials received. Thereafter assume full responsibility for safekeeping of same until final installation has been approved and accepted.

3.7 CUTTING AND PATCHING

A. Carefully lay out all work. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for proper installation, support or anchorage of raceways, outlets or other electrical equipment, this work shall be the responsibility of this Contractor. Any damage to building, piping, and equipment or any defaced finish, plaster, woodwork or metalwork shall be repaired by this contractor at no additional cost to Owner. Do no cutting, channeling, chasing or drilling of unfinished masonry, tile, etc. or cutting, drilling, welding of structural members of building, etc. without first obtaining permission from Architect. If permission is granted, perform work in a manner approved by Architect.

3.8 DIRECTORY CARDS, NAMEPLATES, AND LABELS

A. All components of electrical system shall be neatly and accurately labeled to facilitate ready identification and service. Temporary type of markings, which are visible on equipment, will not be permitted. Repaint trims, housing, etc. where such marking cannot be readily removed. Defaced finish must be refinished.

3.9 CLEAN-UP

A. Remove all materials, scrap, etc. relative to electrical installation, and leave premises in a clean, orderly condition. Any costs to Owner for cleanup of site will be charged to Contractor. At completion, all equipment, lighting fixtures, etc. shall be thoroughly cleaned and all residue removed from the inside and outside surfaces. Defaced finish shall be refinished.

3.10 GUARANTEE

A. Provide in accordance with the General Conditions and City of Boulder Standard Specifications. Leave entire electrical system installed under this Division in proper working order. Replace, without additional charge, any work, materials or equipment provided under this Division which develops defects within one year from date of final acceptance. Guarantee all materials and equipment against defects in composition, design or workmanship.

END OF SECTION 26 05 00

SECTION 26 05 19 – CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED WORK IN OTHER SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical
B. Section 26 05 26 – Grounding and Bonding for Electrical Systems
C. Section 26 05 33 – Raceway and Boxes for Electrical Systems
D. Section 26 05 35 – Underground Hand Holes
E. Section 26 05 53 – Identification for Electrical Systems
F. Section 26 27 26 – Wiring Devices
G. Section 26 56 01 – Exterior Lighting Systems

1.2 RELATED DOCUMENTS

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

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES (600 VOLTS)

A. Type: Conform to the applicable UL and ICEA Standards for the use intended. Copper conductors with 600-volt insulation unless otherwise specified or noted on the drawings. Stranded conductors for No. 10 and larger and where elsewhere specified or noted on the drawings.

B. Aluminum Conductors Prohibited: Aluminum conductors will not be permitted.

C. Insulation: Type THWN/THHN insulation minimum unless otherwise specified or noted on the drawings.

D. Size: No. 12 minimum unless otherwise specified or noted on the drawings. Not less than NEC requirements for the system to be installed.

E. Color Coding: Phase, neutral and ground conductors color-coded in accordance with NEC. Connect all Conductors of the same color to the same phase conductor as follows:

480Y/277V-3PH-4W Color coding shall be:

1. A-Phase = Brown
2. B-Phase = Orange
3. C-Phase = Yellow
4. Neutral = Grey
5. Ground = Green

208Y/120V-3PH-4W Color coding shall be:

1. A-Phase = Black
2. B-Phase = Red
3. C-Phase = Blue
4. Neutral = White
5. Ground = Green

120/240V-1PH-3W Color coding shall be:

1. Line 1 = Black
2. Line 2 = Red
3. Neutral = White
4. Ground = Green

F. Conductors No. 12, 10, 8, and 6 shall be solid color compound for the entire length. All larger size conductors shall be color taped at all termination points, splice and pull boxes a minimum of 6” on either side of a connector, lug or splice with the correct phase, neutral or ground color coding tape.

G. MC, NM, ENT and AC cables are prohibited.

2.3 CONNECTORS AND LUGS

A. For copper conductors No. 10 and smaller: 3M Scotch-Lok, T&B or equal U.L. Listed spring wire connectors.

B. Split bolt connectors are prohibited, use ILSCO clear tap block devices on #8 and larger wire.

C. High pressure compression type splices by T & B or Burndy are acceptable.

D. Use exothermic welds to terminate grounding conductors to building steel and ground rods. Burndy brand QGFL34B1 terminations are acceptable in lieu of exothermic if preferred.

E. 600 Volt rated terminal strips with #4 AWG lugs, all mounting hardware, end clamps and marking strips.

PART 3 - EXECUTION

3.1 SPLICES (300 VOLTS AND UNDER)

A. Permitted only at outlets or accessible enclosures. Conductor lengths shall be continuous from termination to termination without splices unless approved by the Architect/Engineer.

3.2 RACEWAYS

A. Install all power and lighting conductors in an approved raceway system.

3.3 CONDUCTOR PULL

A. Conductors shall not be pulled until after all work is complete and conduits have been swabbed out.

3.4 GROUNDING CONDUCTOR

A. All power and lighting circuits shall include an insulated green grounding conductor.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK IN OTHER SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical
B. Section 26 05 19 – Conductors and Cables
C. Section 26 05 33 – Raceway and Boxes for Electrical Systems
D. Section 26 05 35 – Underground Hand Holes
E. Section 26 05 53 – Identification for Electrical Systems
F. Section 26 27 26 – Wiring Devices
G. Section 26 56 01 – Exterior Lighting Systems

1.2 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.2 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment to metallic water service, to concrete reinforcement steel and steel building structure, and to supplementary grounding electrodes as indicated or required by governing regulations.

B. Ground each separately-derived system neutral to nearest effectively grounded metallic water pipe, nearest effectively grounded building structural steel member or separate grounding electrode as shown on the drawings.

C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing system.

1.3 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 10 ohm or less.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter and Length: 3/4 inch x 10 feet.

2.2 CONDUCTOR

A. Material: Conductors: Install solid conductor for No. 6 AWG and smaller, and stranded conductors for No. 4 AWG and larger, unless otherwise indicated on plans.

B. Foundation Electrodes: minimum 2 AWG bare copper and minimum 20'-0" encased in concrete.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

D. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

2.3 Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
4. Bonding Interior Matal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

2.4 Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 2 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor to the service entrance switchgear and bond to the ground bus.

PART 3 - EXECUTION

3.1 TESTS

A. Perform ground resistance tests, according to IEEE 81 fall-of-potential method, at each service entrance switch or breaker enclosure ground terminal. If ground resistance exceeds 10 ohms, provide additional grounding either by increasing the length of the ground rod, or add more ground rods to the grounding system until the required ground resistance is achieved. Where multiple ground rods are installed, they shall not be less than 6 feet apart.

END OF SECTION 26 05 26

SECTION 26 05 33 – RACEWAY FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK IN OTHER SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical
B. Section 26 05 19 – Conductors and Cables
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 35 – Underground Hand Holes
E. Section 26 05 53 – Identification for Electrical Systems
F. Section 26 27 26 – Wiring Devices
G. Section 26 56 01 – Exterior Lighting Systems

1.2 RELATED DOCUMENTS

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

PART 2 - PRODUCTS

2.1 CONDUITS

A. Galvanized Rigid Conduit (GRC): Rigid, threaded, steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside. Comply with ANSI C80.1

B. Electrical Metallic Tubing (EMT): Mild steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside.

C. Polyvinyl Chloride Conduit (PVC): Rigid, non-metallic, non-magnetic, NEMA TC 2; Schedule 40 PVC, Schedule 80 PVC

D. Rigid Non-metallic Conduit (RNC): NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

E. Conduit Size: Minimum conduit size for this project shall be 1” PVC for all below grade conduit unless otherwise noted on the drawings.

2.2 CONDUIT FITTINGS

A. Rigid Steel Conduit, and EMT Fittings: Iron or steel only, no cast fittings.

B. Connectors and Couplings: Steel compression type connectors and couplings required for EMT. Couplings and connectors shall be steel or malleable iron only (not cast). Connectors to have insulated throats with nylon bushings.

C. PVC Fittings and Conduit Bodies: NEMA TC 3. All fittings shall be chemically welded utilizing PVC conduit cement.

D. Bushings: Insulated type, designed to prevent abrasion of wires without impairing the

continuity of the conduit grounding system, for rigid steel conduit, IMC, and rigid aluminum conduit larger than 1/2-inch size.

E. Provide bonding type bushings on all feeder conduits, motor connections, transformers, panelboards and all other flexible conduits.

PART 3 - EXECUTION

3.1 CONDUIT SIZING AND SUPPORT

A. Size conduit to meet requirements of National Electrical Code, 1/2-inch minimum size, except as otherwise indicated.

B. Route all PVC conduits in 24” minimum depth trench to top of raceway.

3.2 TRENCHING AND BACKFILL

A. Provide all trenching and backfilling required for electrical work. Refer to Division 2, Earthwork. All underground conduit shall be 24” below finished grade with compression backfill.

B. The Contractor shall replace and restore all surface materials in kind, equal to, or exceeding those disturbed by trenching, excavation or backfilling operations. This includes but is not limited to: seeding, sodding, replacement of sub-base, pavement, trees, shrubs. All excess materials shall be disposed of as directed by the Engineer.

C. Repair and restore trenches and surface where settlement occurs for a period of one year from Owner's date of acceptance.

D. Provide safety barriers during all times that trench is open and whenever it will cause a hazard to drivers or pedestrians.

3.3 CONDUIT INSTALLATION

A. Cut conduit square using a hacksaw only (EMT, PVC & GRC); de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. All PVC conduit fittings shall be chemically welded utilizing PVC conduit cement. All PVC conduit shall be 24” deep trench, buried with compression backfill. Return all landscape to like pre-construction condition at job completion.

D. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

E. For all metallic conduits, provide insulated bushing or throat bushings for 1-1/4" diameter and larger. Provide grounding lug bushings where conduits enter switchboards.

F. Install no more than the equivalent of three 90-degree bends between boxes.

G. Use junction boxes to make sharp changes in direction.

H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

I. Provide grounding type bonding bushings on all panel boards, transformers, motors and around all conduits terminated through concentric or eccentric knockouts.

3.4 CONDUIT INSTALLATION SCHEDULE

A. Underground Conduits: PVC coated GRC or schedule 40 (or 80) PVC direct buried in the earth. All PVC conduits shall transition to GRC prior to rising above grade or into a concrete slab, wall or above grade pull box. PVC conduit is not allowed above grade.

B. All exterior exposed conduit from the floor level to 4' above the floor shall be GRC or PVC coated GRC where installed under bridge deck or where possible contact with ground water.

END OF SECTION 26 05 33

SECTION 26 05 35 – UNDERGROUND HAND HOLES

PART 1 GENERAL

1.01 RELATED WORK IN OTHER SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical
B. Section 26 05 19 – Conductors and Cables
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 33 – Raceway for Electrical Systems
E. Section 26 05 53 – Identification for Electrical Systems
F. Section 26 27 26 – Wiring Devices
G. Section 26 56 01 – Exterior Lighting Systems

1.02 RELATED DOCUMENTS

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

1.03 DESCRIPTIONS:

A. Provide hand holes or flush in-grade splice boxes as required per the drawings and specifications. Hand holes shall be bottomless, polymer concrete with heavy duty, traffic rated, TIER 22, (2) bolted covers flush mounted in concrete sidewalks or in landscapes.

B. Work shall consist of furnishing all labor, equipment, supplies, and materials, unless otherwise specified, necessary for the installation of complete underground duct bank and conduit system as required by the specifications and as shown on the drawings, subject to the terms and conditions of the contract.

1.04 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. Latest editions of the following:

1. NSI/NFPA 70 - National Electrical Code
2. ANSI/IEEE C2 - National Electrical Safety Code.
3. NECA - Standard of Installation.
4. NEMA - National Electrical Manufactures Association
5. OSHA - Occupational Safety and Health Administration, as Amended
6. Other references as listed elsewhere in the contract documents.

1.05 DRAWINGS AND SPECIFICATIONS

B. The drawings indicate the general arrangement of locations of hand holes and other work. Drawings and specifications are complementary each to the other. What is called for by one shall be as binding as if called for by both. Data presented on these drawings is as accurate as can be determined. Accuracy is not guaranteed and field verification of all dimensions, locations, levels, etc., to suit field conditions is required. Review all drawings and specifications; adjust all work to conform to all conditions shown therein.

PART 2 PRODUCTS:

2.01 CONSTRUCTION

A. No conduits shall be encased in sidewalks, roadways, footings, grade beams and foundations except under special cases approved by the Project Manager.

B. Hand hole or flush to grade splice boxes shall be of adequate size to handle the application and conductor sizes to the NEC 314.28 (A) through (D).

C. Hand holes shall be bottomless, precast, polymer concrete, TIER 22 rated with traffic rated, heavy duty covers and shall be set with non-shrink mortar and finished flush with the adjoining surfaces after being set plumb.

D. All hand hole hardware and bolts shall be stainless steel. Ground all metal parts in hand holes.

E. Hand hole load ratings shall be tier 22 unless otherwise specified on the drawings. Hand hole covers shall be heavy duty traffic rated.

PART 3 – EXECUTION

3.01 WORKMANSHIP

A. Locate all underground utilities and obstructions by potholing before trenching or excavating. Contractor shall be responsible for all costs associated with damage of existing underground utilities. The contractor is responsible for maintaining existing utilities.

B. Only quality workmanship will be accepted. Use the NECA Standard of Installation as a minimum for installation of equipment. Poor workmanship, improper layout of work and lack of coordination of work is not acceptable.

C. Contractor’s personnel and subcontractors selected to perform the work shall be well versed and skilled in the trades involved.

D. Any changes or deviations from the drawings and specifications must be accepted in writing by the Project Manager. All errors in installation shall be corrected at the expense of the Contractor.

E. Upon completion of work, all equipment and materials shall be installed complete, thoroughly checked, correctly adjusted, and left ready for intended use or operation. All work shall be thoroughly cleaned and all residues shall be removed from surfaces.

F. Contractor shall provide a complete installation, including all required labor, material, cartage, insurance, permits, and taxes.

G. After installation of electrical work, compact backfill in layers to insure against the possibility of differential settling and use compression backfill to final grade.

PART 4 MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 PAYMENT

5.01 PAYMENT

C. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Lump Sum Contract price.

END OF SECTION 26 05 35

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK IN OTHER SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical
B. Section 26 05 19 – Conductors and Cables
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 33 – Raceway for Electrical Systems
E. Section 26 05 35 – Underground Hand Holes
F. Section 26 27 26 – Wiring Devices
G. Section 26 56 01 – Exterior Lighting Systems

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Underground-line warning tape.
3. Equipment identification labels.
4. Miscellaneous identification products.

1.4 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.5 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.6 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a black background. Minimum letter height shall be 3/8 inch (10 mm).

B. Label shall include equipment designation, amperage, voltage, phase, wire and fed from information.

PART 3 - EXECUTION

3.1 APPLICATION

A. Power-Circuit Conductor Identification: For all primary and secondary conductors No. 10 AWG and larger in lighting control center, junction boxes, and hand holes use write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use write-on tags. Identify each ungrounded conductor according to source and circuit number.

C. Conductors to be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, and control wiring. Install underground-line warning tape for both direct-buried cables and cables in raceway.

E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, and lighting control centers. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Outdoor Equipment: Engraved, laminated acrylic or melamine label, stainless steel screw attached to the front cover.

2. Equipment to Be Labeled:

   a. Panel boards, electrical cabinets, and enclosures.
   b. Disconnect switches.
   c. Enclosed circuit breakers.
   d. Contactors.
   e. By-pass switches.
   f. Hand-Off-Auto switches.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied for number 6 AWG and smaller. For number 4 AWG and larger provide color coded tape 6 inches on either side of termination if authorities having jurisdiction permit, field applied.
2. Colors for 120/240-V single phase circuits:

   a. Phase L1: Black.
   b. Phase L2: Red.
   c. Neutral: White.

3. Colors for 208/120-V three phase circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue
   d. Neutral: White.

4. Colors for 480/277-V three phase circuits:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Grey

5. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 12 inches (150 to 300 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protection Device

C. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C**)** to plus 104 deg F (plus 40 deg C).
   b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then

only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

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

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
   d. Other Wet or Damp Indoor/Outdoor Locations: NEMA 250, Type 4.
   e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

   a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Galvanized steel (with the same finish as panels and trim for surface mounted panel boards.
   c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom. See plans.

D. Phase, Neutral, and Ground Buses:

1. Material: [Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

E. Mains: Circuit breaker or Lugs only as indicated on the plans.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

H. Branch Overcurrent Protective Devices: Fused switches.

I. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker or lugs onl**y**. As indicated on plans.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 LOAD CENTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Load Centers: Comply with UL 67.

D. Mains: [Circuit breaker or lugs onl**y**. As indicated on plans.

E. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
    f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."

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 base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED WORK IN OTHER SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical
B. Section 26 05 19 – Conductors and Cables
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 33 – Raceway for Electrical Systems
E. Section 26 05 35 – Underground Hand Holes
F. Section 26 05 53 – Identification for Electrical Systems
G. Section 26 56 01 – Exterior Lighting Systems

1.02 RELATED DOCUMENTS

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

PART 2 - PRODUCTS

2.01 SNAP SWITCHES

A. Unless otherwise specified, each switch (Quiet, Quick Make & Break) shall be of the A.C specification grade type for mounting in a single-gang spacing, fully rated 20 amperes minimum at 120/277 volts, conforming to minimum requirements of the latest revision of the Federal Spec. #W-S-896E, standard Quiet Switches and further requirements herein specified. Switches shall be nylon, spec grade, heavy duty, single-pole, 3-way or 4-way, of the maintained, momentary, or lock type as indicated on the drawings with grounding screw. Switches shall operate in any position and shall be fully enclosed cup type with entire body molded nylon, urea or melamine. Fiber, paper or similar insulating material shall not be used for body or cover, ivory color handles unless otherwise indicated on the drawings. Silver or silver alloy contacts. A.C. 120/277 volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publication, and shall be as follows unless otherwise noted:

Hubbell #1221-I, 1223-I or 1224-I or equal by Leviton, Arrow-Hart, Daniel Woodhead or Eagle. Leviton is the preferred manufacturer of the District.

2.02 RECEPTACLES

A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publications. Fire-resistant, non-absorptive, hot-welded, nylon bodies and bases with metal plaster ears (integral with the supporting member) and a flat face. Single or duplex as shown or noted on drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong. Receptacles shall comply with Federal Spec. #W-C-596E.

B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper the same size as the phase conductor. Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.

C. Unless otherwise noted, receptacles shall be as follows:

Hubbell #5362-I or GF5362 for ground fault or equal by Leviton, Arrow-Hart, Daniel Woodhead or Eagle.

2.03 DEVICE PLATES

A. General: Provide device plates for each switch, and receptacle outlet. Do not use sectional gang plates. Provide multi-gang outlet plates for multi-gang boxes. Plates shall be smooth nylon, of spec. grade, ivory color, as manufactured by Hubbell, Leviton, Arrow-Hart, Daniel Woodhead or Eagle.

B. Exposed exterior: Plates for exposed jointed fittings shall match the fittings with edges of plates flush with edges of fittings. Heavy cadmium plated steel with gasket. Plates for cast type boxes at locations subject to wet or rain conditions shall be of the cast, weatherproof while-in-use type cover. Provide hinged lift covers for devices.

C. Provide blank cover plates for all boxes that are empty at the time of acceptance by the owner.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install specific-use receptacles at heights shown on Contract Drawings.

B. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

C. Install devices and wall plates flush and level.

D. Install with alignment tolerance of one-sixteenth inch and all edges in continuous contact with wall surfaces.

E. Install ground fault circuit interrupter GFCI receptacles for all outdoor or exterior mounted receptacles.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

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. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches, enclosed controllers and motor-control centers.
2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches fuseholders and panelboards.
3. Submersible, breakaway type, single-pole in-line fuse holders for UL 13/32” x 1-1/2” supplemental fuses mounted in luminaire hand-hole.
4. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Coordination charts and tables and related data.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 SUBMERSIBLE, BREAKAWAY TYPE, IN-LINE FUSE HOLDER

A. All roadway, pedestrian and other pole mounted luminaires shall have in-line, submersible, breakaway type fuse holder accessible from the pole's hand hole for each hot conductor used in that pole for luminaire power. Provide a non-fused, breakaway connector for the neutral conductor. Holders shall have the following agency information:
   1. UL Recognized, Guide IZLT2, File E14853
   2. CSA Certified, Class 622501, File 47235
   3. CE, RoHS compliant

B. Breakaway fuse holder shall have insulating boots to provide submersibility per UL IP67.

C. Fuses: UL 13/32" x 1-1/2" Recommended fuses: BAF, FNM, FNQ, KLM and KTK rating:
   1. 600V
   2. Up to 30A limited by conductor size

3. Withstand: 200kA RMS Sym.

2.6 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 10 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class RK1, fast acting .
2. Feeders: Class RK1, fast acting or Class J, fast acting.
3. Motor Branch Circuits: Class RK1, time delay.
4. Other Branch Circuits: Class J, fast acting.
5. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Enclosures.
5. Bolted-pressure contact switches.
6. Molded-case circuit switches.
7. Molded-case switches.

1.2 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 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 MANUFACTURERS

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

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

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Moeller Electric Corporation.
4. Siemens Energy & Automation, Inc.
5. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.

4. GFCI Circuit Breakers: Single- and two-pole configurations with 5 30-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

2.5 INSTALLATION

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Basic Electrical Materials and Methods Electrical Supports and Seismic Restraints," and concrete materials and installation requirements are specified in Division 3.

C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

E. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Work Electrical Supports and Seismic Restraints."

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section “Electrical Identification."

2.6 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 26 28 16

SECTION 26 56 01 – EXTERIOR LIGHTING SYSTEMS FOR PUBLIC SPACES

PART 1 - GENERAL

1.1 GENERAL:

A. The Work described in this section consists of information related to providing and installing exterior luminaires, landscape luminaires, lamps, ballasts, light standards, foundations, and control wiring and equipment required for completion of the project.

1. Luminaire: An electrical device used to create light by use of an electric lamp. The term Luminaire includes the housing, reflector, lens, optical assembly, lamp socket, lamp holder, heat sink, electrical connectors, ballast compartment, gaskets, latches, hardware, mounting bracket, and external or internal shield.
2. Lamp: An electric device that converts electrical energy into visible light. The term Lamp includes the light emitting source (filament, arc tube, cathode or diode), the bulb, and the base or circuit board which provides electrical connection to the luminaire.
3. Ballast: An electrical device that regulates the voltage and current to the Lamp.
4. Light Standard: A light pole assembly that includes the pole, base plate, base plate template, base cover, nut covers, hand holes, hand hole covers, GFCI receptacle with in-use cover, and mast arm.
5. Foundations: A precast or cast-in-place concrete structure used to anchor the Light Standard in place, and includes the concrete, reinforcing steel, ground rods, conduit, connector bolts, anchor bolts, nuts, and washers.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Section 26 05 00 – Common Work Results for Electrical
B. Section 26 05 19 – Conductors and Cables
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 33 – Raceway and Boxes for Electrical Systems
E. Section 26 05 35 – Underground Hand Holes
F. Section 26 05 53 – Identification for Electrical Systems
G. Section 26 27 26 – Wiring Devices

1.2 REFERENCES:

A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. In the event of conflict between referenced standards, this specification or within themselves, the more stringent standard or requirement shall govern.

1. Illuminating Engineering Society of North America (IESNA)
2. NFPA 70 National Electrical Code (NEC)

3. Americans with Disabilities Act (ADA)
4. The Architectural Barriers Act (Public Law 90-480)
5. American National Standard Institute (ANSI) A117.1-1961
6. National Electrical Manufacturers Association (NEMA)
7. Underwriter's Laboratory (UL)
8. Nationally Recognized Testing Laboratory (NRTL)
9. International Code Council ICC
10. All work shall be inspected and approved by the appropriate authorities.
11. American Association of State Highway and Transportation Officials (AASHTO).
12. American Society for Testing and Materials (ASTM)
13. National Electrical Contractors Association (NECA)
14. Laws, codes and regulations of Federal, State, County, City and District authorities having jurisdiction over this work.

1.3 MATERIALS AND WORKMANSHIP:

A. All materials and apparatus required for the Work, except as specified otherwise, shall be new, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the spaces.

B. All component parts of each item of equipment or device shall bear the Manufacturer's Nameplate, giving at least the name of the manufacturer, description, size, type, serial number, and electrical characteristics in order to facilitate maintenance or replacement. This nameplate shall not be visible during normal operation of the equipment.

C. Blemished, damaged, or unsatisfactory luminaires shall be replaced in a satisfactory manner.

1.4 DRAWINGS AND SPECIFICATIONS:

A. Definitions: Instructions in Specifications or on Contract Drawings such as "Provide." shall mean the Contractor shall furnish and install items, equipment, wiring, etc., complete with all details.

B. Drawings and Specifications:

1. Lighting and Electrical Contract Drawings are diagrammatic and indicate general design, layout, and arrangement of equipment and various systems. Install all lighting and electrical equipment per NEC requirements and manufacturer's recommendations.

2. Take all dimensions and measurements from landscape plans and actual equipment to be furnished. All dimensions and measurements must be verified in the field since actual locations, distances, and elevations will be governed by actual field conditions. Contractor shall be responsible for all

measurements taken in the field.

3. Study and review all Contract Documents. Should conflicts arise which require changes in the Contract Documents, notify the Engineer prior to installation. If installation has already occurred, notify the Engineer upon discovery of the discrepancy.

1.5 SUBMITTALS:

A. Product Data Submittals

1. Before releasing any materials, the Contractor shall submit to the Engineer for approval a complete list of all of the equipment and materials intended for installation, in accordance with the Contract Documents. For approval this list shall include the following:

   a. Cutsheets of proposed lighting equipment: The Contractor shall submit to the Engineer a copy of the proposed luminaire cutsheets and shop drawings on which they are submitting for review and approval of luminaires. Allow fourteen (14) calendar days for review of luminaire submittals. The list shall include all pertinent information to identify the luminaires including manufacturers name, luminaire type designation from Contract Drawings, and catalog number.

   b. Light standards, anchor bolts, luminaire mountings, luminaires, lamps, and ballasts;

   c. Luminaire photometric data in IESNA PC electronic file format from an independent testing facility;

   d. Cables, splicing, and termination devices;

   e. Conduits, conduit bends and splices, and electrical bushings;

   f. Fuseholders, fuses, and cable disconnect devices;

   g. Wiring and connection diagrams of all cabinets, circuits, luminaires, contactors, and ground rods.

   h. Grounding systems

2. The list shall include the brand name, any identifying numbers, relevant technical data, and any other information necessary for the agency responsible for maintenance of the system to procure exact replacements of any and all equipment and material used on the Project. All equipment shall be new, and approved by Underwriters Laboratories, Inc or other Nationally Recognized Testing Laboratory.

3. All luminaires of the same type classification shall be provided by the same

manufacturer.

B. Shop Drawings

1. Contractor shall provide shop drawings for all custom or modified standard luminaires, as described in the Luminaire Schedule. Shop drawings shall include light standards, bases, luminaires, lamps, shielding, electrical connections, ballasts, transformers, gasketing, and mounting arms which detail methods of assembly and fastening. Shop drawings shall also indicate colors and their locations on each lighting element for review and approval prior to releasing. Contractor shall also supply manufacturer descriptions on luminaires, light standard materials, fabrication performance, and installation.

C. Samples

1. Submit samples of any luminaires which are substitutes for specified equipment. Unless otherwise indicated, samples shall be as follows:

a. For standard catalog types - complete, production line samples, with all installation hardware, proper lamp(s), and equipped with a cord and plug.

b. Sample of a specially designed or developed luminaire shall be submitted for the purpose of ascertaining its photometric performance, quality of visible parts and details, maintenance features (including relamping process), method of installation, and safety features.

2. Luminaire samples, only required for proposed substitutions to specified equipment, shall be submitted for final review within thirty (30) days after review of shop drawings. If, after a period of thirty (30) days from rejection of samples, the luminaire cannot be made acceptable, then a luminaire (shop drawing and sample) by an alternative manufacturer shall be submitted.

D. Operation and Maintenance Manuals

1. Contractor shall provide Operation and Maintenance Manuals for all luminaires, light standards, lamps and ballasts. Manuals shall include:
   a. Product cutsheets for luminaires, light standards, lamps and ballasts.
   b. Luminaire manufacturer's installation and maintenance instructions.
   c. Luminaire shop drawings for modified or custom luminaires.

1.6 WARRANTIES:

A. Contractor Warranty requirements shall be provided in accordance with the General Contract, and supplementary conditions of City of Boulder Standard Specifications.

B. Standard Manufacturer Warranties shall apply to all light standards, luminaires, lamps, and ballasts.

1.7 DELIVERY, STORAGE AND HANDLING:

A. All components shall be packed in a manner consistent with ICC regulations to minimize damage during shipping.

B. Store all luminaires, lamps and hardware flat, in a clean, dry area off the ground and under cover, or per manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide new exterior luminaires of sizes, types, and ratings indicated, complete with, but not limited to, housings, shields, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship luminaires factory-assembled, with parts and components required for a complete installation. Design luminaires with concealed hinges and catches, with metal parts grounded as common unit, and construct as to dampen ballast-generated sound. Luminaires shall be UL Listed for Wet or Damp Location, as specified.

B. The finish of all new steel products shall be treated in such a manner as to render it corrosion resistant. All steel surfaces shall be bonderized and galvanized after fabrication to provide rust inhibiting and finish coat adherence properties.

C. All new aluminum products shall be treated in such a manner as to render it corrosion resistant, either anodized or Super TGIC (triglycidyl isocyanurate) polyester powder coated.

D. All metal surfaces of refurbished luminaires should be made to match original new condition.

E. Provide accessories as required for compatibility with installation requirements. Luminaire catalog numbers do not necessarily denote specific mounting accessories for where/how luminaire is to be installed.

F. All materials used in fabrication and mounting luminaires shall be of a non-corrosive nature.

G. Luminaires shall be free of light leaks. Luminaires shall be manufactured to provide adequate ventilation for both lamps and ballasts or transformers.

H. Luminaires shall be manufactured to hide mounting hardware from view when luminaire is completely installed. Exposed fasteners shall not be acceptable, except as noted on details.

I. Wiring channels and lampholder mountings shall be rigid and accurately manufactured.

J. In adjustable luminaires, aiming and positive locking devices shall be provided.

K. All luminaires when installed shall be set within 0.25 degrees of plumb and free of warps, dents, or other irregularities. The finish of exposed parts or trims shall be as specified in the Luminaire Schedule.

L. All lamp holders shall be of high quality and shall securely hold lamps preventing vibration.

M. Rivets, springs, and other hardware shall not be visible after installation.

N. All necessary modifications shall be made to insure compatibility of luminaires with the lamps specified.

O. All necessary modifications shall be made to insure compatibility of ballasts with the lamps specified.

2.2 MANUFACTURERS

A. Refer to Luminaire Schedule on Lighting Plan Sheets of the Contract Drawings for acceptable manufacturers of individual luminaires.

2.3 LIGHT STANDARDS

A. A light standard shall consist of a metal pole, base plate, base plate template, base cover, nut covers, hand holes, hand hole covers, GFCI receptacle with in-use cover, and mast arm.

B. All structural components of light standards, bases, couplers, anchor bolts, luminaires, and other attachments to be used for lighting shall be designed for a minimum of 100 MPH sustained wind velocity with gusts up to 130%, in accordance with AASHTO LTS-4.

C. All standards shall have cable-entrance holes and hand holes. Metal surfaces shall be free of any imperfections marring the appearance and of any burrs or sharp edges that might damage the cable.

D. Light standard assemblies, including hand hole and hand hole cover, shall be rated for 2500 hour salt spray test endurance.

E. After erection and alignment of the light standard, the space between the foundation and the base plate shall be filled with non-shrink grout.

F. Light standard assemblies shall be fabricated and placed in accordance with the details and dimensions shown on the Drawings. The careful erection and aligning of the components furnished shall be considered a most essential feature of the installation and shall be within 0.25 degrees from plumb.

G. Where dissimilar metals are used in the materials of the light standard, Contractor

shall ensure protection against galvanic corrosion.

H. All miscellaneous bolts shall meet the requirements of ASTM A 325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength. All nuts, bolts, and washers supplied which are not galvanized shall have chemical properties of ASTM A 325, Type III.

I. All anchor bolts shall be fabricated from steel as specified by the manufacturer, and that portion of the anchor bolts and nuts, which shall be exposed above foundation shall be galvanized in accordance with ASTM A 123 Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

J. The light standard and its accessories must be manufactured of material of like appearance.

K. Provide in-line fusing at pole hand hole for all pole-mounted luminaires.

L. Provide removable unitized ballast/component tray with separable connector in all pole mounted luminaires. Install underground wiring in conduit with watertight connections. Refer to SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

M. Luminaire Pole Bases: Size and construct as indicated on Contract Drawings. Project anchor bolts per luminaire manufacturer and structural requirements or 2 inches minimum above base if not otherwise noted. Install poles on bases within 0.25 degrees of plumb; provide shims for adjustment. Provide structural grout around pole base.

2.4 FOUNDATIONS

A. A foundation shall consist of the concrete, reinforcing steel, ground rods, conduit, connector bolts, anchor bolts (installed according to the Light Standard bolt plate template), nuts, and washers.

B. The Contractor shall be required to construct a new foundation at each location according to the electrical and structural details.

C. All foundations shall be constructed to not less than minimum dimensions as designed by Engineer. The size and number of conduit bends shall be installed in each foundation as indicated in the Contract Drawings. The caged anchor bolt assembly shall be placed in the foundation so that it remains plumb, according to pole manufacturer’s tolerances, and with the projection set as specified by the pole manufacturer. Anchor bolts shall be "caged" in a manner specified by the manufacturer and approved by the Engineer. The top elevation of the foundation shall be set accurately and leveled.

2.5 LAMPS

A. General

1. Lamps shall only be installed and operated in luminaires designed to accommodate the specific lamp.

2. Lamps shall be compatible with ballasts/transformers supplied with luminaires in which they are to be installed.

3. All lamps of similar type to be provided by same manufacturer.

4. Provide lamps as specified in luminaire schedule.

5. Provide lamps in wattages and envelope sizes/configuration, color temperature and color rendering index as indicated in luminaire schedule.

B. Acceptable Manufacturers

1. Osram/Sylvania

2. General Electric

3. North American Philips

C. Equipment and Materials

1. Induction Lamps

a. All induction lamps shall be manufactured by Philips Lighting

b. Average life of induction lamps shall be 100,000 hours.

c. Color Rendering Index (CRI) shall be 80 or higher.

2. Metal Halide Lamps

a. All discharge tubes shall be ceramic.

b. Color Rendering Index (CRI) shall be 80 or higher.

c. Lamps shall have universal operating position.

3. Compact Fluorescent Lamps

a. Lamps shall be of the type utilizing tri-phosphor coating for high color rendering qualities (CRI 80 or better).

b. Average life of Compact Fluorescent lamps shall be 16,000 hours.

2.6 BALLASTS

A. Acceptable Manufacturers

1. QL Induction Generators: Philips

2. HID Ballasts: Aromat, Advance, Universal, Hatch.

3. Fluorescent Ballasts: Advance, Osram/Sylvania, Universal

4. Photocontrols: Tork, Intermatic

B. Equipment and Materials

1. QL Induction Generators

a. QL Induction generators shall be installed luminaires with adequate heat-sink for operation in ambient temperatures of up to 120 degrees Fahrenheit.

b. QL Induction generators shall have a minimum starting temperature of minus 20 degrees Fahrenheit.

2. HID Ballasts

a. Provide magnetic regulator ballast or constant wattage autotransformer HID lamp ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly mate and match lamps to electrical supply by providing appropriate voltages and impedances for which lamps are designed.

b. All HID ballasts shall have a minimum starting temperature of minus 20 degrees Fahrenheit.

c. Ballasts shall operate at a minimum of 90 percent average power factor. Operation shall be suitable with a line voltage variation of +10%.

d. HID fixtures shall operate at 120V, 277V or 480V, as required on Contract Drawings.

3. Electronic Fluorescent Ballasts

a. Ballasts for standard (straight) tube lamps shall be of the high frequency (greater than 30KHz) electronic type which will operate the lamps at full light output.

b. Total harmonic distortion shall not be greater than 10%. Third harmonic distortion shall be less than 6%. Power factor shall be greater than .95.

c. Ballasts shall be manufactured to operate at voltage listed on luminaire schedule.

d. All ballasts shall have a Class 'A' minimum sound rating.

c. All fluorescent ballasts shall have a minimum starting temperature of minus 20 degrees Fahrenheit.

2.7 LED LUMINAIRES

A. LED luminaires shall not be retrofit to existing luminaire housing; the Contractor shall replace housing along with the luminaire as a single unit. Light sources shall be compatible with dimmable drivers supplied with the luminaires in which they are to be installed. All light sources of a similar type shall be provided by the same manufacturer.

B. LED light sources shall meet or exceed the following requirements:

1. CCT, CRI and Flux:s

a. Correlated Color Temperature (CCT) – All LED light sources shall emit white light and have a CCT of 3000K nominal in accordance with ANSI C78.277.

b. Color Rendering Index (CRI) – All LED light sources shall have a minimum Color Rendering Index (CRI) of 70 per the LM79 test results.

c. Luminous Flux – LED light sources shall not exceed the junction temperature recommended by the LED manufacturer. Luminous flux differences between LEDs shall not exceed 10 percent.

2. LEDs shall have a minimum rated life of 60,000 hours per IES TM-21 at 55°C at the normal operating driver current for the specific luminaire. The lumen output shall be maintained at 70 percent of initial rated lumens (L70) or greater at the rated life of the luminaire.

3. LEDs shall be temperature rated for operation and storage within the range of -40°C to +50°C, and shall withstand low and high frequency vibration (ANSI C136.31 Vibration Level 3G) over the rated life of the light source.

4. Cooling System

a. Mechanical design of protruding external surfaces (e.g. heat sink fins) shall facilitate hose-down cleaning and discourage debris accumulation.

b. The cooling system must be passive utilizing heat sinks, convection or conduction.

c. Fans, diaphragms, pumps, or liquids shall not be acceptable.

C. LED Drivers. Led drivers shall conform to the following:

1. Dimming signal protocols are 0-10VDC or Digital Addressable Lighting Interface (DALI).

2. Operating voltage shall be 120/277-volt at 50/60 Hz, and shall operate normally with input voltage fluctuations of ±10 percent, consistent with NEMA SSl-1-2010, Electronic Drivers for LED Devices, Arrays or Systems.

3. Minimum Power Factor (PF) shall be 0.90 at full input power and across specified voltage range.

4. Maximum Total Harmonic Distortion (THD) shall be 20 percent at full input power and across specified voltage range.

5. Factory-set drive current shall be 530mA or less unless approved by Engineer. If higher drive currents are proposed, the submittal must be accompanied with IES LM79 and TM21 test results for higher operating drive current.

6. Drivers shall be Restriction of Hazardous Substances (RoHS) compliant.

7. Rated case temperature shall conform to subsection 715.04 (c) b.

8. All electronics of the power supply and the LEDs shall be protected from all electrical surges with an elevated electrical immunity rating, including but not limited to lightning strikes and stray current in rebar and concrete. Surge protection shall be integral to the LED power supply.

9. Luminaire, including driver, shall consume no more than 4 watts in the off state power.

10. Electrical immunity (including surge protection)

11. Luminaire shall meet the “Elevated” requirements per IEEE C62.41.2 -2002. Manufacturer shall indicate whether failure of the electrical immunity system can possibly result in disconnect of power to luminaire.

12. Electromagnetic interference: Shall comply with Federal Communications Commission (FCC) 47 Code of Federal Regulations (CFR) part 15 non-consumer radio frequency interference (RFI) and/or electromagnetic interference (EMI) standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. All products and materials shall be inspected by Contractor upon delivery to identify any defects. Report to the Engineer all defects that will affect the installation.

Contractor shall be held responsible for any existing defects which adversely affect the luminaire or its functioning.

3.2 INSTALLATION

A. The installation shall be in accordance with all governing local ordinances and regulations, the Contract Drawings, these Specifications which apply.

B. Install all luminaires in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that luminaires fulfill all requirements.

C. The Contractor shall coordinate his work with other construction phases so as to provide a minimum of interference to the combined operations. Contractor shall also coordinate his work with the work on adjacent projects where required.

D. Install all luminaires at locations and heights as indicated.

E. All field drilled holes in light standards shall be de-burred and cold galvanized.

F. Provide flexible inner-duct for lower voltage wires to maintain voltage separation within light standards where different voltage wires are required for additional electrical equipment mounted to light standards.

G. Provide labor and materials for final focusing of all adjustable luminaires under the Engineer’s supervision. Aim adjustable luminaires in night test of system. Focusing shall take place before Project is turned over to the Owner.

H. Clean the housing, trim, reflector surfaces, lens of all luminaires after construction is complete, so as to render them free of any dirt, dust, oil, and grease.

I. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

J. Provide ground rod(s) at each pole with grounding conductors. All ground rod systems shall have an electrical resistance of 10 Ohms or less.

K. Bond light fixtures and metal accessories to branch circuit equipment grounding conductor No. 6 AWG copper minimum.

L. Any luminaire, standard, foundation, or other lighting/electrical equipment damaged during construction shall be replaced or satisfactorily repaired.

M. Replace all burned out lamps, or inoperative lamps and/or inoperative ballasts and transformers in all luminaires just prior to acceptance of Project by Owner. Ascertain and make sure that all lamps installed are exactly as specified for each luminaire type.

N. Notify Engineer about field conditions at variance with Contract Documents. This includes but is not inclusive of changes in landscape type and location, and field verification of towers, trees, walls, boundary markers, signs, walkways, and other changes that affect location of equipment.

O. It shall be the Contractor's responsibility to replace and restore all surface materials in kind, equal to, or exceeding those disturbed by trenching, excavation or backfilling operations. This includes but is not limited to: seeding, sod, replacement of sub-base, pavement, trees, shrubs. All excess materials shall be disposed of as directed by Owner.

3.3 TESTS

A. All lighting circuits and equipment shall be given an initial operational test, consisting of having the entire system energized for seventy-two (72) consecutive hours without any failures of any type occurring anywhere in the system. All circuits shall test clear of faults, grounds and open circuits to the satisfaction of the Owner.

B. The Contractor shall demonstrate that the lighting controls, including photocell, time switch, and lighting contactors, are fully operational and comply with the Sequence of Operations.

C. After satisfactory completion of all tests required in these Specifications and by the Contractor’s, the illumination system shall be placed in operation. Final acceptance will not be made until the system has operated satisfactory for a period of not less than fourteen (14) days.

D. The Contractor shall be fully responsible for the system during this period of operation and he shall make any adjustment or repairs which may be required, and remedy any defects or damages which may occur.

E. The Contractor shall not be required to pay for electrical energy consumed by the system during the period of trial operation.

END OF SECTION 26 56 01

SECTION 31 00 00 – EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, and Division One and other related specification sections apply to work of this section.

1.2 SECTION INCLUDES

A. Clearing, grubbing and site preparation

B. Removal and disposal of debris

C. Handling, storage, transportation, and disposal of excavated material

D. Sheeting, shoring, bracing and protection work

E. Pumping and dewatering as required or necessary

F. Backfilling

G. Pipe embedment

H. Construction of fills and embankments

I. Excavation for buildings & structures

J. Pavement Subgrade preparation

K. Trench Stabilization

L. Final grading

M. Slope Stabilization

N. Erosion Control

O. Appurtenant work

1.3 RELATED SECTIONS

A. Section 32 12 00 – Flexible Paving

1.4 REFERENCES

A. AASHTO – American Association of State Highway and Transportation Officials

B. ASTM – American Society for Testing and Materials
   1. C33 – Concrete Aggregates

2. C136 – Sieve Analysis of Fine and Coarse Aggregates
3. D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb Rammer and 12-Inch Drop
4. D1241 – Material for Soil Aggregate Subbase, Base and Surface Courses
5. D4253 – Test Methods for Maximum Index Density of Soils and Unit Weight of Soils Using a Vibratory Table
6. D4254 – Test Methods for Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density
7. D6938 – Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

C. ACI – American Concrete Institute
1. 229 – Controlled Low-Strength Materials

D. CABO/ANSI – Council of American Building Officials/American National Standards Institute
1. A117.1 – Accessible and Useable Buildings and Facilities Standards

E. CDOT – Colorado Department of Transportation

F. OSHA – Occupational Safety and Health Administration

1.5 SUBMITTALS

A. Submit under provisions of Division One specifications.

B. Product Data: Submit on all products or materials supplied herein

C. Test Reports: Indicate supplier, sieve analysis, optimum moisture content and density in accordance with ASTM D698 if appropriate for crushed rock or gravel, pipe embedment and material for fills and embankment

1.6 REGULATORY REQUIREMENTS

A. Burning will not be allowed on-site. Comply with all applicable codes, regulations, and laws.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

C. Obtain and comply with all requirements of City of Boulder and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

D. For public improvements only, in the event of a conflict between municipal standards and this specification, municipal standards for products and installation will govern.

E. Excavation work shall be performed in compliance with City of Boulder and current OSHA requirements.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling

B. Protect work from erosion or other similar types of damage until the project has been accepted. Leave protection in place for building contractors use.

C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35°F and rising

D. Do not use frozen materials, snow, or ice in any backfill or fill area

E. Do not backfill or construct fill on frozen surfaces

F. Protect excavated material from becoming frozen

G. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities

H. Provide temporary bridges for roadways, walkways, driveways, etc.

1.8 QUALITY ASSURANCE

A. All imported material to be free of hazardous and organic wastes, “clean” as defined by EPA, and approved for its intended use by the Owner or project geotechnical engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. General - Soil materials, whether from sources on or off the site must be approved by the soils engineer as suitable for intended use and specifically for required location or purpose.

B. Classification of Excavated Materials:
   1. No classification applies. Remove and handle all excavated materials regardless of its type, character, composition, condition, or depth. This includes the sandstones and claystones encountered onsite which can be ripped from place using a Caterpillar Model 235 trackhoe or equivalent, rippers, chisels, breaker bars, and/or other hand or mechanical methods.
   2. Excavation of rock that cannot be excavated as outlined above will be considered rock excavation and may require alternative means that may include drilling, blasting, or expansive compounds.
   3. Transport and properly dispose of any rubble and waste materials found in excavation off the Owner’s property
      a. If transite or asbestos containing materials are found in excavation, notify the Owner immediately and comply with special handling requirements.

C. Fills and Embankments
   1. To the maximum extent practical use excess earth from onsite excavation for fills and embankments.
   2. Free from rocks or stones larger than 12 inch in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials
   3. Fill and embankment material must be acceptable to Engineer
   4. No rocks or stones larger than 6 inch in upper 18 inches of fill or embankment. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.

D. Imported Fill for Fills and Embankments:

1. The contractor is responsible for obtaining additional material for fills and embankments as necessary to meet the requirements shown on the plans.
2. Imported fill conforming to the following:
   a. Gradation (percent finer by weight ASTM C136): 3" – 100% passing, No. 4 Sieve – 50-100% passing, and No. 200 Sieve – 35% passing (max)
   b. Liquid Limit: 35 (max), Plasticity Index: 15 (max), Group Index: 10 (max)

E. Structural Fill
1. Imported structural fill, such as a ½-inch minus, CDOT Class 7 Aggregate Road Base, conforming to the following:
   a. Gradation: 1" – 100% passing (percent finer by weight ASTM C136), No. 8 Sieve – 20-85% passing, and No. 200 Sieve – 20% (max)
   b. Liquid Limit: 35 (max), Plasticity Index: 15 (max), R- Value: 50 (min)

F. Topsoil
1. Topsoil is defined as fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of rocks, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth for areas to be seeded or planted. Coordinate testing requirements with Landscape Architect and Owner.

G. Grubbings
1. Grubbings are defined as the first 1 inch of surface vegetation and topsoil consisting of primarily existing grass groundcover free of roots, brush, and other objectionable material and debris.

H. Pipe Embedment: Graded gravel
1. Comply with City of Boulder, requirements for pipe embedment for public utilities.
2. 3/4" – 1" Crushed rock – AASHTO 57/67

Sieve Size (Inch)	Percent Passing by Weight
1	100
3/4"	90-100
1/2"	25-60
3/8"	20-55
NO. 4	0-10
NO. 8	0-5
NO. 200	0-2

3. Squeegee

Sieve Size	Percent Passing by Weight
3/8"	100
No. 4	85-100
No. 8	30-70
No. 16	5-40
No. 30	0-15
No. 50	0-10
No. 100	0-5
No. 200	<1

4. Refer to Foundation or Underdrain specification for perforated pipe bedding requirements

I. Compacted Trench Backfill

1. Job excavated material finely divided, free of debris, organic material, and stones larger than 6 inch in greatest dimension without masses of moist, stiff clay, or topsoil

J. Controlled Low Strength Material (Flow Fill)
1. Comply with City of Boulder requirements and ACI 229 for the use of flowable fill within the right-of-way or for public utility trench backfill.
2. Product shall be a lean, sand-cement slurry, “flowable fill” or similar material with a 28-day unconfined compressive strength between 50 and 200 psi.

K. Non-woven geotextile fabric
1. Needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Product must be inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Product must meet AASHTO M288-06 Class 3 for elongation > 50%.
   a. Mirafi 140N or accepted substitution

PART 3 EXECUTION

3.1 EXAMINATION

A. Field verify the location of all underground utilities, pipelines and structures prior to excavation

3.2 PERFORMANCE—GENERAL

A. Contractor to verify quantities of cuts and fills and perform all earthwork required to meet the grades as shown on the plans, including but not limited to, additional import or export required to handle compaction, building and pavement subgrade preparation, and pipe bedding.

B. Perform work in a safe and proper manner with appropriate precautions against hazard

C. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

D. Contain all construction activity on the designated site and within the limits of work. Cost of restoration off site will be the responsibility of the Contractor

3.3 PRESERVATION OF TREES

A. Do not remove trees outside fill or excavated areas, except as authorized by Engineer

B. Protect trees and their roots within the drip line that are to remain from permanent damage by construction operation

C. Trim standing trees in conflict with construction operations as directed by Owner and Landscape Architect.

3.4 PREPARATION

A. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris.

B. Strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil. Strip and stockpile all on-site material meeting the topsoil definition for all areas receiving grading where shown on drawings

C. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.

D. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted

3.5 TOPSOIL

A. At the completion of work in each area, place and grade topsoil to maintain gradient as indicated and required.

B. Clean topsoil, free of plants and seed will be spread to 4 inch minimum depth, or as specified by landscaping specifications and plans, whichever is greater, for areas of the site as detailed by the landscape plans.

C. Reuse grubbings and surface topsoil containing plants and seeds in designated revegetation areas only.

D. Provide separate stockpiles of topsoil for building contractors of quantity and location designated on the plans

3.6 DEWATERING

A. Provide and maintain adequate dewatering equipment (including power supply, if necessary) to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the work

B. Keep each excavation dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result

C. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least 12 inches below the bottom of the excavation

D. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property

E. Maintain all drainage pipes, keep clean and free of sediment during construction and final cleanup

F. Dewatering to surface waterways requires Colorado Department of Public Health and Environment dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, if necessary

3.7 SHEETING, SHORING AND BRACING

A. Provide proper and substantial sheeting, shoring, and bracing, in accordance with OSHA Standards as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities

B. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure, and to be rigid, maintaining shape and position under all circumstances

C. Do not pull trench sheeting before backfilling unless pipe strength is sufficient, to carry trench loads based on trench width to the back of sheeting

D. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe

E. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed

F. Contractor responsible for obtaining all required permits or easements for encroachments into the public right-of-way and for coordinating any encroachments onto adjacent properties.

3.8 TRENCH STABILIZATION

A. Thoroughly compact and consolidate subgrades for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities

B. Remove all mud and muck during excavation

C. Reinforce subgrades with crushed rock or gravel if they become mucky during construction activities

D. Finished elevation of stabilized subgrades are to be at or below subgrade elevations indicated on drawings

E. Allow no more than ½ inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

3.9 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot

B. Remove existing unsuitable/uncompacted fill, old foundations, rubble/debris, soft or otherwise unsuitable material, and replace with suitable material in excavation

C. Refer to soils report, for overexcavation and recompaction areas at site structures. The subexcavation shall be configured at a minimum side slope inclination of 1(horizontal):1(vertical) from the toe of the subexcavation slope. The toe of the subexcavation slope shall be no closer than 5 feet outside the outermost edge of all concrete footings or building boundaries laterally, whichever is larger. Slope shall continue to the proposed surface grades.

D. Provide dewatering and temporary drainage as required to keep excavations dry.

E. Reshape subgrade and wet as required

3.10 PAVEMENT OVEREXCAVATION AND SUBGRADE PREPARATION

A. Excavate subgrade for asphalt pavement areas per the lines, grades, and dimensions indicated on drawings within a tolerance of plus or minus 0.10 foot. Excavate subgrade for concrete

pavement areas per the lines, grades, and dimensions indicated on drawings within a tolerance of plus or minus 0.05 foot.

B. Overexcavate and scarify existing soil as required under pavement areas, slabs, curbs and walks to meet the moisture and compaction specifications herein to depth shown on drawings.

C. Extend subgrade preparation a minimum of 1 foot beyond back of proposed pavement, slabs, curbs and walks.

D. Proof roll with a pneumatic tire equipment with a minimum axle load of 18 kips per axle a maximum of 24 hours prior to paving to locate any soft spots that exhibit instability and deflection beyond subgrade tolerances listed above. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Geotechnical Engineer, shall be ripped, scarified, dried or wetted as necessary and recompacted to the requirements for density and moisture at the Contractor's expense. After recompaction, these areas shall be proof rolled again and all failures again corrected at the Contractor's expense.

E. If the Contractor fails to place the sub base, base course, or initial pavement course within 24 hours or the condition of the subgrade changes due to weather or other conditions, proof rolling and correction shall be performed again at the Contractor's expense.

3.11 FILLS AND EMBANKMENTS

A. Level and roll subgrade so surface materials will be compact and bond with the first layer of fill or embankment

B. Place in horizontal layers at maximum uncompacted depth per compaction specifications herein.

C. Spread and level material deposited in piles and windrows before compacting

D. Thoroughly compact each layer by rolling or other means acceptable to Geotechnical Engineer to meet the moisture and compaction specifications herein.

E. Alter compaction methods if material fails to meet specified density

F. Where a trench passes through a fill or embankment, place and compact fill or embankment to 12 inch above the top of the pipe before excavating the trench

G. Add water and harrow, disc, blade, or otherwise work each layer to obtain the uniform moisture content and adequate compaction

H. Refer to geotechnical report for additional requirements for fill and subgrade preparation requirements.

I. Per the soils report, prior to filling, the top 12 inches of in-place materials on which fill soils will be placed should be scarified, moisture content and properly compacted in accordance with the parameters shown in the report to provide a uniform base for fill placement.

3.12 COMPACTION

A. Place backfill and fill materials in layers not more than 8 in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure as described herein.

C. Refer to geotechnical report for additional requirements for site development material, subexcavation, compaction, etc.

D. Percentage of Maximum Dry Density Requirements: Moisture treat and compact soil to not less than the following percentages of maximum dry density and to within the specified moisture content range of optimum moisture content according to ASTM D 698 as follows:

Surface Improvement	Compaction %	Moisture Content
Structures	98%	-2 to +2
Paved Areas	95%	-2 to +2
Synthetic Turf Fields	95%	-2 to +2
Utility Trenches	95%	-2 to +2
Lawns or Unpaved Areas	90%	-2 to +2
Public Right-of-way	Per municipal standards	

1. Do not deposit or compact tamped or otherwise mechanically compacted backfill if frozen or if in water.
2. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters, or other surface construction.

3.13 BORROW OR SPOIL AREA

A. Obtain suitable material required to complete fill and embankments from excavation, on-site areas.

B. The location, size, shape, depth, drainage, and surfacing of borrow or spoil pits shall be acceptable to Owner.

C. Make all areas regular in shape with graded and surfaced side and bottom slopes when completed

D. Cut side slopes not steeper than 1:1 and uniform for the entire length of any one side

E. Final grade disturbed areas of borrow to uniform slope (maximum slope = 4:1, minimum slope = 50:1).

F. Use material free of debris and deleterious material

G. Provide erosion and sediment control measures for borrow or spoil areas as required by municipal or local Municipal Separate Storm Sewer System (MS4) requirements.

3.14 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Use excess excavated materials in fills and embankments as indicated on the drawings to the extent needed. Coordinate with Owner and Engineer on locations for excess material placement.

B. The Contractor is responsible for disposing of excess excavated materials from the site to a location approved by the Owner or Engineer and permitted with the local authorities.

C. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots, and other unsuitable material from the site and dispose of it

3.15 TRENCH EXCAVATION

A. Establish alignment and grade or elevation from offset stakes provided by the contractor's surveyor.

B. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the drawings

C. Comply with pipe specification sections regarding vertical and horizontal alignment and max joint deflection

D. Where grades or elevations are not fixed on the drawings, excavate trenches to provide a minimum depth of backfill cover over the top of pipe as follows. Coordinate depth of cover with utility owners. Increase depth as required by utility owner and at crossings.
   1. 2.5 feet for gas piping
   2. 2.5 feet for electric, telecom, and fiber optic conduit.
   3. 2.0 feet for irrigation piping
   4. Increase depth as required at vertical curves and for clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades

E. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation

F. Do not open more trench in advance of pipe laying than is necessary to expedite the work; not more than 200 feet

G. Except where tunneling or boring is indicated on the drawings, specified, or permitted by Engineer, excavate trenches by open cut from the surface

H. Limiting trench widths
   1. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment
   2. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than 1 foot above the top of the pipe
   3. Stipulated minimum clearances are minimum clear distances, not minimum average distances
   4. Maximum trench width from 1 foot above the top of pipe to trench bottom is the pipe outside diameter plus 24 inches
   5. If the width of the lower portion of the trench exceeds the max permitted, provide special pipe embedment, or concrete encasement as required by loading conditions

I. Mechanical excavation
   1. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas
   2. Use mechanical equipment of a type, design, and construction and operated so that
      a. Rough trench bottom elevation can be controlled
      b. Uniform trench widths and vertical sidewalls are obtained from 1 foot above the top of the installed pipe to the bottom of the trench
      c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls
   3. Do not undercut trench sidewalls
   4. Recompact trench bottom disturbed by bucket teeth prior to placement of embedment material

J. Except as otherwise required, excavate trenches below the underside of pipes as indicated in the drawings to provide for installation of granular embedment pipe foundation material

K. Where in earth, trench bottoms for 6 inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support (between bell holes or end joints) of the installed pipe, Contractor's option

L. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material as Engineer may direct

M. For unstable soils, provide concrete or other bedding as directed by Engineer

N. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined

O. Cuts in existing surface construction
   1. No larger than necessary to provide adequate working space
   2. Cut a clean groove not less than 1½ inch deep along each side of trench or around perimeter of excavation area
   3. Remove pavement and base pavement to provide shoulder not less than 6 feet wide between cut edge and top edge of trench
   4. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation
   5. Remove pavement for connections to existing lines or structures only to the extent required for the installation
   6. Replace the pavements between saw cuts to match original surface construction

3.16 PIPE EMBEDMENT

A. Embed pipes above and below the bottom of pipe as indicated in the drawings and as specified herein

B. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints

C. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe and to hold the pipe in proper position and alignment during subsequent operations

D. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent lateral displacement

E. Granular embedment compact by slicing with shovel or vibrating
   1. Maximum uncompacted thickness of layers: 6 inch

F. Compacted embedment: Place in horizontal layers at maximum uncompacted depth per compaction specifications herein. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

3.17 TRENCH BACKFILL

A. Compacted backfill needed for all trench excavations

B. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench

C. Place job excavated materials in 8 inch max uncompacted thickness, uniform layers
   1. Increased layer thickness may be permitted for uncohesive material if Contractor demonstrates to Engineer's satisfaction that specified compacted density will be achieved
   2. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

D. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe

E. Graded gravel
   1. Deposit in uniform layers of 12 inch max uncompacted thickness
   2. Compact with suitable vibrating roller or platform vibrator to not less than 70 percent relative density per ASTM D4253/D4254

F. Finish the top portion of backfill with at least 4 inches of topsoil or as specified by landscaping specifications, whichever is greater, corresponding to, or better than, that underlying adjoining turf areas.

G. Trench backfill within the public right-of-way shall conform to municipal street and utility standards.

H. Trench backfills through unimproved areas should be restored to previous conditions and left 3” above adjacent grades to allow for settlement. Seed all disturbed areas according to landscape specifications.

3.18 PROTECTION OF TRENCH BACKFILL

A. Where trenches are constructed in ditches or other water courses, protect backfill from erosion

B. Install ditch checks where the ditch grade exceeds 1 percent
   1. Minimum depth: 2 feet below the original ditch or water course bottom for the full bottom width
   2. Minimum width: 18 inches into the side slopes
   3. Minimum thickness: 12 inches

3.19 DRAINAGE MAINTENANCE

A. Do not backfill trenches across roadways, drives, walks or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid

B. Backfill so that water does not accumulate in unfilled or partially filled trenches

C. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours

D. Do not obstruct surface drainage any longer than necessary

E. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic

F. Provide adequate storm flow conveyance through the site at all times during construction to avoid flooding of any buildings or adjacent property. Provide overland drainage routing when storm sewer inlets are not fully functioning due to erosion and sediment control measures.

3.20 FINAL GRADING

A. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the indicated elevations

B. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work

C. Grade all surfaces for effective drainage, provide a 2 percent minimum slope except as otherwise shown on the plans

D. Provide a smooth transition between adjacent existing grades and new grades

E. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances

F. Slope grades to direct water away from buildings and prevent ponds from forming where not intended.

G. Finish subgrades at lawns and unpaved areas to required elevations within a tolerance of plus or minus one (1) inch.

H. Coordinate final subgrade depth with finish landscape treatment.

3.21 SLOPE AND CHANNEL STABILIZATION

A. Cover channel banks, slopes, bottom and thalweg (water flowline at lowest point in channel) with erosion control fabric mat where grade is steeper than 3H to 1V and where indicated on the Drawings

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6-inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil

C. Secure outside edges and overlaps at 48 inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches

F. Maintain integrity of erosion control fabric

G. Prior to laying fabric, seed disturbed areas under provisions of related seeding and landscaping specification sections.

3.22 SETTLEMENT

A. Warranty for settlement of all fills, embankments, and backfills is stipulated in the General Conditions from final completion of Contract under which Work is performed

B. Repair or replace within 30 days after notice by Engineer or Owner

3.23 FIELD QUALITY CONTROL

A. Provide under provisions of General Conditions and Division One Specifications

B. Coordinate testing with Owner. Owner will provide all field testing to determine compliance of in-place and backfill materials and compaction in accordance with the specifications, and to verify design bearing capacities.

C. Fills and Embankment Testing
1. Two moisture-density relationship tests, ASTM D698, on each type of fill material
2. One in-place compaction test for each 5,000 square feet every 1.5 feet of vertical lift of material placed
3. Additional in-place compaction tests at the discretion of the Owner

D. Pipe Embedment and Backfill Testing
1. Two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material
2. One in-place compaction test every 200 lineal feet of trench in the compacted embedment zone and at every 1.5 feet of vertical lift of backfill materials, ASTM D2922/D3017
3. One in-place compaction test near top of trench for trench depth of 2 feet or less, ASTM D2922/D3017
4. Additional in-place compaction tests at the discretion of the Owner

E. Pavement and Structural Subgrade Testing
1. At a minimum, two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate and adequate for each type backfill material proposed.
2. Perform tests for each footing, concrete site feature, and drainage structure subgrade. Perform tests at every 100 linear feet of subgrade of foundation walls, retaining walls, and every 150 feet for curbing, pans, drainage features, walks, etc. (or portions thereof). Perform tests every 2,000 square feet required of building slab area, exterior slabs and pavement/flatwork areas (with no less than 3 tests). Test at subgrade and at every vertical lift of backfill materials placed.
3. Additional in-place compaction tests at the discretion of the Owner

END OF SECTION 31 00 00

SECTION 31 13 00: SELECTIVE TREE PROTECTION, REMOVAL AND TRIMMING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The conditions and general requirements of the Contract, Division 0 and applicable parts of Division 1, apply to the work under this Section.

B. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the work in accordance with all local, state and federal regulations in force at the time of this Contract and in accordance with the various Items specified herein.

C. The work of this Section consists of all tree protection, pruning and removal work and related Items as specified herein and includes, but is not limited to:

1. Tree Protection
2. Crown Cleaning
3. Crown Raising
4. Crown Reduction
5. Crown Thinning
6. Crown Training
7. Tree Removal
8. Shrub Removal

D. All work in this section shall be performed by a licensed City of Boulder Certified Arborist. (See 1.02, Qualification of Arborist, below.)

E. All trees to be pruned or removed are located on the site. All trees indicated shall be inspected by the Arborist, Owners Representative and Landscape Architect before work is to be done. In addition to trees indicated for removal on the Drawings, trees should be removed for the following reasons: dead trees, hazardous trees, or trees in serious decline, as determined by a certified Arborist. If the Arborist discovers tree(s) which have not been marked for removal and are intended for pruning, but whose condition is such that removal is warranted, whether due to death, disease, decay, damage, or structural weakness, such tree(s) shall not be pruned and the Arborist shall immediately report these findings in writing to the Owner and await the Owner's direction before proceeding with work on the particular tree(s) in question.

F. The intent of this portion of the Contract is to identify trees that should be removed while pruning all remaining trees on the site to provide safety, protection of property, clearance of roadways, walks, buildings and luminaries, and to improve the overall structure of the trees.

G. The Contractor is required to review and inspect the site regarding trees to be removed (as indicated on the Drawings) prior to bid proposal in order to form his/her own assumptions as to the ultimate cost of the work.

H. The Contractor shall be required to measure the DBH (Diameter of the tree at 4.5' from the ground) of each tree pruned and to record the species of the tree and its overall condition after pruning. This report shall also include any police detail information. Payments will not be processed until this information is received.

1.02 QUALIFICATION OF ARBORIST

A. The City of Boulder arborist license is a two tier system:

1. Certified Arborist License – for all ISA certified arborists or professional level tree care companies. Licensees in this category have demonstrated a higher level of knowledge and professionalism and are allowed to perform tree work to trees in the public rights-of-way and to both public and private trees that are infested/infected with a major insect/disease problem.

2. Tree Contractor – for all persons/companies performing tree work that are not ISA certified or choose not to test through the city of Boulder office. Licensees under this category are not allowed to perform tree work to trees in the public rights-of-way or to both public and private property trees that are infested/infected with a major insect/disease problem.

B. Work on this section of the Contract shall be limited to individuals, partnerships and corporations who are actively engaged in the field of Arboriculture, and who demonstrate competence, experience and financial capability to carry out the terms of this project. Subcontractors must derive a majority of their income from arboricultural work. The Owner may require proof of these qualifications.

C. Unless otherwise approved by the Owner, all work shall be conducted by qualified and trained personnel under the direct supervision of a Certified Arborist, in good standing. A Certified Arborist must be on site at all times during any pruning operations. The Contractor shall be required to provide proof of certification.

D. Any subcontractor hired by the General Contractor to perform any portion of the work shall meet all qualifications herein and be acceptable to the Owner.

1.03 SPECIAL REQUIREMENTS

A. Dutch elm disease wood (if any) shall be disposed of in accordance with provisions of General Laws, Chapter 87, Section 5, and Chapter 132, Section 8 and 11 as amended; and in accordance with any additional local regulations. All wood shall be removed from the site and be properly disposed of in accordance with state and local regulations.

B. No burning is permitted on the project site.

C. Prior to commencing work, the Contractor shall submit a plan for legal disposal of removed materials, acceptable to the Owner.

D. The Contractor shall be required to place door hangers at all properties that abut a tree to be serviced. The door hanger will contain information regarding the City's intention to prune the trees near their property. The Contractor shall be required to indicate the date when the trees will be serviced on the door hanger. The door hanger is to be placed 48 hours in advance of the work. Door hangers will be provided by the Owner.

1.04 STANDARDS AND DEFINITIONS

A. Pruning and Removals shall conform to the following:

1. American National Standards Institute (ASNI): Standard A300-2001 Standard Practices for Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance

2. American National Standards Institute (ANSI): Standard Z-133.1.-2001 Safety Requirements for Tree Care Operations – Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush

3. All other applicable Occupational Safety and Health Administration (OSHA) standards, and state and local regulations.

B. American National Standards Institute- (ANSI) is the private, non-profit organization that administers the safety and maintenance regulations for the Tree Care Industry.

C. Crown Cleaning- The removal of dead, diseased, obstructing, split, and/or broken branches that are 2 inches in diameter or greater. Limbs that are susceptible to failure from dense or heavy foliar masses should be thinned.

D. Crown Raising- The removal of lower tree branches to allow safe movement of vehicles and pedestrians under the canopy of the tree. Limbs above sidewalks shall be no lower than 10 feet from the ground. Limbs over the road shall be no lower than 16 feet from the ground.

E. Crown Reduction- The technique used to reduce the overall mass of the tree by thinning out the top and sides or just removing individual limbs of the tree. Reduction pruning is commonly associated with pruning away from buildings, structures, signs, lights and other overhead obstructions.

F. Crown Thinning- The selective removal of branches to increase light penetration and air movement. No more than 25% of the trees living branches shall be removed.

G. Crown Training- A pruning process that utilizes all the major pruning types to promote a strong central leader and strong scaffold branches on recently planted trees.

H. D.B.H.- Diameter at breast height. The location on a tree 4.5 feet above ground where the diameter of the tree is measured.

I. International Society of Arboriculture- (ICA) An individual who is listed by the City of Boulder and ICA who has passed a comprehensive exam and maintained their certification through the accumulation of continuing education credits.

J. Occupational Safety & Health Administration- (OSHA) is the Federal agency responsible for insuring worker safety.

K. Owner- the individual or designated representative responsible insuring the requirements of this Contract are adhered to.

L. Street tree- Any tree planted and maintained with in the public right of way under the jurisdiction of the City of boulder

M. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction, defined by the drip line or 15 fee from the trunk (whichever is greater) of individual trees or the perimeter drip line or 15 fee from the trunks of the outermost trees in the group (whichever is greater), unless otherwise indicated. Tree Protection Zones shall be fenced as outlined below.

1. For a full set of Tree Protection Standards see the City of Boulder Design and Construction Standards, Chapter 3 “Streetscape Design and Tree Protection”

1.05 EXAMINATION OF SITE AND DOCUMENTS

A. The Contractor shall be responsible for having a clear understanding of the existing conditions of the site before submitting a bid for this Contract and shall be responsible for fully carrying out the work of the Contract, regardless of actual site conditions encountered.

1.06 ORDER OF WORK

A. Before any work is started, the Contractor shall attend a conference with the Owner and the Landscape Architect. The Contractor shall provide a list of trees that should be removed for the following reasons: dead trees, hazardous trees, or trees in serious decline. All trees to remain shall be pruned to provide safety, protection of property, clearance of roadways, walk, buildings and luminaries, and to improve the overall structure of the tree. The type of pruning to be performed includes but is not limited to crown cleaning, crown raising, crown reduction, crown thinning, and crown training. At this conference the Owner will also establish the order of precedence for carrying out the work.

B. Based on the conference, the Contractor shall submit a schedule of work for the Owner’s review and approval prior to beginning work. Any changes to this schedule must be approved by the Owner. Unless otherwise authorized by the Owner, failure of the Contractor to comply with the approved pruning and removal schedule shall be sufficient cause to give notice that the Contractor is in default of the Contract and will result in its termination. Unless otherwise authorized by the Owner, the Contractor must complete ALL pruning work within 40 business days from the notice to proceed.

1.07 CHANGES IN THE WORK

A. The Owner reserves the rights to change, add, or delete areas or quantities to be pruned or removed as deemed to be in the City's best interest.

B. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.

C. Any alterations or modifications of the work performed under this contract shall be made only by written agreement between the Contractor and the Owner. No claims for extra work or materials shall be allowed unless covered by written agreement.

1.08 PROTECTION OF VEGETATION TO BE PRESERVED

A. The Contractor shall protect all existing trees, shrubs and lawns designated to remain for the length of the construction period.

1. Protect adjacent trees and plants to remain from injury or damage. Do not stockpile soil or other material within drip line of trees or within 15 feet of the tree trunk, whichever distance is greater.

a. Protect existing trees to remain throughout construction by establishing a Protection-Zone Fencing.

b. Orange plastic safety mesh and 4' high minimum wood stakes shall be six (6) foot long by 1 inch by 1 inch square driven a minimum of two feet into the ground. Posts shall be spaced eight (8) feet on center, max.

c. Consult with Landscape Architect or owner's representative prior to staking out Protection-Zone Fencing

B. Root Protection

1. Tree roots shall not be cut unless cutting is unavoidable.

2. When rooting cutting is unavoidable, a clean, sharp cut shall be made to avoid shredding or smashing. Roots cuts should be made to a lateral root.

3. The Owner shall be notified of any cutting of the following roots:

a. Two roots having a diameter of more than 4 inches, or

b. Four roots having diameters between 2 and 4 inches.

4. Trenches shall be hand-dug within the dripline in areas where roots 2 inches and larger in diameter are present, and when low branches which may be damaged by equipment are present.

5. Whenever possible, roots 2 inches or larger in diameter shall be tunneled or bored under and shall be covered to prevent dehydration. Exposed roots shall be covered immediately with soil or burlap and kept moist.

C. Damage no plant to remain by burning, by pumping of water, by cutting of live roots or branches, or by any other means. No plants to be saved shall be used for crane stays, guys or their fastenings. Vehicles shall not be parked within the dripline of trees to remain, or wherever damage may result to trees to be saved. Construction material shall not be stored beneath trees to be saved.

D. The Contractor shall be liable for any damage to any tree, shrub or lawn to remain, and shall immediately report to the Owner for appraisal of any damage and for determination of corrective treatment of compensation to the Owner.

1. Damage to trees will be assessed based on the full appraised value of the tree. For example, 30% trunk damage will be assessed at 30% full value of the tree. Determination of damage will be made by the City Forester and be final.

E. The Contractor shall compensate the Owner for damages by installing replacement tree(s) of the size and species approved by the City, and of sufficient quantity such as the sum of the DBH inches for replacement trees equals the total DBH inches of the damaged tree(s). Damaged shrubs shall be replaced with shrub(s) of the same size, species, and quantity, unless determined otherwise by the Owner.

F. Damaged shrubs or lawns shall be restored or replaced to match existing to remain to the satisfaction of the Owner, at no cost to the Owner.

PART 2 - MATERIALS

2.01 EQUIPMENT AND MATERIALS

A. Equipment necessary for this Contract shall be properly maintained and in good operating condition to the City's satisfaction. The Contractor shall promptly remove and replace any equipment which the Owner deems to be in unsatisfactory repair or condition or otherwise unsuitable.

B. At the discretion of the Owner, if the equipment failures, breakdowns or other related problems occur that are jeopardizing the meeting of deadlines established in the written schedule provided by the Contractor, the Contract will be terminated.

C. Vehicles shall display prominently the Contractor's name, address, and telephone number on both doors.

D. Aerial lift equipment shall be required for pruning and removal work unless otherwise approved by the Owner. Such equipment shall have a minimal working height of fifty-five (55) feet, and shall include an articulated upper boom, insulated lower boom, a ten to fifteen (10-15) cubic yard enclosed hydraulic dump body, pintlehook and attachments for a towed chipper, or approved equal.

E. A chipper, meeting all OSHA requirements, shall be used which will process material up to twelve (12) inches in diameter.

F. A crane or log loader shall be used on site to remove logs too large to be chipped.

2.02 PERSONNEL

A. The Contractor shall submit each employee's name and title prior to the commencement of work. The Contractor shall provide a list of all City of Boulder Certified Arborists who will be working on this contract. This list shall include the names of those individuals and their certification number. The Contractor shall advise the Owner of any changes in the roster assigned to this contract.

B. A crew shall consist of a minimum, one (1) tree trimmer/ climber, and one (1) ground person (one of which shall be a crew foreman and a City of Boulder Certified Arborist in good standing). The crew foreman shall have a minimum of five (5) years climbing and pruning experience.

C. Each worker shall be experienced and highly qualified with necessary tree work skills to successfully complete this contract, including the ability and training to perform aerial rescue. Said skill shall also include worker safety and ability to be in compliance with current OSHA and ANSI Z-133.1 Standards.

PART 3 - EXECUTION

3.01 DESCRIPTION OF WORK

A. Each tree to be pruned shall be serviced according to the following types of pruning, as needed: Crown Cleaning, Crown Raising, Crown Reduction, Crown Thinning and Crown Training.

B. The Contractor shall adhere to the specifications and provide suitable facilities for inspecting the work. Failure of the Owner to immediately reject unsatisfactory work or to notify the Contractor of deviations from the Specifications shall not relieve the Contractor of responsibility to correct or remedy unsatisfactory work.

C. The Contractor shall only work on trees designated by the Owner. No compensation will be made for work performed on any other trees.

D. If the Contractor discovers tree(s) which have been marked for pruning, but whose condition is such that removal is warranted, whether due to death, disease, decay, or structural weakness, such tree(s) shall not be pruned and the Contractor shall report these findings to the Owner, in writing, within 24 hours, and await the Owner's direction before proceeding with work on the particular tree(s) in question.

E. Tree removal is generally described as the removal of individual trees that have been found to be dead, hazardous, and/ or otherwise marked for removal by the Owner.

3.02 USE AND CARE OF THE SITE

A. The Contractor shall leave the work site at the end of each working period in a condition satisfactory to the Owner.

B. Pavements shall be swept and lawns or other surfaces raked or otherwise cleaned of all material related to the work operation. Degree of clean up required will be described by the Owner at the Pre-construction Conference and will be based upon the character of the work area.

C. All trimmings or any other form of debris shall be collected, chipped, hauled and disposed of properly in accordance with all applicable laws at the Contractor's expense.

D. No over night parking of equipment will be allowed

3.03 PRUNING PROCEDURES AND QUALITY CONTROL

A. All pruning shall be performed in manner which maintains the natural aesthetic characteristics of the species and variety of trees. No topping or dehorning of trees or stubbing back of branches shall be permitted. All cuts shall be made to a lateral branch a minimum of one third (1/3) the size of the branch being removed, unless otherwise instructed by the Owner.

B. The use of climbing spurs or spiked shoes shall not be permitted for pruning trees and their use will result in immediate cancellation of the Contract. They are only permitted during tree removal operations and emergency aerial rescue operations.

C. All cuts shall be made sufficiently close to the parent stem so that wound closure can be readily started under normal conditions. Cuts shall never be made through the branch collar. Slab cuts, rip cuts and all other cuts that do not meet the most current edition of the ANSI A300 pruning standard will result in cancellation of the Contract.

D. Luminaries and proper elevation over street and sidewalk surfaces to at least the following minimum specifications:

1. Sidewalk/Paths – All branches shall be pruned to allow a minimum seven (7) foot clearance over sidewalks and paths, including proposed new paths.

2. Luminaries – Any and all branches extending directly below a street light, limiting the light reaching the street or path shall be removed and all branches shall be cut back to afford a minimum four (4) foot clearance.

3. House/Building – All branches shall be pruned to allow a minimum of five (5) foot clearance away from homes and buildings, or if possible ten (10) foot clearance where trees will not be severely disfigured due to crown reduction, this shall be determined by the City Arborist.

4. Street/Roads – All branches shall be pruned to allow a minimum sixteen (16) foot clearance over street surface.

E. All limbs over two inches in diameter to be removed shall be precut to prevent splitting. Any branches that would injure the tree or other objects by falling shall be lowered to the ground by proper rigging and rope procedures.

F. Remove one of two crossed or rubbing branches where practical so the removal will not leave large holes in the general outline of the tree.

G. On trees known to be diseased, tools are to be disinfected with alcohol after each cut between trees and where there is known to be a danger of transmitting the disease on tools.

H. Lateral branches as well as occasional water sprouts may be retained. Complete removal of secondary laterals and water sprouts resulting in the stripping of major limbs, will not be permitted.

3.04 REMOVAL PROCEDURES AND QUALITY CONTROL

A. Trees designated to be removed shall be taken down and all leaves, branches and trunks of trees properly disposed of by chipping or removal from the premises.

B. Trees are to be felled in such a manner that does not injure trees to be saved or endangers or harms the public and adjacent property.

C. Removal of all parts of each tree, excluding the stump, shall be completed on the same day that the removal process is started, including the trunk (or butt) of the tree.

D. Stump removal shall consist of grinding the stump and any roots to a depth of six inches below grade and the disposal of the wood waste. The area or tree pit is to be left at the finish grade using the specified planting mix that meets the requirements laid out in section 32 90 00. Unless otherwise approved by the Owner, the stump must be removed within ten (10) business days from the date the above ground portion of the tree is removed.

3.05 SAFETY

A. All equipment to be used and all work to be performed must be in full compliance with all standards as promulgated by OSHA at the time of bidding, including, but not limited to those regulations concerning noise levels, protective devices and operator safety.

B. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall protect the public and its property from injury or damage that could be caused by the progress of the work. To this end the Contractor shall post all work areas. The Contractor must also provide police details and / or erect and maintain protective devices acceptable to the City Arborist, including but not limited to barricades, lights and warning signs.

C. Any practice employed by the Contractor that is obviously hazardous, as determined by the City Arborist, shall be immediately discontinued.

3.06 FINAL ACCEPTANCE

A. Upon completion of the work the Contractor shall notify the Owner in writing and request that a final inspection for acceptance be made.

END OF SECTION 31 13 00

SECTION 31 23 17 – EXCAVATION AND EMBANKMENT (PHASE 1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work shall consist of excavation, embankment fill, disposal of excess material, shaping, and compaction of all material encountered within the limits of work, including excavation and backfill for structures. The excavation shall include, but is not limited to, the native soils which must be excavated for the project work. All work shall be completed in accordance with these Specifications and the lines and grades on the Drawings.

1.02 DEFINITIONS

A. Unclassified Excavation shall consist of the excavation of all materials on site to final grades, excluding the bid items included in section 02220. Excavation of unsuitable material will only be paid for if it is found to be unsuitable in its original state.

B. Muck Excavation shall consist of the removal and disposal of mixtures of soils and organic matter not suitable for foundation material and replacement with approved material. Material damaged due to rain or weather will not be paid for as Muck excavation and is entirely the responsibility of the CONTRACTOR.

C. Rock Excavation shall consist of igneous, metamorphic and sedimentary rock which cannot be excavated without the use of rippers, and all boulders or other detached stones each having a volume of 1/2 cubic yard or more, as determined by physical or visual measurement. It shall also include replacement with approved material as required.

D. Embankment (Complete in Place): shall consist of placing all excavated material, except material being hauled and disposed, as embankment and compacted to final grades as specified in the Contract Documents and on the Drawings.

1.03 DESCRIPTION

A. This work shall consist of excavation, disposal, placement, and compaction of all material encountered within the limits of the work, and not being completed under some other item, necessary for the construction of the project in accordance with the Specifications and the lines, grades, and typical cross-sections shown on the Drawings. All excavation will be classified, “unclassified excavation”, or “muck excavation” or “rock excavation”, as hereafter described. All embankment will be classified “embankment material” as hereafter described.

1.04 RELATED SECTIONS

A. Section 02230 – Clearing and Grubbing

B. Section 02240 – Water Control and Dewatering

C. Section 02320 – Trench Excavation and Backfill

1.05 QUALITY ASSURANCE

A. Final topography and/or cross-sections will be surveyed of areas that are to finished grade and compared to the design section for accuracy. Final grade shall match design grades within the tolerances discussed in PART 3 EXECUTION.

PART 2 PRODUCTS

2.01 MATERIALS

A. Embankment material may consist of approved material acquired from excavations or material hauled from outside the project limits. Suitable material identified on-site shall be used first for embankments and backfill. Excess excavated native soils which are not used as embankment or backfill shall become the property of the CONTRACTOR and shall be disposed of off-site by the CONTRACTOR, in a location acceptable to the ENGINEER.

B. Muck excavation encountered in all areas shall also include the replacement of excavated muck with uniformly graded rock, riprap, on-site or imported soils, or other material whichever is most suitable for the specific situation encountered. The ENGINEER will determine which type of aggregate or other material which shall be used after observing the specific site conditions.

PART 3 EXECUTION

3.01 GENERAL EXCAVATION/EMBANKMENT

A. General: The excavation and embankment for the project work shall be finished to reasonably smooth and uniform surfaces. Variation from the subgrade plane shall not be more than .08 feet in soil or more than .08 feet above or .50 below in rock. Where bituminous or concrete surfacing materials are to be placed directly on the subgrade, the subgrade plane shall not vary more than 0.04 feet. Materials shall not be wasted without permission of the ENGINEER. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed. Prior to beginning grading operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with Section 02230 of these Specifications.

When the CONTRACTOR's excavating operations encounter remains of pre-historic people's dwelling sites or artifacts of historical or archaeological significance, the operations, shall be temporarily discontinued. The ENGINEER will contact archaeological authorities to determine the disposition thereof. When directed, the CONTRACTOR shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper state authorities. Such excavation will be considered and paid for as extra work.

B. Excavation:

1. Unclassified: All excess suitable material excavated from the project site and not used for embankment shall be removed from the project site and become the property of the CONTRACTOR. Where material encountered within the limit of the work is considered unsuitable for embankment (fills) on any portion of this project work, such material shall be excavated as directed by the ENGINEER and replaced with suitable fill material. All unsuitable excavated material from excavation consisting of any type of debris (surface or buried), excavated rock,

bedrock or rocks larger than 6 inches in diameter and boulders shall be hauled from the project site and disposed of. Debris is defined as "anything that is not earth which exists at the job site".

2 . Muck: Where excavation to the finished grade section results in a subgrade or slopes of unsuitable soil, the ENGINEER may require the CONTRACTOR to remove the unsuitable materials and backfill to the finished graded section with approved material. Disposal of the material shall be at the CONTRACTOR's expense.

Good surface drainage shall be provided around all permanent cuts to direct surface runoff away from the cut face.

3. Rock: Unless otherwise specified, rock shall be excavated to a minimum depth of 0.5 feet below subgrade within the limits of the channel area, and the excavation shall be backfilled with material shown on the Drawings or as designated by the ENGINEER. Disposal of material and replacement with suitable approved material shall be at the CONTRACTOR's expense.

C. Embankment Construction: Embankment construction shall consist of constructing all fill areas, including preparation of the areas upon which they are to be placed, and the placing and compacting of embankment material in holes, pits and other depressions within the project area. Only approved materials shall be used in the construction of embankments and backfills.

Approved materials shall consist of clean on-site cohesive soils or approved imported soils. On-site cohesive soils are suitable for use as compacted fill provided the following recommendations are met:

Excavation and Embankment will only be paid when a significant change in grade is required, as determined by the ENGINEER. Minor cuts and fills will be considered incidental to the work, and will not be paid for separately under this section.

Gradation	Percent Finer by Weight (ASTM C136)
½-Inch	100
3/8-Inch	70 – 100
No. 4 Sieve	50 – 100
No. 200 Sieve	60 (min)

Gradation	Percent Finer by Weight (ASTM C136)
• Liquid Limit	35 (max)
• Plasticity Index	20 (max)
• In-Situ Coefficient of Permeability	$1x10^{-6}$ cm/sec

On-site cohesive soils or imported soils should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift and embankment height. On-site or imported cohesive soils should be compacted within a moisture content range of 2% below, to 2% above

optimum moisture content and compacted to 95% of the Maximum Standard Proctor Density (ASTM D698).

When embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built 1/2 width at a time, the slopes that are steeper than 4:1 when measured longitudinally or at right angles to the adjacent ground shall be continuously benched over those areas where it is required as the work is brought up in layers. Benching shall be well keyed and where practical a minimum of 8 feet. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be recompacted along with the new embankment material at the CONTRACTOR's expense.

The ground surface underlying all fills shall be carefully prepared by removing all organic matter, scarification to a depth of 8 inches and recompacting to 95% of the Maximum Standard Proctor Density (ASTM D698) at optimum moisture content + or - 2% prior to fill placement.

Embankment material shall be placed in horizontal layers not exceeding 8 inches (loose measurement) and shall be compacted to 95% of the Maximum Standard Proctor Density (ASTM D698) at optimum moisture content + or - 2%. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. As the compaction of each layer progresses, continuous leveling and manipulating will be required to assure uniform density.

For embankments which serve as berms, the downstream portion shall be "keyed" into the subsurface soils a minimum of 3 feet to enhance the stability of the slope.

Materials which are removed from excavations beneath the water table may be over the optimum moisture content and will require that they be dried out prior to reusing them.

Cross hauling or other action as appropriate will be ordered when necessary to insure that the best available material is placed in critical areas of embankments, including the top 2 feet of all embankments. No additional payment will be made for cross hauling ordered by the ENGINEER.

Frozen materials shall not be used in construction of embankments.

During the construction of the channels, the channel bottom shall be maintained in such condition that it will be well drained at all times.

Excavation or Embankment (Fill), and Structural Backfill work either completed or in a stage of completion that is either eroded or washed away or becomes unstable due to either rains, snow, snow melt, channel flows or lack of proper water control shall be either removed and replaced, recompacted or reshaped as directed by the ENGINEER and in accordance with the Drawings and Specifications at the CONTRACTOR's sole expense. Removed unsuitable materials shall be hauled away and disposed of at the CONTRACTOR's expense. Placing of replacement materials for removed unsuitable materials shall be purchased, placed and compacted at the CONTRACTOR' expense.

D. Proof rolling with a heavy rubber tired roller will be required, if designated on the Drawings or when ordered by the ENGINEER. Proof rolling shall be done after specified compaction has been obtained. Areas found to be weak and those areas which failed

shall be ripped, scarified, wetted if necessary, and recompacted to the requirements for density and moisture at the CONTRACTOR's expense.

Proof rolling shall be done with equipment and in a manner acceptable to the ENGINEER. Proof rolling as shown on the Drawings or as ordered by the ENGINEER shall not be measured and paid for separately, but shall be included in the unit prices bid for the work.

3.02 EXCAVATION AND BACKFILL FOR STRUCTURES

A. Poor foundation material for any of the work shall be removed, by the CONTRACTOR, as directed by the ENGINEER. The CONTRACTOR will be compensated for removal and replacement of such materials in accordance with Muck Excavation.

The CONTRACTOR is cautioned that construction equipment may cause the natural soils to pump or deform while performing excavation work inside and on footings, structural floor slabs, or other structure foundation areas.

Foundation materials which are: a) saturated by either surface or subsurface flows due to the lack of adequate water control or dewatering work by the CONTRACTOR; b) frozen for any reason; or, c) that are disturbed by the CONTRACTOR's work or caused to become unacceptable for foundation material purposes by means of the CONTRACTOR's equipment, manpower, or methods of work shall be removed and replaced by the CONTRACTOR at his expense.

Dewatering should not be conducted by pumping from inside footing, structural floor slab, or other structure foundation limits. This may decrease the supporting capacity of the soils.

Care should be taken when excavating the foundations to avoid disturbing the supporting materials. Excavation by either hand or careful backhoe soil removal, may be required in excavating the last few inches of material to obtain the subgrade of any item of the concrete work.

Any over-excavated subgrades that are due to the CONTRACTOR's actions, shall be brought back to subgrade elevations by the CONTRACTOR and at his expense in the following manner:

1. For over-excavations of 2 inches or less, either: Backfill and compact with an approved granular materials; backfill with 1/2 inch crushed rock; or fill within concrete at the time of the appurtenant structure concrete pour.

2. For over-excavations greater than 2 inches, backfill and compact with an approved granular material.

All granular footings, structural floor slabs, or other structure areas shall be compacted with a vibratory plate compactor prior to placement of concrete, reinforcing, or bedding materials.

B. Backfill, and fill within 2 feet of and adjacent to all structures and for full height of the walls, shall be selected non-swelling material. It shall be granular, well graded, and free from stones larger than 3 inches. Material may be job excavated, but selectivity will be required as determined by the ENGINEER. Refer to the Drawings for job specific requirements. Stockpiled material, other than topsoil from the excavation shall be used

for backfilling unless an impervious structural backfill is specified. The backfill material shall consist of either clean on-site granular materials free of stones larger than 3 inches in diameter with no more than 20% passing the No. 200 sieve, or equivalent imported materials. All backfill around the structures shall be consolidated by mechanical tamping. The material shall be placed in 8-inch loose lifts within a range of 2% above to 2% below the optimum moisture content and compacted to 95% of Maximum Standard Proctor Density (ASTM D698) for cohesive soils, or to 70% relative density for pervious material as determined by the relative density of cohesionless soils test, ASTM D4253.

When specified on the Drawings or as required by the ENGINEER, Class I structural backfill shall meet the following gradation requirements:

Sieve Size	% by Weight Passing Square Mesh Sieves
2-Inch	100
No. 4	30 - 100
No. 50	10 – 60
No. 200	5 – 20

In addition, this material shall have a liquid limit not exceeding 35 and a plasticity index of not over 6.

C. Backfill around Stormwater Inlets

1. Backfill and fill within excavated areas around stormwater inlet structures for full height of the walls, shall be Flo-Fill containing ½ sack of cement. Material shall meet the requirements of Section 02321.

D. Backfill around structures in and along Pond #347, Pond #396b, and Pond #396a.

1. Impervious structural backfill, where shown or specified, shall consist of material having 100% finer than 2 inches in diameter and a minimum of 30% passing a No. 200 U.S. Standard Sieve. The material shall be placed in 6-inch loose lifts within a range of 2% above to 2% below the optimum moisture content and compacted to 95% of Maximum Standard Proctor Density for cohesive soils as determined by ASTM D698.

2. Non-Shrink Backfill (a.k.a. Flo-Fill) containing 2 sacks of cement shall be used for fill around structures. Material shall meet the requirements of Section 02321.

END SECTION 32 23 17

SECTION 31 23 19 – WATER CONTROL AND DEWATERING (PHASE 1)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work of this section consists of controlling groundwater, site drainage, and storm flows during construction. The CONTRACTOR is cautioned that the work involves construction in and around drainage channels, local streams or rivers, and areas of local drainage. These areas are subject to frequent periodic inundation.

1.02 RELATED SECTIONS

A. Section 02315 – Excavation and Embankments

B. Section 02320 – Trench Excavation and Backfill

PART 2 PRODUCTS

2.01 MATERIALS

A. On-site materials may be used within the limits of construction to construct temporary dams and berms. The materials such as plastic sheeting, sand bags, and storm sewer pipe may also be used if desired by the CONTRACTOR.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. General: For all excavation, the CONTRACTOR shall provide suitable equipment and labor to remove water, and he shall keep the excavation dewatered so that construction can be carried on under dewatered conditions where required by the Drawings and Specifications. Water control shall be accomplished such that no damage is done to adjacent channel banks or structures. The CONTRACTOR is responsible for investigating and familiarizing himself with all site conditions that may affect the work including surface water, level of groundwater and the time of year the work is to be done. All excavations made as part of dewatering operations shall be backfilled with the same type material as was removed and compacted to 95% of Maximum Standard Proctor Density (ASTM D698) except where replacement by other materials and/or methods are required.

The CONTRACTOR shall conduct his operation in such a manner that storm or other waters may proceed uninterrupted along their existing drainage courses. By submitting a bid, the CONTRACTOR acknowledges that he has investigated the risk arising from such waters and has prepared his bid accordingly, and assumes all of said risk.

At no time during construction shall the CONTRACTOR affect existing surface or subsurface drainage patterns of adjacent property. Any damage to adjacent property

resulting from the CONTRACTOR's alteration of surface or subsurface drainage patterns shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

CONTRACTOR shall remove all temporary water control facilities when they are no longer needed or at the completion of the project.

Pumps and generators used for dewatering and water control shall be quiet equipment enclosed in sound deadening devices.

B. Surface Water Control: Surface water control generally falls in to the following categories:

1. Normal low flows along the channel;
2. Storm/flood flows along the channel;
3. Flows from existing storm drain pipelines; and,
4. Local surface inflows not conveyed by pipelines.

The CONTRACTOR shall coordinate, evaluate, design, construct, and maintain temporary water conveyance systems. These systems shall not worsen flooding, alter major flow paths, or worsen flow characteristics during construction. The CONTRACTOR is responsible to ensure that any such worsening of flooding does not occur. The CONTRACTOR is solely responsible for determining the methods and adequacy of water control measures.

At a minimum, the CONTRACTOR will be responsible for diverting the quantity of surface flow around the construction area so that the excavations will remain free of surface water for the time it takes to install these materials, and the time required for curing of any concrete or grout. The CONTRACTOR is cautioned that the minimum quantity of water to be diverted is for erosion control and construction purposes and not for general protection of the construction-site. It shall be the CONTRACTOR's responsibility to determine the quantity of water which shall be diverted to protect his work from damage caused by storm water.

The CONTRACTOR shall, at all times, maintain a flow path for all channels. Temporary structures such as berms, sandbags, pipeline diversions, etc., may be permitted for the control of channel flow, as long as such measures are not a major obstruction to flood flows, do not worsen flooding, or alter historic flow routes.

C. Groundwater Control: The CONTRACTOR shall install adequate measures to maintain the level of groundwater below the foundation subgrade elevation and maintain sufficient bearing capacity for all structures, pipelines, earthwork, and rock work. Such measures may include, but are not limited to, installation of perimeter subdrains, pumping from drilled holes or by pumping from sumps excavated below the subgrade elevation. The foundation bearing surfaces are to be kept dewatered and stable until the structures or other types of work are complete and backfilled. Disturbance of foundation subgrade by CONTRACTOR operations shall not be considered as originally unsuitable foundation subgrade and shall be repaired at CONTRACTOR's expense.

Any temporary dewatering trenches or well points shall be restored following dewatering operations to reduce permeability in those areas as approved by the ENGINEER.

D. Contaminated Groundwater Control: CONTRACTOR shall not discharge contaminated water exceeding local, State and/or Federal limits to above ground channels or watercourses.

END SECTION 31 23 19

SECTION 31 37 00 - RIPRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work of this section shall include excavation, grading and installation of all riprap, and bedding placed at the locations shown on the Drawings. The materials to be used for the construction of such structures shall be as specified herein.

1.02 RELATED SECTIONS

A. Section 31 23 19 – Water Control and Dewatering

B. Section 31 23 17 – Excavation and Embankment

1.03 SUBMITTALS

A. The CONTRACTOR shall cooperate with the ENGINEER in obtaining and providing samples of all specified materials. The CONTRACTOR shall submit certified laboratory test certificates for all items required in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Riprap:

Riprap used shall be the type designated on the Drawings and shall conform to the following:

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	d_{50} * (Inches)
Type VL (Class 6)	70 - 100	12	6
	50 - 70	9	
	35 - 50	6	
	2 - 10	2	
Type L (Class 9)	70 - 100	15	9
	50 - 70	12	
	35 - 50	9	
	2 - 10	3	
Type M (Class 12)	70 - 100	21	12
	50 - 70	18	
	35 - 50	12	
	2 - 10	4	

Type H (Class 18)	70 - 100	30	18
	50 - 70	24	
	35 - 50	18	
	2 - 10	6	
Type VH (Class 24)	70 - 100	42	24
	50 - 70	33	
	35 - 50	24	
	2 - 10	9	

* d_{50} = Mean Particle Size

1. The riprap designation and total thickness of riprap shall be as shown on the Drawings. The maximum stone size shall not be larger than the thickness of the riprap.

2. The specific gravity of the riprap shall be 2.65 or greater.

3. Neither width nor thickness of a single stone of riprap shall be less than 1/3 of its length.

4. Broken concrete or asphalt pavement shall not be acceptable for use in the work. Rounded riprap (river rock) is not acceptable unless specifically designated on the Drawings.

5. The color of the riprap shall be as approved by the OWNER and Landscape Architect prior to delivery to the project site. Color shall be consistent on the entire project and shall match the color of rock to be used for all other portions of the work. Color required for this project shall be light grey to light beige rock.

6. Minimum density for acceptable riprap shall be 165 pounds per cubic foot. The specific gravity shall be according to the bulk-saturated, surface-dry basis, AASHTO T85.

7. The riprap shall have a percentage loss of not more than 40 percent after 500 revolutions when tested in the Los Angeles machine in accordance with AASHTO Test T96.

8. The riprap shall have a percentage loss of not more than 10 percent after 5 cycles when tested in accordance with AASHTO Test T104 for ledge rock using sodium sulfate.

9. The riprap shall have a percentage loss of not more than 10 percent after 12 cycles of freezing and thawing when tested in accordance with AASHTO Test T103 for ledge rock, procedure A.

10. Rock shall be free of calcite intrusions.

11. Each load of riprap shall be reasonably well graded from the smallest to the largest size specified. Stones smaller than the 2-10 percent size will not be permitted in an amount exceeding 10 percent by weight of each load.

    Control of gradation will be by visual inspection. However in the event the ENGINEER determines the riprap to be unacceptable, the ENGINEER will pick 2

random truck loads to be dumped and checked for gradation. Mechanical equipment and labor needed to assist in checking gradation shall be provided by the CONTRACTOR at no additional cost.

B. Bedding:

1. Gradation for Granular Bedding

U.S. Standard Sieve Size	Percent by Weight Passing Type I	Square Mesh Sieves Type II
3 Inch		90 - 100
1-½ Inch		
¾ Inch		20 - 90
3/8 Inch	100	
No. 4	95 – 100	0 - 20
No. 16	45 - 80	
No. 50	10 - 30	
No. 100	2 - 10	
No. 200	0 - 2	0 - 3

Granular bedding designation and total thickness of bedding shall be as shown on the Drawings. Granular bedding shall meet the same requirements for specific gravity, absorption, abrasion, sodium sulfate soundness, and freeze-thaw durability as required for riprap and specified above.

C. Geotextile Fabric:

Where soil conditions dictate, geotextile fabric shall be placed directly on excavated slopes, channel beds, etc. prior to the placement of any riprap bedding or riprap. The extent and location of geotextile placement will be shown on the Drawings.

Geotextile fabric shall be Trevira S1120 or approved equal under all riprap.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Channel slopes, bottoms, or other areas that are to be protected with riprap shall be free of brush, trees, stumps, and other objectionable material and be graded to a smooth compacted surface. The CONTRACTOR shall excavate areas to receive

riprap to the subgrade for granular bedding. The subgrade for bedding materials shall be stable. If unsuitable materials are encountered, they shall be removed and replaced as Muck Excavation in accordance with Section 02315 of the Specifications. Unsuitable materials shall be disposed of from the site by the CONTRACTOR at his expense. After an acceptable subgrade for granular bedding material is established, the bedding shall be immediately placed and leveled to the subgrade elevation. Immediately following this, the riprap shall be placed. If bedding material is disturbed for any reason, it shall be replaced and graded at the CONTRACTOR's expense. In-place bedding materials shall not be contaminated with soils, debris or vegetation before the riprap is placed. If contaminated, the bedding material shall be removed and replaced at the CONTRACTOR's expense.

3.02 PLACEMENT

A. Following acceptable placement of geotextile fabric, granular bedding, riprap placement shall commence as follows:

1. Machine Placed Riprap: Riprap shall be placed on the prepared slope or channel bottom areas in a manner which will produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids. Riprap shall be machine placed, unless otherwise stipulated in the Drawings or Specifications.

When riprap is placed on slopes, placement shall commence at the bottom of the slopes working up the slope. Place the riprap in a stepped fashion with the bottom of the uphill riprap below the top of the downhill riprap by half of the height of the riprap minimum.

The entire mass of riprap shall be placed on either channel slopes or bottoms so as to be in conformance with the required gradation mixtures and to lines, grades, and thickness shown on the Drawings. Riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the underlying bedding material. Placing of riprap in layers, or by dumping into chutes, or by similar methods shall not be permitted.

All material going into riprap protection for channel slopes or bottoms shall be so placed and distributed that there will be no large accumulations of either the larger or smaller sizes of stone. Some hand placement may be required to achieve this distribution.

It is the intent of these Specifications to produce a fairly compact riprap protection in which all sizes of material are placed in their proper proportions. Unless otherwise authorized by the ENGINEER, the riprap protection shall be placed in conjunction with the construction of embankments or channel bottoms with only sufficient delay in construction of the riprap protection, as may be necessary, to allow for proper construction of the portion of the embankment and channel bottom which is to be protected. The CONTRACTOR shall maintain the riprap protection

until accepted. Any material displaced for any reason shall be replaced to the lines and grades shown on the Drawings at no additional cost to the OWNER. If the bedding materials are removed or disturbed, such material shall be replaced prior to replacing the displaced riprap.

2. Hand Placed Riprap: Hand placed riprap shall be performed during machine placement of riprap and shall conform to all the requirements of PART 1 above. Hand placed riprap shall also be required when the depth of riprap is less than 2 times the nominal stone size, or when required by the Drawings or Specifications.

   After the riprap has been placed, hand placing or rearranging of individual stones by mechanical equipment shall be required to the extent necessary to secure a flat uniform surface and the specified depth of riprap, to the lines and grades as shown on the Drawings.

3. Soil Replacement In and Over Riprap: Where riprap is designated to be buried, place onsite excavated material that is free from trash and organic matter in riprap voids by washing and rodding. Prevent excessive washing of material into stream. When voids are filled and the surface accepted by the ENGINEER, place a nominal 6 inches of soil over the area, or as designated on the Drawings. Fine grade, seed, and mulch per the Specifications.

4. Rejection of Work and Materials: The ENGINEER shall reject placed riprap which does not conform to this Section and the CONTRACTOR shall immediately remove and relay the riprap to conform with said sections.

   Riprap shall be rejected, which is either delivered to the job site or placed, that does not conform to this Section. Rejected riprap shall be removed from the project site by the CONTRACTOR and at his expense.

5. Geotextile fabric shall be installed according to the manufacturer's specifications. Material proposed for use shall be submitted and approved by the ENGINEER prior to installation.

END OF SECTION 31 37 00

SECTION 31 63 29 – DRILLED CONCRETE PIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes dry-installed drilled piers.

1.2 UNIT PRICES

A. Unit prices are included in Division 01 Section "Unit Prices."

B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts and bells.

1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft and the diameter of shaft.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed outside dimensions of drilled piers cast against rock. Unit prices for rock excavation include replacement with approved materials.

1.3 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture.

C. Shop Drawings: For concrete reinforcement.

D. Welding certificates.

E. Material certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

B. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is referenced elsewhere in the Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

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

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type as shown in structural drawings.

B. Normal-Weight Aggregate: ASTM C 33, graded, 3/4-inch- (19-mm-) nominal maximum coarse-aggregate size.
   1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.3 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283/A 283M, Grade C, or ASTM A 36/A 36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.

2.4 CONCRETE MIXTURES AND MIXING

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Proportion normal-weight concrete mixture as follows:
   1. Compressive Strength (28 Days): As shown in structural drawings.
   2. Air Content: Do not air entrain concrete.

E. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered.

B. Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations as follows:
   1. Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work.
   2. Special excavation includes excavation that requires special equipment or procedures above or below indicated depth of drilled piers where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.
   3. Obstructions: Payment for removing unanticipated boulders, concrete, masonry, or other subsurface obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.

C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.

D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
   1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
   2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.

E. End-Bearing Drilled Piers: Probe with auger to a depth below bearing elevation, equal to diameter of the bearing area of drilled pier. Determine whether voids, clay seams, or solution channels exist.

F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
   1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete, or leave temporary casings in place.

G. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

3.2 INSTALLATION

A. Install steel casings of minimum wall thickness indicated and of diameter not less than diameter of drilled pier.

B. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

C. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.

D. Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement. Vibrate top 60 inches (1500 mm) of concrete.

E. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch (1500-mm) head of concrete above bottom of casing. Vibrate top 60 inches (1500 mm) of concrete after withdrawal of temporary casing.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Drilled piers.
   2. Excavation.
   3. Concrete.
   4. Steel reinforcement welding.

B. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
   1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.

C. Concrete Tests and Inspections: ACI 301.

END OF SECTION 31 63 29

SECTION 32 11 00 - BASE COURSES (PAVEMENT)

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies requirements for the preparation of the subgrade for and placement of granular subbase and base materials for pavement areas.

B. The work includes:

1. Fine grading and compaction of pavement subgrade.

2. Furnishing, placing and compacting of subbase and base materials.

1.02 RELATED SECTIONS

A. Other specification Sections which directly relate to the work of this Section include:

1. Section 03 30 00 - CAST-IN-PLACE CONCRETE
2. Section 31 00 00 - EARTHWORK
2. Section 32 14 04 – BRICK PAVERS

PART 2 - PRODUCTS

2.01 GRAVEL

A. Gravel shall conform to the requirements of Section 31 00 00 - EARTHWORK, Article, 2.02C. DENSE GRADED CRUSHED STONE.

2.02 CRUSHED STONE

A. Crushed stone shall conform to the requirements of Section 31 00 00 - EARTHWORK, Article, 2.02D. Crushed Stone for subbase and base.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. All subsurface utility construction shall be completed before fine grading is begun.

B. The pavement and curb subgrade shall be fine graded to the location, elevations and cross slope shown on the Drawings, using gravel for final adjustments.

C. Subgrades in in-situ soils in excavation areas and in embankment areas shall be compacted during fine grading to 90 percent of maximum dry density in conformance with Section 31 00 00 - EARTHWORK.

3.02 SUBBASE MATERIAL PLACEMENT

A. Subbase material shall not be placed until the Engineer has approved the fine grading, compaction and, condition of the subgrade.

B. Subbase material shall be placed and spread on the approved subgrade in layers not exceeding eight inches (8") in thickness by approved self-spreading equipment. Any displacement of the compacted subgrade material by the equipment shall be restored to the required grade and recompacted before placement of the subbase material.

C. Subbase material shall be compacted to 95 percent of maximum dry density in conformance with Section 31 00 00 - EARTHWORK.

D. The surface of the subbase material shall be fine graded to the location, elevations, and cross slope shown on the Drawings during final layer compaction operations.

3.03 BASE MATERIAL PLACEMENT

A. Base material shall not be placed until the Engineer has approved the fine grading, compaction, and condition of the subbase material.

B. Base material shall be spread on the approved subbase in layers not exceeding four inches (4") in thickness by approved self-spreading equipment. Any displacement of the subbase material by equipment shall be restored to the required grade and recompacted before placement of the base material.

C. Base material shall be compacted to 95 percent of dry density in conformance with Section 31 00 00 - EARTHWORK.

D. The surface of the base material shall be fine graded to the proposed location, elevations, and cross slope shown on the Drawings during final layer compaction operations.

END OF SECTION 32 11 00

SECTION 32 12 00 - FLEXIBLE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Full depth asphaltic concrete paving over prepared subgrade

1.2 RELATED SECTIONS

A. Section 01 02 00 – Geotechnical Report

B. Section 31 00 00 – Earthwork

1.3 REFERENCES

A. ASTM C29: Unit Weight and Voids in Aggregate

B. ASTM C88: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C. ASTM C117: Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing

D. ASTM C128: Specific Gravity Test and Absorption of Fine Aggregate

E. ASTM C131: Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

F. ASTM C136: Sieve or Screen Analysis of Fine and Coarse Aggregates

G. ASTM D4: Bitumen Content

H. ASTM D5: Penetration of Bituminous Materials

I. ASTM D70: Specific Gravity of Semi-Solid Bituminous Materials

J. ASTM D93: Flash Point by Pensky-Martens Closed Tester

K. ASTM D113: Ductility of Bituminous Materials

L. ASTM D1188: Bulk Specific Gravity of Compacted Bituminous Mixtures

M. ASTM D1559: Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

N. ASTM D2041: Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures

O. ASTM D2170: Kinematic Viscosity of Asphalts (Bitumens)

P. ASTM D2172: Quantities Extraction of Bitumens from Bituminous Paving Mixtures

Q. ASTM D2419: Sand Equivalent Value of Soils and Fine Aggregate

R. ASTM D290: Bituminous Mixing Plant Inspection

S. ASTM D946: Asphalt Cement for Use in Pavement Construction

T. ASTM D692: Course Aggregate for Bituminous Paving

U. ASTM D1073: Fine Aggregate for Bituminous Paving Mixtures

V. ASTM 1241: Materials for Soil-Aggregate Subbase, Base and Surface Courses

W. ASTM D2026: Cutback Asphalt (Slow-Curing Type)

X. ASTM D2027: Cutback Asphalt (Medium-Curing Type)

Y. ASTM D2028: Cutback Asphalt (Rapid-Curing Type)

Z. MS-2: Mix Design Method for Asphalt Concrete and Other Hot Mix Types -The Asphaltic Institute (AI)

AA. CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

BB. Colorado Department of Transportation

CC. Colorado Asphalt Pavement Association

DD. City of Boulder construction specifications, standards and details.

1.4 SUBMITTALS

A. Submit under provisions of Division One Specifications

B. Samples: Provide samples of materials for laboratory testing and job-mix design for asphaltic concrete paving section.

C. Record of Work: Maintain record of time and date of placement, temperature, and weather conditions, retain until completion and furnish copy to engineer.

D. Test Reports: Submit laboratory reports for following materials tests
   1. Coarse and fine aggregate from each material source and each required grading
      a. Sieve analysis: ASTM C136 (AASHTO T19)
      b. Unit weight of slag: ASTM C29 (AASHTO T19)
      c. Soundness: ASTM C88 (AASHTO T104) for surface course aggregates only
      d. Sand equivalent: ASTM D2419 (AASHTO T176)
      e. Abrasion of coarse aggregate: ASTM C131 (AASHTO T96), for surface course aggregates only
   2. Asphalt cement for each penetration grade
      a. Penetration: ASTM D5 (AASHTO T49)
      b. Viscosity (Kinematic): ASTM D2170 (AASHTO T201)
      c. Flash Point: ASTM D93 (AASHTO T48)
      d. Ductility: ASTM D113 (AASHTO T51)
      e. Solubility: ASTM D4 (AASHTO T44)
      f. Specific gravity: ASTM D70 (AASHTO T43)
   3. Job-mix design mixtures for each material or grade

a. Bulk specific gravity for fine aggregate: ASTM C128 (AASHTO T84)
4. Uncompacted asphalt concrete mix: Maximum specific gravity ASTM D2041 (AASHTO T209)
5. Compacted asphalt concrete mix
   a. Bulk density: ASTM D1188 (AASHTO T166)
   b. Marshall stability and flow: ASTM D1559
6. Density and void analysis
   a. Provide each series of asphalt concrete mixture test specimens, in accordance with MS-2
   b. Use Marshall method of mix design unless otherwise directed or acceptable to Engineer
7. Sampling and testing of asphalt concrete mixtures for quality control during paving operations
   a. Uncompacted asphalt concrete mix
      i) Asphalt cement content: ASTM D2172 (AASHTO T164)
      ii) Penetration of recovered asphalt cement: ASTM D5 (AASHTO T49)
      iii) Ductibility of recovered asphalt cement: ASTM D113 (AASHTO T51)
   b. Compacted asphalt concrete mix
      i) Bulk density: ASTM D1188 (AASHTO T166)
      ii) Marshall stability and flow: ASTM D1559
   c. Perform at least one test for each day's paving but not less than one test per each 4000 sf of each lift.

1.5 QUALITY ASSURANCE

A. Materials and installation shall conform to applicable portions of Colorado Department of Transportation and City of Boulder construction specifications, standards and details.

1.6 REGULATORY REQUIREMENTS

A. For work on public streets or rights-of-way conform to the requirements of City of Boulder construction specifications, standards and details for the Construction of Curbs, Gutters, Sidewalks, Driveways, Street Paving, and Other Public Right-of-Way Improvements.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle materials under provisions of Division One Specifications

B. Transport mixture from mix plant in trucks with tight, clean, non-sticking compartments. Coat hauling compartments with lime-water mixture to prevent sticking. Elevate and drain compartment of excess solution before loading mix.

C. Cover to protect from weather and prevent loss of heat when temperature is below 50 degrees F

D. Provide insulated truck beds during temperature below 50 degrees F on long distance deliveries

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply when underlying surface is muddy, frozen or wet

B. Do not place by spreading and finishing machine tack coat or asphaltic cement when temperature is below 45 degrees F and falling. Place when above 40 degrees F and rising

PART 2 PRODUCTS

2.1 MATERIALS

A. Tack Coat: Emulsified asphalt: SS-1 or CSS-1h, ASTM D977

B. Asphaltic Cement: ASTM D946, AASHTO M226, AC10 or AC20 grade determined by design mix, homogeneous, free from water, no tendency to foam when heated to 347 degrees F, and per CDOT Standard Section 702.

C. Aggregate for Asphaltic Concrete, General
   1. Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D692
   2. Sand, stone, or slag screening: ASTM D1073
   3. Percent wear: ASTM C131, less than 45 for aggregates retained in #10 sieve

D. Base Course Aggregates for Asphaltic Concrete
   1. Uncrushed gravel may be used in mixture if it meets design criteria specified
   2. Provide uniform quality combined aggregates with a minimum sand equivalent value of 40
   3. Provide aggregate in gradations for courses to comply with Class S and SG, Colorado Department of Transportation, ASTM C136
   4. A maximum of 20% Reclaimed Asphalt Pavement (RAP) will be allowed in (non-polymer or non-rubberized) mixes, provided that all the requirements for hot bituminous pavement are met.

E. Surface Course Aggregates for Asphaltic Concrete
   1. Provide natural sand, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions
   2. Provide uniform quality combined aggregate with a minimum sand equivalent value of 50
   3. Provide aggregate in gradations for courses to comply with Class SX, Colorado Department of Transportation, ASTM C136.

F. Weed Control: First application, “Roundup.” Second application, Casoron “W-50" or “G-10” with colored marker dye, manufactured by Pacific Coast Borax Company or an accepted substitute of non-flammable type.

2.2 ACCESSORIES

A. Traffic Control Devices
   1. Signs.
      a. Comply with City of Boulder standards and specifications for signs within the public right-of-way.
      b. Sign faces, posts and bases shall be in conformance with the following materials specifications. All nonstandard sign faces, posts and bases must be approved by City of Boulder. Private property or nonstandard signs will be maintained by the owner. Submit shop drawings for approval prior to fabrication. All signs shall conform to current M.U.T.C.D. Standards and Colorado Supplements. All signs shall be 3M-engineer grade reflective sheeting or accepted substitute.
      c. Traffic/Parking Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy .080 inches thick. Facing shall be specified reflective sheeting with standard sign colors based on standard graphics and as shown on the plans.
   2. Sign Posts.
      a. For large signs greater than 12”W x 18”H and for multiple signs of any size mounted on the same post: sign posts shall be two (2) inch by two (2) inch galvanized telespar tube.
      b. For regular single signs 12”W x 18”H or smaller: sign posts shall be one and one-half (1-1/2) inch by one and one-half (1-1/2) inch galvanized telespar tube.

c. Galvanized telespar tube shall have 0.120-inch wall thickness, and three-eighths (3/8) inch holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length (min).

3. Sign Post Anchor Bases (Stubs). All sign post anchor bases shall be twist resistant square galvanized telespar tube post with thickness and hole pattern the same as sign posts. Use 2-1/4" by 2-1/4" anchor for large posts and 1-3/4" by 1-3/4" anchor for regular posts. Bases shall be embedded a minimum of 36" below finished grade and shall extend 3" above finished grade.
4. Signs Post Anchor Bases with concrete footing: Sign, post, base and compacted soil shall be rigid and able to withstand wind loads. Where predominantly clay soils are present which will not properly compact at sign base, install a 6" diameter by 36" deep concrete footing around signs post anchor base for all signs in landscaped areas.
5. All signs and posts shall be mounted and secured with municipal-approved vandal-proof type TL-3896 drive rivets with washers, or accepted substitute.

B. Pavement Marking. Specified pavement marking materials shall be used at locations as identified below.
1. Comply with City of Boulder standards and specifications for pavement marking within the public right-of-way.
2. FS TT-P-115, Type I Alkyd, white, blue, yellow and red color paint meeting requirements of CDOT Standard Specification 708. Verify colors and extent of painting prior to painting. Unless noted on plans, evident at existing striping or instructed, provide white in color for traffic striping, parking stalls, and other control markings on internal pavement, yellow in color for traffic control markings or restricted parking or where indicated, blue in color for accessible parking stalls, and red in color for curbs where no parking is indicated. Reflectorized paint required for traffic stripes and control markings on internal drive, road or street pavements.
3. Furnish paint with a no-pick-up maximum drying time of 20 minutes, when tested according to ASTM D711 using a wet film thickness of 0.015-inch when tested and applied at 77 degrees F.
4. 3M Stamark 5730 preformed plastic marking material or an accepted substitute shall be used for crosswalks, stop bars, symbols (i.e. turn arrows) and striping for separation of turn and through lanes in right-of-way. Use of thermoplastic pavement marking is not permitted.

2.3 MIXES/SOURCE QUALITY CONTROL

A. Determine full depth design mix based upon aggregates furnished
1. Test mix by independent laboratory at Contractor's expense
2. Grade dependent on temperature during placement
3. Submit mix designs under provisions of Section Division One specifications for review and acceptance by Engineer

B. Submit mix design giving unit weight and to meet following requirements prior to placement of asphalt:

Property – 50 Blow	S Mix	SX Mix
Marshall Stability lbs	1600 (min.)	500 (min.)
Flow, 0.01'	8-18	8-20
Air Voids in Mix, %	3-5	3-5
VMA, % min.	14	15
Initial Gyrations	7-8	7-8
Design Gyrations	75-100	75-100
Hveem Stability	30 min	30 min
Voids Filled w/ Asphalt	65-75	65-75

Establish a single percentage passing each sieve size, a single percent of asphalt and a mix temperature. Maintain job mixes within following percentages of design mix: Aggregates:

#8 and larger	± 8%
#16 to #100	± 6%
#200	± 2%
Asphalt Content Tolerance	± 0.5%
Discharge Mix temp	± 20˚ F

PART 3 EXECUTION

3.1 EXAMINATION

A. Establish and maintain required lines and elevations. Provide grade and location stakes under this section as required for asphaltic concrete paving work.

B. Operate heavy, rubber-tired front loader over subgrade of paved areas. Where soft spots occur, remove loose materials and replace with Class 6 road base aggregate complying with CDOT standards compacted to level of subgrade.

3.2 PREPARATION

A. Prepare subgrade under provisions of Section 31 00 00

B. Loose and Foreign Material
1. Remove loose and foreign material from compacted subgrade surface immediately before application of paving. Clean surface with mechanical sweeper, blowers, or hand brooms, until surfaces are free from dust

C. Weed Control
1. If weeds or vegetation exist at or on the subgrade, apply “Round-up” at rates following manufacturer’s instructions. Apply “Round-up” three days prior to removal of vegetation, subgrade preparation and application of Casoron as described below to allow “Round-up” to kill all vegetation. Remove all living and dead weeds, root balls, tree/shrub roots, vegetation, and/or any organic matter from on or in the subgrade per applicable earthwork specifications prior to subgrade preparation and paving at all areas to be paved.
2. After all fine grading, checking, shaping, and compacting of the subgrade has been completed, and just prior to placing asphalt or aggregate base course, all subgrade soil in the area to receive asphalt pavement shall be thoroughly treated with Casoron soil sterilant (in addition to “Round-up” and regardless of presence of existing weeds or vegetation). Casoron shall be thoroughly sprinkled to distribute the chemical through the first two or three inches of the subgrade. For all areas to be paved, apply Casoron weed control at a minimum rate per 100 square yards of 2.4 pounds for G-10 or 4.0 pounds for 50w at rates and methods recommended by manufacturer within one day of paving.
3. The Contractor shall provide all necessary protection to prevent injury to animal, fish, or plant life and property occasioned by the application of the soil sterilant. Apply on a calm, wind-free day. The Contractor will be held responsible for all application of soil sterilant or the storage of same. Protect existing and new trees and shrubs beyond the limit of paving from damage due to weed killer or soil sterilant overspray or root contact. Extra caution is required to prevent over-application of products in areas to be paved under tree canopies. Trees and shrubs damaged or killed by weed killer or sterilant application shall be replaced by the contractor at contractor’s expense.
4. Do not apply within 20 feet of trees or shrubs

D. Tack Coat
   1. Apply in similar manner as prime coat, except as modified
   2. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphaltic concrete or portland cement concrete and surfaces
   3. Apply at rate of 0.05 to 0.15 gallons per square yard of surface
   4. Apply tack coat by brush to contact surfaces of curbs, gutters, catch basins, and other structures projecting into or abutting asphaltic concrete pavement
   5. Allow surfaces to dry until material is at condition of tackiness to receive pavement
   6. Where asphaltic concrete will adhere to all surfaces (including areas that have been milled), tack coat may be eliminated by Engineer

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to minimum depth of 1 ½-inches, or as indicated on the plans.
   2. Mill to a uniform finished surface free of gouges, grooves, and ridges of more than ¼ inch depth.
   3. Control rate of milling to prevent tearing of existing asphalt course.
   4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
   5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
   6. Transport milled hot-mix asphalt to asphalt recycling facility.
   7. Keep milled pavement surface free of loose material and dust.

3.4 RING/FRAME ADJUSTMENTS

A. Set ring/frames of subsurface structures to final grade as a part of this work.

B. Placing Ring/Frames
   1. Surround ring/frames set to elevation with a ring of compacted asphalt concrete base prior to paving
   2. Place asphalt concrete mixture up to 1-inch below top of ring/frame, slope to grade, and compact by hand tamping

C. Adjust frames to proper position to meet paving

D. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations

E. Set ring/frames to grade, flush with surface of adjacent pavement

3.5 PREPARING THE MIXTURE

A. Comply with ASTM D995 for material storage, control, and mixing and for plant equipment and operation

B. Stockpile
   1. Keep each component of the various sized combined aggregates in separate stockpiles
   2. Maintain stockpiles so that separate aggregate sizes will not be intermixed and to prevent segregation

C. Heating

1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture
2. Use lowest possible temperature to suite temperature viscosity characteristics of asphalt
3. Do not exceed 350 degrees F

D. Aggregate
1. Heat-dry aggregates to acceptable moisture content
2. Deliver to mixer at recommended temperature to suite penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture
3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements

E. Mix aggregate and asphalt cement to achieve 90-95 percent coated particles for base mixtures and 85-90 percent coated particles for surface mixture, per ASTM D2489

3.6 EQUIPMENT

A. Bituminous Pavers: Self-propelled, spreads without tearing surfaces, and controls pavement edges to true lines without use of stationary forms

B. Rolling Equipment
1. Steel-wheel roller: Self-propelled, contact pressure of 250 to 350 psi per inch of width of roller wheel, equipped with adjustable scrapers and means for keeping wheel wet to prevent mix from sticking
2. Pneumatic-tired rollers: Self-propelled, contact pressure under each tire of 85 to 110 psi, wheels spaced so that one pass will accomplish one complete coverage equal to rolling width of machine, oscillating wheels. Remove and replace immediately tires picking up fines

C. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools

3.7 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine

B. Complete placement over full width of section on each day's run

C. Spread mixture at minimum temperature of 280 degrees F and maximum 350 degrees. With ambient temperatures below 50 degrees F, maintain minimum temperature of 300 degrees in the truck prior to lay down

D. Inaccessible and small areas may be placed by hand

E. Conform to the grade, cross section, finish thickness, and density indicated.

F. Lift Thickness
1. Place in multiple lifts. Place asphalt in lifts such that each compacted lift thickness is no less than 2.0” thick and no greater than 3.0” thick. Top lift to be 2” thick.
2. Typical Lift Thickness Sequencing:

Final Asphalt Section Required (inches)	No. of Lifts	Thickness of each Lift (inches)
2”	1	2
3”	1	3

4”	2	2-2
5”	2	3-2
6”	3	2-2-2
7”	3	3-2-2
8”	3	3-3-2
9”	4	3-2-2-2
10”	4	3-3-2-2
>10	Review with Engineer	

G. Paver Placing
1. Unless otherwise directed, begin placing along centerline of areas in crowned section and at high side on one-way slope and in direction of traffic flow
2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips
3. Complete base courses before placing surface courses
4. Place mixture in continuous operation as practicable

H. Hand Placing
1. Spread, tamp, and finish mixing using hand tools in areas where machine spreading is not possible as acceptable to Engineer
2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature

I. Joints
1. Construct transverse joint at right angles to centerline when operations are suspended long enough for mixture to chill
2. Construct joints to have same texture, density, and smoothness as adjacent sections of asphalt concrete course
3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat
4. Offset transverse joints in succeeding courses not less than 24 inches
5. Cut back edge of existing pavement or previously placed course to expose an even, vertical surface for full course thickness
6. Offset longitudinal joints in succeeding courses not less than 6 inches
7. When the edges of longitudinal joints are irregular, honeycombed or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness
8. Wearing course constructed in even number of strips; place 1 longitudinal joint on centerline of road
9. Wearing course constructed in odd number of strips; place the centerline of 1 strip on centerline of road

J. Gutter: Finish surface high adjacent to concrete gutter so when compacted surface is slightly higher than edge of curb and flashing

3.8 COMPACTING THE MIX

A. Provide pneumatic and steel-wheel type rollers to obtain the required pavement density, surface texture and rideability

B. Begin rolling operations when the mixture will bear weight of roller without excessive displacement

C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set

D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers

E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs

F. Do not roll centers of sections first under any circumstances

G. Breakdown Rolling
1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge
2. Operate rollers as close as possible to paver without causing pavement displacement
3. Check crown, grade, and smoothness after breakdown rolling
4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling

H. Second Rolling
1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction
2. Continue second rolling until mixture has been thoroughly compacted

I. Finish Rolling
1. Perform finish rolling while mixture is still warm enough for removal of roller marks by combination of steel and pneumatic rollers
2. Continue rolling until roller marks are eliminated and course has attained specified density, and required surface texture and surface tolerances
3. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled and attained its maximum degree of hardness

J. Patching
1. Remove and replace defective areas
2. Cut-out and fill with fresh, hot asphaltic concrete
3. Remove deficient areas for full depth of course
4. Cut sides perpendicular and parallel to direction of traffic with edges vertical
5. Apply tack coat to exposed surfaces before placing new asphaltic concrete mixture
6. Compact by rolling to specified surface density and smoothness

3.9 JOINING TO EXISTING WORK

A. Cut sides vertically and apply tack coat to exposed asphalt surfaces before placing new pavement. Meet existing thickness of surface and base courses, but not less than specified for new work.

3.10 FIELD QUALITY CONTROL

A. The owner will engage a testing agency to perform field testing to determine compliance of in-place asphaltic concrete paving materials and compaction in accordance with Section 01 45 00 OR with quality control section of project manual.

B. Testing Agency will test in-place pavement for density and thickness.

C. Asphalt density test shall be taken every one-hundred fifty (150) lineal feet per driving lane. Densities shall be between ninety two percent (92%) and ninety six percent (96%) of the Rice unit

weight or between ninety five percent (95%) and one-hundred percent (100%) of the Marshall unit weight.

D. Contractor to verify final surfaces are of uniform texture, conforming to required grades and cross sections

E. Testing agency will take not less than 4-inch diameter pavement specimens for each completed course from locations as directed by Engineer

F. Repair holes from test specimens as specified for patching defective work

G. Minimum acceptable density of in-place course materials is 95 percent of the recorded laboratory specimen density. Immediately re-compact asphaltic concrete not conforming to acceptable density. Remove and replace all sections not in conformance density requirements

H. Thickness: Variations from drawings
   1. Base course: 1/4-inch +
   2. Remove and replace paving less than minimum thickness

I. Surface Smoothness
   1. Test using a 10 foot straight edge applied parallel to direction of drainage
   2. Advance straight edge five feet, maximum 1/4-inch per foot from nearest point of contact
   3. Do not permit pockets or depressions where water may pool
   4. Remove and replace areas, deficient in smoothness. Overlay corrections may be permitted only if acceptable to Engineer

J. Inspection: The work of this section is subject to the inspection and approval of the engineer and/or owner. The following inspections are required:
   1. Protection of adjacent property
   2. Staking and establishment of elevations
   3. Establishment and compaction of subgrade
   4. Placement and compaction of bituminous base course and wearing surface
   5. Final inspection
   6. Obtain approval of each element of work listed above in sequence of its completion before proceeding with the next item

3.11 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of Engineer

3.12 PROTECTION OF FINISHED WORK

A. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened and in no case sooner than 6 hours

B. Provide barricades and warning devices as required to protect pavement and the general public

3.13 WARRANTY

A. Provide installer's 2-year written warranty endorsed by the contractor warranting the pavement from creeping, shoring, cracking, softening, settling, ponding and other defects due to improper placing or defective materials. Replace defective materials upon notification by the owner in accordance with the requirements of the original work.

3.14 SCHEDULE OF MIX PLACEMENT:

A. Refer to Drawings for asphalt thickness and lift requirements.

END OF SECTION 32 12 00

SECTION 32 14 03 – BRICK PAVER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

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

1.02 SUMMARY

A. The work of this Section includes, but is not limited to, the following:
1. Brick paver.
2. Preparation of subgrade and bases for brick paver.
3. Brick pavers set on bituminous concrete base.
4. Brick pavers set on compacted gravel base.
5. Edge restraints for brick pavers.

B. Related Sections include the following:

1. Division 31 Section 31 00 00 Earthwork

1.03 REFERENCES

A. American Society of Testing and Materials (ASTM):
1. C 136, Method for Sieve Analysis for Fine and Course Aggregate.
2. C 144, Standard Specification for Aggregate for Masonry Mortar.
3. D 698, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5lb (2.49kg) Rammer and 12 in. (305 mm) drop.
4. D 1557, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (4.54 kg) Rammer and 18 in. (457 mm) drop.
5. D 2940, Graded Aggregate Material Bases or Subbases for Highways or Airports.

1.04 SUBMITTALS

A. General: Refer to and comply with Division 1 Section 00 70 00 General Conditions, for procedures and other submittal criteria.

B. Material and equipment requiring Shop Drawing Submittals shall include but not be limited to:
1. Brick paving unit showing detail sections and profile for all unit items. Details shall show all reinforcing and special hardware for fastening.

C. Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM D 312 or other applicable requirements.

D. Sieve analysis for grading of bedding and joint sand.

E. 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 expected in the permanent work:
   1. Brick unit pavers: three full size pavers of each size and each color within the color range, showing color and finish expected in the final work.
      a. Color will be selected by Landscape Architect and Owner from Manufacturer's available colors.
   2. Paver edge restraint.
   3. Sand: (2) one-pint bags.

F. Mock-Ups/ Sample Panels: Upon approval of all materials, the Contractor shall construct sample panels on site in the minimum size indicated below. Each sample panel shall be large enough to display typical characteristics of each item and type of work. Construct sample panels concurrently to aid in review of all materials. The Landscape Architect must approve the visual characteristics, quality of workmanship, and an installation method before final work is started. If the original sample is not approved, the Contractor shall provide additional samples, as required, at no cost to the Owner until an approved sample is obtained. The approved sample shall become the standard for the entire job. Sample panel 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. Contractor shall completely remove any panels not set in place as part of the final work from site upon final acceptance of work.
   1. Brick pavers: Independent sample: 6' x 6' minimum. Landscape Architect to determine portion of paving pattern to sample. Refer to Drawings for pattern types.
   2. Brick pavers: In-place sample: Upon Landscape Architect's written approval of independent sample, Contractor shall erect an in-place sample, 100 SF minimum, in locations specified by Landscape Architect.

G. Performance Requirements
   1. Brick pavers to meet the following requirements:
      a. Consistent joint spacing
      b. Consistent surface throughout freeze thaw cycles

H. Certification
   1. Suppliers shall furnish certification attesting that materials meet specification requirements.

1.05 QUALITY ASSURANCE

A. Materials and methods of construction shall comply with the following standards:
   1. ASTM: American Society of Testing and Materials.
   2. ANSI: American National Standards Institute.

B. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

C. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide adequate quantities of materials and products of consistent quality in appearance and physical properties.

D. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Landscape Architect's approval for layout and grading.
   1. Also refer to Division 01 Section "Execution".
   2. The Contractor shall locate all pavement edges by means of survey. Edges shall be staked or painted.
   3. The Contractor shall locate all pavement elevations by means of survey. Elevations shall be shown on grade stakes.
   4. Layout of horizontal and vertical alignments shall be coincident.
   5. At least 72 hours before commencing work, the Contractor shall have substantial portions of the pavement laid out for the Landscape Architect's review. The Contractor shall not proceed with work until the Landscape Architect accepts the horizontal and vertical layout.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect brick pavers during storage and construction against soiling or contamination from earth and other materials.
   1. Cover brick pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.

B. Store cement and other bituminous materials in tightly closed containers.

C. Store paver edge restraint in original packaging until installation begins.

1.07 WARRANTY

A. Manufacturer/Installer will certify specific pavers to meet or exceed internal standards as well as previously stated ASTM performance standards.

1.08 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or build on frozen subgrade or setting beds.

B. Weather Limitations:
   1. Install concrete only when atmospheric temperature is above 40 deg F and when base is dry.
   2. Apply prime and tack coats when ambient temperature is above 50 deg F for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

C. Grade Control: Establish and maintain required lines and elevations. Review grades and lines with

D. Landscape Architect prior to starting work and as work progresses.

PART 2 - PRODUCTS

2.01 BRICK PAVER

A. Manufacturers:
1. Supplier:
a. Pine Hall Brick, 2701 Shorefuir Drive, Winston Salem, NC 27105, (336) 721-7500 or
b. Endicott Brick. 402-729-3315, endicott@endicott.com or
c. Approved equal by Owner.
2. Shapes and overall dimensions as per the Drawings.
a. 4”x8” (7-5/8” x 3-5/8” and 4”x12” (3-5/8” x 11-5/8”)
3. Thickness: 2-1/4”
4. Color: TBD.
5. Finish: NA
6. Clarification Note: Drawings and specifications are based on manufacturer’s proprietary literature. Other manufacturers shall comply with minimum levels of materials specifications and detailing indicated on the drawings specified herein.

B. Materials:
1. Cement shall conform to Type 3 asphalt ASTM Designation D-312 with a penetration at 77 Degrees F, 100 G, 5 sec of minimum 15mm and maximum of 35mm.
2. Aggregates: All aggregates shall be blended to meet individual project requirements. They shall contain clean, hard, unweathered stone, which shall be crushed in such a manner that particles shall be as nearly cubic as possible and vary in size up to 3/8”. The inorganic dust or filler contained in the block shall be produced from sound limestone or other approved material.
3. Coloring: Pigments used shall be inorganic, resistant to alkalinity and used per manufacturer’s recommendations.
4. Average absorption of a set of four blocks shall not me more than 0.25%

C. Manufactured Units
1. Sizing Tolerances
a. All units to conform to shop drawings, with a 1/8” tolerance in dimension. all materials, equipment and supplies as required to completely perform the demolition and site preparation work specified herein and as shown on the Drawings.

2.02 EDGE RESTRAINTS FOR PAVERS

A. Steel Edge Restraints: Steel paver restraint to be supplied by Border Concepts, Inc.
1. Edge Restraint
a. Sections are to be 5” high with a 1/4” thickness. Sections are to be notched to provide for smooth curves and crisp angles. Spikes are to be steel not less than 24” length, placement every 12”-24”.
2. Edge Restraint - over shallow utilities
a. Sections are to be 5” high with a 1/4” thickness. Sections are to be notched to provide for smooth curves and crisp angles. Spikes are to be steel 15” in length, placement every 12”-24”.
3. Manufacturer: Border Concepts, Inc., or approved equal.
a. PO Box 471185
b. Charlotte, NC 28247
c. Ph: 704.541.5509

d. Fax: 704.514.5610
e. Website: http://www.borderconcepts.com/products/browse/steel-edge-iron-edge
4. Model: Iron Edge Paver Restraint

2.03 CONCRETE BASE

A. Shall conform to Division 03 Section 03 30 00 Cast-In-Place Concrete

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PACKING, LOADING AND STORAGE

A. Packing and Loading: Finished unit pavers shall be carefully packed and loaded for shipment using all reasonable and customary precautions against damage in transit. No material that may cause staining or discoloration shall be used for blocking or packing.

B. Site Storage: Upon receipt at the building site or storage yard, the unit pavers and stone shall be stacked on timber or platforms at least 4” above the ground, and extreme care should be taken to prevent staining during storage. If storage is to be for a prolonged period, polyurethane or other suitable plastic film shall be placed between wood and finished surfaces, and shall also be used as an overall protective covering. Salt shall not be used for melting of ice formed on unit paver pieces or for any purpose involving its contact with unit pavers.

3.03 INSTALLATION, GENERAL

A. The Contractor shall before commencing work, carefully and thoroughly clean surfaces to be covered with unit pavers of all dust, dirt, and foreign matter.

B. Setting: All setting shall be done by competent unit paver setters, in accordance with approved Sample Panels. Before setting, all unit pavers shall be clean and free of ice and frost.

C. Do not use pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

D. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

E. Joint Pattern : Strictly comply with pattern shown on the Drawings.
1. Paving pattern is a custom layout that will require careful preparation, precise control points, quality control and consultation with the Landscape Architect before, during and after pavement work.

2. Prior to starting work, the Contractor shall meet with the Landscape Architect and review the paving pattern and requirements for quality control and the Contractors means and methods. The Contractor shall not proceed with work in uncertainty and shall consult with the Landscape Architect for all questions pertaining to the paving.
3. The Contractor shall continuously consult with the Landscape Architect to verify that the paving pattern work is proceeding in accordance with the Drawings. The Landscape Architect shall review the paving pattern after every 500 SF of work is completed.
4. The Landscape Architect shall be permitted to adjust the pavement layout as Work progresses. The Contractor shall make layout adjustments at no additional cost.

F. Install edge restraints as indicated and in strict accordance with manufacturer's instructions. Install edge restraints before placing unit pavers.

3.04 SUBGRADE PREPARATION AND COMPACTED GRAVEL BASE COURSE

A. Prepare and install compacted subgrade and compacted gravel base courses in accordance with Division 31 Section "312000" for Earthwork.

3.05 COMPACTED GRAVEL BASE PAVER APPLICATIONS

A. Proof-roll prepared subgrade and correct deficient areas.

B. Place aggregate base in thickness indicated on the Drawings. Compact in two lifts by tamping with plate vibrator to 95% dry density.

C. Place setting bed (leveling course) and screed to thickness indicated, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

D. Set pavers with hand-tight joints, being careful not to disturb leveling base.

E. Vibrate pavers into setting bed (leveling course) with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz.

F. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
1. Contractor shall inspect joints at one, two, and four-week intervals after final filling and if joints are not full, repeat application until joints are full and stable.

3.06 CONCRETE BASE APPLICATIONS

A. Place concrete base to the depths and dimensions shown on the Drawings and in accordance with the Standard Specifications.

B. FORMS
1. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain

formwork construction tolerances and surface irregularities complying with the following ACI 347 limits.
a. Provide Class A tolerances for concrete surfaces exposed to view.
b. Provide Class C tolerances for other concrete surfaces.

2. Construct forms to provide for openings, offsets, sinkages, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, anchorages, and inserts, and other features required for the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent cement paste from leaking.
3. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and other features for easy removal.
4. Chamfer exposed corners and edges, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
5. Double stake form joints
6. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Re-tighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

C. REPARING FORM SURFACES
1. Coat contact surfaces of forms with an approved, nonresidual, low-VOC form-coating compound before placing reinforcement.

D. STANDARD CONCRETE PLACING
1. Equipment, methods of mixing and placing, and precautions to be observed as to weather, and condition of base shall meet the requirements of ACI 316R.
2. The Engineer shall be notified of scheduled concrete placement sufficiently in advance of start of operation to allow preliminary inspection of the work, including subgrade, forms, and reinforcing steel.
3. Work shall not be performed during rainy weather or when temperature is less than 40°F. (4.4°C.)
4. Adjacent work shall be protected from stain and damage. Damaged and stained areas shall be replaced or repaired to equal their original conditions.
5. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.
6. Concrete which has set or partially set, before placing shall not be used. Retempering of concrete will not be permitted.
7. Concrete shall be thoroughly vibrated, or otherwise consolidated to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.
8. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8 inch thick, shall be well scrubbed into the thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

E. BRICK PAVER
1. Crowned surfaces: test with crowned template centered and at right angle to crown. Maximum allowable variance from template 1/4”
2. Place pavers by hand, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. If

additional leveling of paving is required, and before treating joints, roll paving with power roller.

3. Place unit pavers per dimensions indicated on the Drawings. Fill joints with sand by sweeping over paved surface until joints are filled.

3.07 GRADES AND ELEVATIONS

A. The Drawings indicate, in general, the alignment and finish grade elevations. The Landscape Architect may make such adjustments in grades and alignments as are found necessary to properly complete the work. The Contactor shall not receive further compensation for adjustments.

1. Also refer to Division 01 Section “Execution”.

3.08 ACCEPTANCE

A. Final acceptance shall be based on quality of craftsmanship, adherence to patterns, and surface elevations. Poor craftsmanship, pattern deviations, and uneven surface elevations shall not be accepted. Unacceptable work shall be re-done at no cost to the Owner. The Landscape Architect and Owner shall be the sole judges of whether the work is acceptable.

3.09 REPAIR, CLEANING AND PROTECTION

A. Remove and replace pavers that are chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. After the work is installed it shall be the responsibility of the Contractor to see that the pavement is properly and adequately protected from damage. Suitable protection shall be required wherever necessary, but no lumber that may stain or deface the pavement shall be used. All fastenings and nails used in conjunction with protecting devices shall be non-staining. All pavement 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.

3.010 FINAL CORRECTIONS

A. The Landscape Architect reserves the right to inspect the work to determine if adjustments are necessary in grade, alignment or layout. The Contractor shall make such adjusts without further compensation.

END OF SECTION 32 14 03

SECTION 32 15 35 – AGGREGATE PAVING

PART 1 - PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stabilized Aggregate Paving.
2. Ornamental /Gobble Gravel Mulch.
3. Geotextile Fabric Weed Barrier.
4. Steel Header/Steel Pavement Edging.

B. Related Sections:

1. Division 31: Earthwork.
2. Section 03 30 00: Cast-In-Place Concrete.
3. Section 05 50 10: Metal Fabrications.
4. Section 32 91 13: Planting Soils
5. Section 32 92 00: Turf and Grasses.
6. Section 32 93 00: Plants

1.1 REFERENCES AND STANDARDS

A. ASTM - American Society for Testing and Materials.

B. Percent Compaction: as referred to in these specifications, percent compaction or relative compaction is required for in-place dry density of material expressed as a percentage of maximum dry density of the same material determined in accordance with ASTM Test Method D-1557-78(C).

C. Perform gradation of decomposed granite crushed aggregate in accordance with ASTM C 136 – Method for Sieve Analysis for Fine and Course.

D. Regulatory Requirements: Meet requirements of applicable laws, codes and regulations required by authorities having jurisdiction over such Work.

1.2 SUBMITTALS

A. Product Data:

1. Geotextile fabric weed barrier.
2. Stabilizer binder.
3. Steel header/steel edging.

B. Samples:

1. Crushed Stone for Aggregate Paving: 1-pound bag.

2. Geotextile Weed Barrier Fabric: 1-square foot.
3. Steel Edging: 12 inches long; full section of edging with specified finish and one stake.

C. Test Reports: Aggregate Paving Aggregate Sieve Analysis.

1.3 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Installer to provide evidence to indicate successful experience in providing and installing aggregate paving containing stabilizer binder additive.
2. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Mock-Ups:

1. 10-foot by 4-foot area of stabilized aggregate paving.
2. Mock-Up Location to be approved by Owner's Representative.
3. Install over compacted aggregate base and subgrade.
4. Install steel header along the two long sides.
5. Construct as many mock-ups as necessary to achieve an accepted finish over the entire surface of the mock-up.
6. Mock-ups which are completely or partially finished incorrectly will be rejected.
7. Remove rejected mock-ups immediately from the site.
8. Mock-ups may be installed and remain as part of the permanent installation if found acceptable by the Owner's Representative.
9. The mock-up, when accepted, shall become the project standard for compaction, aggregate consolidation, tolerances and appearance.

C. Tests:

1. Compaction Testing: The Owner's Representative may at any time during the paving installation require soil compaction tests of subgrade, aggregate base and aggregate surface paving.

1.4 SITE CONDITIONS

A. Environmental Requirements:

1. Meet stabilizer manufacturer's requirements.
2. Do not apply stabilized aggregate during, just prior to, or immediately following rainfall.
3. Do not install stabilized aggregate when ambient temperature is below 40 degrees Fahrenheit.

1.5 MAINTENANCE MATERIALS

A. Extra Stabilizer-aggregate Mix:

1. Provide to the Owner stabilizer-aggregate mix of an amount equal to 5 percent of the stabilizer-aggregate mix indicated on the Drawings.
2. Deliver stabilizer-aggregate mix to a location within the project site designated by the Owner's Representative.
3. Provide stabilizer-aggregate mix in waterproof containers.

1.6 WARRANTY

A. General Description: Warrant Work for a period of one year from the date of Final Completion against defects in materials and workmanship by Contractor. This shall include a written warranty executed by the Contractor agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period.

B. Additional Items Covered: Warranty shall also cover repair of damage to other materials and workmanship resulting from defects in materials and workmanship.

C. Exceptions: Contractor shall not be held responsible for failures due to ordinary wear, neglect by Owner, vandalism and other causes outside the Contractor's control.

PART 2 - PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SUPPLIERS

A. Aggregates or Aggregate-Stabilizer Mix for Stabilized Aggregate Paving:

1. Kafka Granite, 550 East WI-153, Mosinee, WI 54455; (715) 687-2423;

B. Geotextile Fabric Under Stabilized Aggregate Paving:

1. Carthage Mills, Cincinnati, OH; (513) 242-2740; (800) 543-4430.
2. Synthetic Industries, Chattanooga, TN; (800) 621-0444; (615) 899-0444.
3. TC Mirafi, Pendergrass, GA; (706) 693-2226.

C. Stabilizer:

a. Stabilizer Solutions Inc., Phoenix, AZ; (800) 336-2468; (602) 225-5900 or

b. Organic Lock by Enviro-Bond

D. Steel Header/Steel Edging:

1. Dura Edge/J.D. Russell Company, Tucson, AZ; (800) 888-7425; (520) 742-6194; www.jdrussellco.com.
2. Ryerson Inc., Livermore, CA; (925) 449-3498; www.ryerson.com.

2.2 MATERIALS

A. Aggregate for Stabilized Aggregate Paving:

1. Clean, hard, durable particles or fragments of ¼ inch max minus select crushed granite screenings, free of clay lumps, vegetable matter and deleterious material.
2. Color: “Hazelnut Marble” or “Rose Pink Quartz Sand”

B. Aggregate for Ornamental Gravel Areas:

1. Tree / Shrub Mulch along 11th Street Spine and Nature Play, see Drawing:

    a. Size: ½ in. to ¾ in. select crushed granite, clean and free of fines.
    b. Color: “Hazenut Marble” or “Rose Pink Quartz Sand”

C. Geotextile Fabric Weed Barrier under Stabilized Aggregate Paving: Carthage 30 percent; Mirafi FW 402; Synthetic Industries Erosion X; or equal.

D. Aggregate Base: Caltrans Standard Specifications, Section 26, Class 2 aggregate base.

E. Stabilizer for Stabilizer-Aggregate Mix: Non-toxic, odorless, colorless, organic, granular soil additive for dirt or crushed stone, which binds together aggregate screening to provide a firm paving surface as available from Stabilizer Solutions; or Organic Lock by Enviro-Bond

F. Steel Header/Steel Edging:

1. Landscape Edging: manufacturer’s heavy-duty and standard galvanized, flexible steel strips, provided with slots to receive anchoring stakes.
2. Anchoring Stakes: Manufacturer’s standard galvanized tapered steel, 16 in. long.
3. Size: 1/4 in. by 5 in. deep, typical.
4. Color/Finish: Manufacturer’s standard hot-dipped galvanized.

2.3 AGGREGATE STABILIZER MIX

A. Stabilizer-Aggregate Mix:

1. Thoroughly blend stabilizer with aggregate paving material, at the rate of 11 to 12 pounds of stabilizer per ton of aggregate screenings prior to placing stabilized mix. (It is essential that stabilizer be mixed thoroughly and uniformly through the crushed aggregate screening to achieve a successful result. The stabilizer locks the fines together, trapping the larger crushed aggregate screening. Stabilizer does not act directly on larger aggregate.)
2. Mix materials with a pug mill, truck-mounted cement mixer, or a portable mechanical mixer.
3. Mix for a minimum of 15 minutes prior to placing on substrate.

PART 3 - PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of General Conditions: Examine site and verify that conditions are suitable to receive Work and that no defects or errors are present which would cause defective installation of products or cause latent defects in workmanship and function.

B. Coordination: Coordinate aggregate paving installation with items of other trades to be furnished and set in place. This includes light poles, site furnishings, concrete footings and adjacent paving.

C. Unsuitable conditions: Before proceeding with Work, notify the Owner's Representative in writing of unsuitable conditions and conflicts.

3.2 PREPARATION

A. Protection of Existing Conditions:

1. Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the Work.
2. Provide barricades, fences or other barriers as necessary to protect existing conditions to remain from damage during construction.
3. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of existing plants to remain.
4. Submit written notification of conditions damaged during construction to the Owner's Representative.

B. Verification of Subgrades:

1. Verify that subgrades have been fine graded to the specified lines and grades and compacted to the specified compaction.
2. Notify Owner's Representative in writing of any inconsistencies.

3.3 LAYOUT REQUIREMENTS

A. Lines and Levels: Establish lines and levels, locate and lay out by instrumentation and similar appropriate means for aggregate paving.

B. Staking: Provide a sufficient quantity of grade stakes as required to establish proper finish grades.

C. Drainage: Ensure that all aggregate paving surfaces pitch to drain a minimum of 1.5% gradient and that no surface puddling or ponding occurs.

3.4 COMPACTION REQUIREMENTS

A. Compact Subgrade to minimum 90% compaction.

B. Compact aggregate base to minimum 95% compaction.

C. Compact stabilized aggregate paving to minimum 85% compaction.

3.5 WEED BARRIER INSTALLATION

A. Lay geotextile fabric weed barrier over prepared subgrade meeting requirements of fabric manufacturer's current printed installation instructions.

B. Return fabric perimeter edges up sides of headers, walls, paving edges 2 inches unless indicated otherwise.

C. Lap fabric 1 inch onto area drain rim.

3.6 AGGREGATE BASE

A. Spread aggregate base material compacted in two lifts of approximate equal thickness to the total thickness indicated on the Drawings. Compact to 95% relative compaction.

3.7 INSTALLATION OF STEEL HEADER

A. Lay out steel edging as indicated on the Drawings.

B. Install edging per manufacturer's instructions, true to the lines and grades indicated. Set edging flush with the finish grade. Weld all corners.

C. Drive steel anchor stakes through slots punched in steel edging. Set top of stakes ½ inch minimum below the top of edging.

D. Steel edging shall be reinforced as necessary to resist springing during deposition and compaction of material. Edging shall be realigned as needed in the event it is deformed during placement and compaction.

3.8 BLENDING OF STABILIZER AND AGGREGATE

A. Blend 12 to 16-lbs (call manufacturer for exact blend) of Stabilizer per 1-ton of decomposed granite aggregate screenings. It is critical that Stabilizer be thoroughly and uniformly mixed throughout decomposed granite or crushed 1/4 in. or 3/8 in. minus aggregate screenings. Bucket blending is not acceptable. Blending with a rake and or shovel is not acceptable. Blend material dry as water will make the material hard.

3.9 INSTALLATION OF STABILIZED AGGREGATE PAVING

A. Placement:

1. Place the stabilizer-aggregate mix on substrate, and rake smooth to the specified grade and cross section profile, allowing for settlement and compaction.
2. Place mix to avoid segregation, in one layer of 3-inch minimum thickness.

B. Watering Installed Paving Mix:

1. Water to achieve full-depth moisture penetration of the paving. 25 to 45-gallons of water per 1-ton of paving mix must be applied. A one-hour water application at a rate of plus or minus 20 gpm per 1,000 square feet of paving surface has achieved the desired full-depth moisture penetration on past projects.
2. Water activates stabilizer; consequently, it is essential that the full depth of stabilized aggregate is saturated.
3. Apply water using a garden hose with spray nozzle set to coarse spray.
4. Do not hold nozzle so close to paving mix surface that the aggregate surface is disturbed.
5. Do not blast surface with a water truck.
6. Test for depth of water penetration by random inspection of core holes.
7. After inspection, fill core holes with material removed, smooth and hand tamp to match adjoining paving surface grade.
8. Before compacting, watered paving must be allowed to stand 6–24 hours until surface water is no longer present and the paving mix is moist, but not wet.

C. Initial Compaction: While the paving mix is still thoroughly moist, roll with a minimum 225-pounds and maximum 30-inch-width lawn roller to achieve finish grade and initial compaction.

D. Final Compaction:

1. Compact aggregate to 85% relative compaction.
2. Use heavy compaction drum roller equipment such as a 1- to 5-ton small rider roller, after having initially used the lawn roller, to obtain the desired final, dense, smooth uniform texture.
3. If the surface is dry or flaky or sticks to the roller drums, uniformly apply more water in a light mist.
4. If the roller creates a wash-board effect, or rills, extra set-up time is needed before rolling.
5. DO NOT use whackers, vibrator plate compactors, or vibratory rollers as vibration separates the large aggregate particles, impeding proper setting and hardening of the finish paving.

3.10 ORNAMENTAL GRAVEL MULCH INSTALLATION

A. Subgrade/Sub-Surface Preparation: Remove all debris, loose dirt and other extraneous materials before installing aggregate material. Do not install aggregate prior to proper subgrade/sub-surface preparation.

B. Placement: Place ornamental gravel on top of prepared substrate with equipment of adequate size and appropriate type to achieve timely placement of surface material without damage to adjacent conditions.

3.11 FIELD QUALITY CONTROL

A. Loose Surface Gravel Inspection of Stabilized Aggregate Paving:

1. Finished surface of paving shall be smooth, uniform and solid, with no evidence of chipping or cracking.
2. Dried, compacted paving material shall be firm through depth of paving with no spongy areas.
3. Loose material shall not be present on the surface initially.
4. After the first year of use, a minor amount of loose material is expected on the surface.
5. Amount of loose material present depends on use type and frequency.

B. Improper Bonding Inspection of Stabilized Aggregate Paving:

1. Loose gravel on the surface, or unconsolidated crushed aggregate screening below the surface, is evidence of improper bonding due to poor mixing or insufficient watering.
2. Test the loose material for adequate stabilizer by wetting, then tamping, and allowing it to dry.
3. If the material still is unconsolidated, stabilizer did not get mixed adequately throughout the crushed aggregate screening.
4. If the material now is solid, initial watering was insufficient.
5. Cracking or sponginess is evidence of excessive stabilizer in the mix.
6. Any significant irregularities in finish paved surface shall be repaired to achieve uniformity in the entire installation.

3.12 REPAIRS

A. Excavate damaged area to the depth of the Stabilized aggregate and square off sidewalls.

B. If area is dry, moisten damaged portion lightly.

C. Pre-bend the dry required amount of Stabilizer powder with the proper amount of aggregate in a concrete mixer.

D. Add water to the pre-blended aggregate and Stabilizer. Thoroughly moisten mix with 25 to 45 gallons of water per 1-ton of pre-blended material or to approximately 10% moisture content.

E. Apply moistened pre-blended aggregate to excavated area to finish grade.

F. Compact with an 8 in. to 10 in. hand tamp or 250 to 300 pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

G. DO NOT use wackers or vibratory rollers.

3.13 MAINTENANCE

A. Remove debris such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed.

B. During the first year, a minor amount of loose aggregate will appear on the paving surface (1/16 in. to ¼ in.). If this material exceeds a ¼ in., redistribute the material over the entire surface. Water thoroughly to the depth of 1 in. Compact with power roller of no less than 1000 lbs. This process should be repeated as needed.

C. If cracking occurs, simply sweep fines into the cracks, water thoroughly and hand tamp with an 8 in. to 10 in. hand tamp plate.

3.14 PROTECTION

A. Stabilized Aggregate Paving: Protect surface and edges from vehicular and foot traffic for a minimum of 48 hours after final compaction by using barricades, fencing or other accepted methods.

3.15 CLEAN UP

A. Upon completion of the work of this Section, the Contractor shall remove all surplus materials and debris, and leave the site in a “broom-clean” and orderly condition.

END OF SECTION 32 15 35

END OF SECTION 32 15 35

SECTION 32 18 16 – PLAYGROUND SURFACING

PART 1 - GENERAL

1.01 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.

1.02 SCOPE OF WORK

A. The work of this Section includes, but is not limited to, the following:

1. Poured-in-Place Playground Surfacing System.

1.03 RELATED SECTIONS

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

1. Section 32 30 00 – Site Improvements.
2. Section 03 30 00 – Cast-In-Place Concrete.

1.04 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself 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. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct to the best of the Landscape Architect's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.05 DEFINITIONS

A. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."

B Fall Height: According to ASTM F 1487, this means "the vertical distance between a designated play surface and the protective surfacing beneath it." The fall height of playground equipment should not exceed the Critical Height of the protective surfacing beneath it.

C. EPDM: Ethylene Propylene Diene Monomer.

D. SBR: Styrene butadiene rubber.

E. ASTM: American Society for Testing and Materials: D412, D624, D2047, D2859, E303, F1292, F1951.

F. CPSC: Consumer Product Safety Commission.

G. IPEMA: International Play Equipment Manufacturers Association.

H. Transfer Point: According to ASTM F 1487, this is "a platform or deck along an accessible route of travel or an accessible platform provided to allow a child in a wheelchair to transfer from the chair onto the equipment."

I. Use Zone: According to ASTM F 1487, this is "the area beneath and immediately adjacent to a play structure that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.06 SYSTEM DESCRIPTION

A. Performance Requirements: Provide playground surfacing system(s) that has been designed, manufactured and installed to meet the following specifications:

1. Shock Attenuation: The test shall meet ASTM F1292 and CPSC guidelines. Gmax: Less than 200, Head Injury Criteria: Less than 1000 HIC (Head Injury Criteria).
2. Flammability: ASTM D2859: Pass.
3. Tensile Strength: ASTM D412: 60 PHI (413 kPa)
4. Tear Resistance: ASTM D624: 140%.
5. Skid Resistance: ASTM E303
6. Water Permeability: 0.4 gal/square yard/ second.
7. Accessibility: Comply with ASTM F1951 when tested on a 2% grade.

1.07 SUBMITTALS

A. Submittals shall conform to Division 1.

B. Product Data: Provide manufacturer's data showing installation and limitations in use. Submit manufacturer's technical data for the Poured in place playground surfacing and including certification that the product complies with ASTM 1292-99 "Impact Attenuation of Surface Systems Under and Around Playground Equipment" and ASTM PS 83-97 "Standard Specification for Determination of Accessible Surface Systems Under and Around Playground Equipment.".. Work includes but is not limited to:

1. Playground Surfacing Systems, all components.
2. Color Charts.
3. Provide field layout of color and pattern of surfacing to be approved by the Designer.
4. Provide samples as directed by the Designer.
5. Post installation testing will be required by the Owner at the Contractor's expense. An independent testing agency shall test to ensure a HIC of 1000; the Contractor is responsible for removal and reinstallation of the test results do not conform.

C. Shop Drawings: Show materials, cross sections, and drainage.

1. Show penetration details.
2. Show edge terminations.

D. Coordination Drawings: Layout plans and elevations drawn to scale and coordinating installation of playground surface systems with playground equipment. Show playground equipment locations, use zones, fall heights for each component, extent and depth of protective surfacing, and Critical Heights.

1. Show Critical Height of playground surfacing systems as defined in CPSC No. 325.
2. Show equipment use zones and fall heights as defined in ASTM F 1487.
3. Show edging details around boulders, vertical surfaces, fountain components and play equipment.

E. Samples:

1. Poured in Place Surface: Two (2) one-pint bags of loose material plus two 9" x 9" samples of final material with specified binder material.

F. Maintenance and Warranty data. Minimum warranty period: 5 Years.

G. Color Samples Panels: For the following products, for each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the final Work.

1. Poured in Place Surfacing System: Minimum 6' x 6'sample showing color transitions and texture variations.

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H. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

I. Product Certificates: Signed by manufacturers of playground surface systems certifying that protective surfacings furnished comply with requirements.

J. Product Test Reports: From a qualified testing agency indicating playground surface system complies with requirements, based on comprehensive testing of current products.

K. Maintenance Data: For play surfacing systems to include in maintenance manuals specified in Division 1.

L. Field Measurements: Take accurate field measurement before preparation of Shop Drawings and fabrication. Do not delay job progress.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Engage an installer who is certified in writing by manufacturer to install manufacturer's products and certified by the International Play Equipment Manufacturer's Association (IPEMA). An experienced installer who has specialized in installing work similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.

1. Engage an installer who employs workers trained and approved by playground surface system manufacturer to install manufacturer's products.
2. Engage an installer who is certified in writing by playground surface system manufacturer to install playground surface system specified.

B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain primary seamless playground surface system materials, including primers, binders, and rubber particles for cushion-base and wearing-surface layers, through one source from a single playground surface system manufacturer. Provide secondary materials including adhesives, primers, and repair materials of type and from source recommended by manufacturer of primary playground surface system materials.

D. Standards and Guidelines: Provide playground surface systems complying with applicable provisions of the following, unless more stringent provisions are indicated:

1. CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.
2. Requirements of state or local authorities having jurisdiction.

E. 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 Landscape Architect reserves the right to adjust the layout and grade without the Contractor submitting claims for extra compensation.
2. The Contractor shall not proceed with the work of this Section without obtaining the Landscape Architect's written acceptance of layout and grading.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original packages with seals unbroken and bearing manufacturer's labels indicating brand name and directions for storing.

B. Store manufactured materials in a clean, dry location, protected from the weather and deterioration, and complying with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

C. Protect UV-light-sensitive materials from exposure to sunlight.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply playground surface system materials or components over wet, frozen, or excessively damp substrates if prohibited by manufacturer's written instructions.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit playground surface system to be performed according to manufacturer's written instructions.

C. Field Measurements: Where playground surface system is indicated to fit to other construction, verify dimensions of other construction by field measurements.

1.11 COORDINATION

A. Coordinate construction of playground surface systems with installation of playground equipment, including accurate use zones and fall heights, specified in Section 32 30 00 “Site Improvements”.

PART 2 - PRODUCTS

2.01 PLAYGROUND SURFACE SYSTEMS, GENERAL

A. Accessibility: Provide playground surface systems determined to be accessible when tested according to ASTM PS 83 and designed to comply with requirements for an accessible route as recommended by ANSI A117.1.

2.02 BASE MATERIALS AND COORDINATION

A. Subgrade and subbase materials shall conform to the requirements of Section 32 11 00.

B. Cast-in-place concrete shall conform to the requirements of Section 03 30 00.

C. For coordination with Playground Equipment installation refer to Section 32 30 00.

2.03 POURED IN PLACE PLAYGROUND SURFACING SYSTEMS

A. Surface System: Poured-in place, two-layer system with wearing course over cushion course. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951

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

a. USSA PolyStar Play Surfaces (Preferred)
b. Surface America Incorporated; Play Bound Poured-in-Place.
c. Hanover Specialties, Inc.; Vitriturf.
d. GT Max Poured, as manufactured by Gametime Inc

2. Wearing Course: Formulation of EPDM rubber particles, with minimum of 20 percent and maximum of 26 percent of ethylene propylene-diene-saturated polymethylene main chain along with other organic and inorganic components, ½: thick.

3. Cushion Course: Manufacturer's standard formulation of 100% recycled SBR particles and polyurethane, site mixed and applied.

4. Binder: Weather-resistant, UV-Stabilized, flexible, Allophatic binder, nonhardening, 100 percent solids aliphatic polyurethane complying with requirements of authorities having jurisdiction for nontoxic and low VOC content. Aromatic binder will not be accepted for the top course.

5. Critical Height: 7 feet (2.1 m) and 8 feet (2.4m).

6. Overall Thickness: as required for critical height required

7. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location indicated.

8. Wearing Course Color(s): As selected by Architect from manufacturer's full range.

a. Color: As indicated on Drawings.

b. Color Mix 1 – 25% Bright Yellow, 25% Azure Blue, 25% Turquoise, 25% Black - sample for initial selection. Assume 5 additional color samples showing different color percentages for review and final selection.

c. Color Mix 2 – 25% Blue, 25% Azure Blue, 25% Turquoise, 25% Black - sample for initial selection. Assume 5 additional color samples showing different color percentages for review and final selection.

9. Base course shall be compacted gravel and shall conform to Section 31 00 00 Earthwork

10. For thickness – Manufacturer should submit appropriate thickness of material based on fall heights given in drawings and specifications, assuming a hard (not gravel) base.

11. Gravel fill shall be as specified under Section 31 00 00 Earthwork.

2.05 RUBBER TILES

A. Material: Playground safety cushions shall be produced in a square configuration in a 48” x 48” size with hollow vertical cavities on the bottom and a seamless, solid top surface. Each tile is 4 square feet and is comprised of safety surfacing obtained exclusively from the recycling of scrap tires with a dual durometer construction (SBT-Styrene Butadiene Safety) and EPDM colored granules bound together by a wear and weather resistant polyurethane.

B. Coloration should be uniform throughout the structure of the cushion expect for internal particles. Uniform density throughout prevents product separation and provides maximum resilience and adhesive attachment.

C. Fall Protection – Shall have been tested and passed for shock attenuation under ASTM F 1292-99 G-Max of less than 200 and HIC (head Injury Criteria) of less than 850-900 for the appropriate/corresponding fall height.

D. Thickness shall be a minimum of 3 ¾”

E. Shall have the following minimum technical specifications:

1. ABRASION RESISTANCE (ASTM D 4060) Durability: Wear Index—657 avg.

2. TEAR STRENGTH (ASTM D 4060) Durability: 124 lbf/in. & psi avg.

3. DUAL DUROMETER Resistance: 25/45

4. COEFFICIENT OF FRICTION* (ASTM C 1028) 0.65 dry, 0.63 wet

5. WATER PERMEABILITY* 0.27 gal/min/sq yd

6. LEAD CONTENT (ASTM D 4004) 5.97 ppm

7. WEATHERIZATION TEST (ASTM C 67 & D 573) There were no signs of failure of the play tiles after the freeze-thaw and drying conditions

8. FALL HEIGHT CRITERIA (ASTM F 1292-99) Play Tiles met their respective design fall height criteria

NOTE: ASTM = American Standard for Testing Materials *Test conducted on colored material

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound without high spots, ridges, holes, and depressions. Do not proceed with installation until suitable conditions are corrected.

B. Subgrade, subbase, and base course installation shall conform to the requirements of Section 32 11 00.

C. Bituminous base shall conform to Section 32 12 16

D. Geotextile filter fabric shall conform to Section 31 00 00

E. Strictly follow manufacturer's instruction for installation. Do not proceed without a clear understanding of how project condition and limitations affect installation. Confer with manufacturer to ensure proper installation.

3.02 INSTALLATION OF POURED IN PLACE PLAYGROUND SURFACE SYSTEMS

A. Place playground surfacing materials in excavations promptly, including manufacturer's recommended standard amount of excess material for compacting to required elevations, but not before the following have occurred:
1. Completion of subgrade construction.
2. Installation of play structure foundations.
3. Installation of concrete pavement base.
4. Installation of containment edgings.
5. Installation of Playground Equipment foundations and anchors.
6. Removal of obstructions, trash, debris, and waste fill materials.
7. Installation of Athletic Equipment foundations, anchors and sleeves.
8. Landscape Architect's approval.

B. Grading: Uniformly grade areas to an even surface free from irregular surface changes and to cross sections, lines, and elevations indicated. Unless otherwise indicated, provide a smooth transition between adjacent existing grades and new grades.

C. Base:

1. Concrete Base: Install in accordance with Section 32 12 16 and play surface manufacturer's instructions. Refer to the Drawings for pavement material at play equipment locations.

D. Geotextile Filter Fabric: Install in accordance with Section 31 00 00 and play surface manufacturer's instructions. Refer to the Drawings for pavement material at play equipment locations.

E. Poured In Place Playground Surfacing Systems

1. General: Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated.

2. Primer Application:

a. Using a brush or a short nap roller, apply Polyurethane primer to the concrete or bituminous base material and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 150-200 ft^2 /gal (7.5 m squared/L). Do not prime the entire area at once, prime at a rate of approximately 700 square feet sections.

3. Cushion Course Base:

a. Mix SBR buffings and MDI Polyurethane Binder in strict accordance with the manufacturer's instructions. Spread and trowel the mix to the required depths and allow to cure for 24 hours before the Top Coat application

4. Top Surface Installation:

a. Apply a coat of Polyurethane Primer over the cured SBR/polyurethane layer per the manufacturer's recommendations.
b. Mix wearing course and binder per the manufacturer's recommendations so pebbles are covered evenly. Spread the mix and trowel to a minimum depth of 0.5" immediately after the application of the primer and let cure for 48-72 hours.
c. At the end of the minimum curing period, verify that the top surface is sufficiently dry and firm to allow foot traffic and use without damage to the surface.
d. Do not allow foot traffic or use of the surface until it is sufficiently cured.

5. Cushion Course Base:

a. Mix SBR buffings and MDI Polyurethane Binder in accordance with the manufacturer's instructions. Spread and trowel the mix to the required depths and allow to cure for 24 hours before the Top Coat application

G. Protecting and Repairing: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Replenish with matching material, repair, and reestablish densities and finish elevations where surfaces become worn or otherwise damaged.

3.03 RESILENT TILES ON BASE COURSE

A. Insure that the base surface is clean, level and dry. Tiles must be dry. Check ambient air temperature. Minimum temperature for installation is 50 degrees and rising.

B. Provide a stable compacted sub surface in accordance with drawing details. Standard sub surface of 8” minimum medium to coarse crushed gravel (3/8” minus) moisten and compacted to 95% proctor. A ¼” graded medium sand compacted should be used to smooth the surface. A geotextile filter cloth then put over the top of the compacted surface. A 12” overlap on all joints is required. The tiles should be glued to the geotextile cover fabric by applying adhesive to both geotextile and tile base.

C. If, at any time before the final acceptance of the work, any soft imperfect areas shall develop in the surface or low points that cause standing water develop, all such places shall be removed, replaced with new materials and then compacted until the edges at which the new work connects with the old becomes visible.

D. The minimum pitch on all surfaces shall be 1.5%.

E. No vehicular traffic or loads shall be permitted on the newly completed pavement until adequate stability has been attained and the material has cooled sufficiently to prevent distortion or loss of fines.

F. Do not proceed with playground surfacing installation until all applicable site work, including substrate preparation, fencing, playground equipment installation, and any other relevant work has been completed.

G. Tiles to be flush with adjacent poured in place rubber surface.

H. Avoid placement when large temperature swings during the time between adhesive applications and final curing are expected, as gapping between tiles may result.

I. Apply adhesive on tight asphalt at a rate recommended by the manufacturer. Adhesive consumption will increase as asphalt porosity increases. Apply using a notched trowel.

J. Apply adhesive to tiles sides using a putty knife, roller, or adhesive tube. Apply adhesive to 50% of the perimeter to allow for rainwater discharge.

K. Maintain a straight line at the tile joints. To keep lines straight, adjust tiles using a rubber mallet as they are installed

3.04 CLEAN-UP AND PROTECTION

A. Non-Loose Fill Systems: Prevent traffic over system for not less than 48 hours after installation. Protect playground surface system from damage and wear during the remainder of construction period. Clean playground surface system after time period recommended in writing by playground surface system manufacturer but not more than four days before dates scheduled for inspections intended to establish date of Substantial Completion. Use cleaning materials and procedures recommended in writing by playground surface system manufacturer.

1. During installation of adhesively applied products, immediately remove visible adhesive from surfaces. Use cleaner recommended by playground surface system manufacturer.

C. Clean tiles in accordance with manufacturer’s instructions.

D. Protect playground safety surfacing tiles from foot traffic for a minimum of 12 hours after installation.

E. Protect completed tiles from damage during construction.

END OF SECTION 32 18 16

SECTION 32 30 00 – SITE IMPROVEMENTS

PART 1 - GENERAL

1.01 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.

1.02 SCOPE OF WORK

A. The work of this Section includes providing interactive play pieces consisting of the following types with design configurations and accessory components shown on Contract Drawings and/or specified herein:

1. Play Equipment
2. Water Plays Equipment
3. Benches
4. Trash Receptacles
5. Bike Racks

1.03 RELATED SECTIONS

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

1. Section 01 23 00 – Alternates.
2. Section 03 30 00 – Cast in Place Concrete
3. Section 31 00 00 – Earthwork
4. Section 32 18 16– Playground Protective Surfacing.

1.04 DEFINITIONS

A. Composite Play Structures: According to ASTM F 1487, this means "two or more play structures, attached or functionally linked," creating one integral unit with more than one play activity.

B. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."

C. Fall Height: According to ASTM F 1487, this means "the vertical distance between a designated play surface and the protective surfacing beneath it." The fall height of playground equipment should not exceed the Critical Height of the protective surfacing beneath it.

D. IPEMA: International Play Equipment Manufacturers Association

E. Play Structure: According to ASTM F 1487, this is "a free-standing structure with one or more components and their supporting members."

F. Protective Surfacing: According to ASTM F 1487, this means impact-attenuating "materials to be used within the use zone of any playground equipment" for playground surface systems.

G. Transfer Point: According to ASTM F 1487, this is "a platform or deck along an accessible route of travel or an accessible platform provided to allow a child in a wheelchair to transfer from the chair onto the equipment."

H. Use Zone: According to ASTM F 1487, this is "the area beneath and immediately adjacent to a play structure that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.05 SUBMITTALS

A. Submittals shall conform to Division 1.

B. Product Data: Submit manufacturer's technical and physical property data and installation instructions for each item/type of play equipment specified. Include materials, components, construction details, material descriptions, dimensions of individual components and profiles, and finishes to completely describe assemblies.

1. Include component data for items of attachment devices and accessories of each type identified and for each condition.

C. Shop Drawings for All Play Equipment Fabrication: For each type of playground equipment, include materials, plans, elevations, sections, details, method of field assembly, connections, and installation details not otherwise detailed as part of submitted Product Data. Include details as needed to clearly convey the form of the item assembly, methods of assembly, connections, supports, hardware, and installation details; and details of play accessories.

1. Include schedule(s) related to selected color and finish for each item of each unit assembly.

D. Shop Drawings for Layout and Coordination: Drawn to scale and coordinating playground equipment installation with playground surfacing systems. Show playground equipment locations and extent of playground surfacing systems.

1. Show equipment use zones and fall heights as defined in ASTM F 1487.
2. Show Critical Height of playground surfacing systems as defined in CPSC No. 325.
3. Coordinate equipment use zones with layout of walls, benches, existing curbs, planting areas and adjacent pavements, so that play equipment when installed

meets the minimum use zone allowable for each component in conformance with CPSC guidelines.

4. Coordinate layout of play equipment footings prior to installation.
5. Coordinate construction of equipment use zones and fall heights during installation of playground equipment with installation of protective surfacing specified in Section 32 18 16 – Playground Protective Surfacing. Sequence work so protective surfacing can be installed immediately after concrete footings have set.

E. Shop Drawings for Erection: To guide installation, play equipment units shall be accompanied by erection drawings, bills of materials, and written instructions for handling and erection/assembling. Prepare and submit prior to delivery of the play structures and include copies with delivery. To facilitate assembly, each part/component shall be clearly marked with easily read identifying information keyed to the bills of materials and erection drawings.

F. Quality Assurance Submittals: Submit for the following and as additionally specified in Article “Quality assurance” herein.
1. Manufacturer / Product Certificates: Submit certificate, signed by manufacturer’s of playground equipment, certifying that products furnished comply with requirements of specifications and applicable safety standards related to use of play equipment.
2. Installer’s Qualifications Certificate: Submit copy of Installer’s resume, signed by play equipment manufacturer, certifying that Installer play equipment complies with experience requirements of specifications and of play equipment manufacturer.

G. Contract Closeout Submittals:
1. Field Quality Control Report: Indicate compliance of playground and installed playground equipment and components with requirements as specified in Article “Field Quality Control” herein.
2. Maintenance Data: Submit maintenance manuals specified in Division 1 Section “Closeout Procedures” for all items of playground equipment, operating devices, and related finishes. Include the following:
   a. Specific instructions and product recommendations for cleaning, including graffiti removal, related to each surface condition.
   b. Manufacturer’s recommended play equipment maintenance schedule and maintenance instructions.

H. Samples: Prior to ordering items specified as work of this Section, submit representative samples to Landscape Architect for selection and approval. Do not order materials or equipment until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples. Submit duplicate samples of each type showing full range of color variation, finish and texture that can be expected in the permanent work for each exposed finish.

I. Product test reports.

J. The Contractor shall submit to the Landscape Architect, for approval by the Owner, a progress schedule for all work as specified herein in accordance with Division 1.

K. Field Measurements: Take accurate field measurement before preparation of Shop Drawings and fabrication. Do not delay job progress.

1.06 QUALITY ASSURANCE

A. Installer's Qualifications: An experienced installer who has specialized in installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to the manufacturer of playground equipment. Confirm qualifications with resume of work experience showing that Installer has successfully completed (2) two installations using play equipment manufacturer's products.

B. Contract Documents (Specifications and Drawings) are intended to convey the salient features, function and character of the playground equipment assemblies and systems and do not undertake to illustrate or set forth every item or detail necessary for the work. Minor details not usually indicated by the Contract Documents, but that are necessary or normally required for the proper execution, completion, and installation of the playground equipment, shall be included, the same as if they were herein specified or indicated.

C. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in manufacturer's shop prior to Project delivery. Work that cannot be permanently shop assembled, shall be completely assembled, marked, and disassembled in shop before shipment to insure proper assembly in field.

1.07 COORDINATION

A. Coordinate layout of play equipment footings prior to installation. Furnish all necessary templates and patterns required by work specified in other Sections. Furnish all pertaining items that are to be built into or attached to work under other Sections. Supervise and be responsible for the proper location and installation of such built-in items.

1.08 DELIVERY, STORAGE, AND HANDLING

A. All components shall be shipped protectively wrapped, and ready for assembly.

B. Protect finished products and components against soiling, staining, or damage from scratches and abrasion. Maintain suitable protection during transport, handling operations, storage, and construction until completion.

PART 2 - PRODUCTS

2.01 PLAYGROUND EQUIPMENT

A. Provide the following play equipment fabricated as a "Basis of Design" (no substitutions), manufactured by Richter Spielgerate GMBH, Representative Architectural Playground Equipment, Inc., US Partner, Richter Spielgeräte GmbH William Larson, Custom Design & Technical support, Tel.: 212-213-6694. 26 Bond Street, New York NY 10012 Email: planning@archplayequipment.com & rmeyer@archplayequipment.com:

1. Project Number 1082-01
2. Provide the following play equipment fabricated of V4A stainless steel (AISI Type 316) as a "Basis of Design" (no substitutions)
3. Two Storey Play House. (Model # L4.10500)
4. (4) Jumping Discs (Model #6.06000)
5. Water Play Elements of Metal

a. (2) Playground Pump (Model # A5.17630)
b. Water Flooder (Model # 5.13000/5.13050)
c. Mud Trough (Model # 5.14700)
d. Water Tray with Ball Shutter (Model #5.14200)
e. Small Bucket Wheel (Model #5.15910)
f. (2) Mushroom Spring (Model #5.18005)
g. Archimedes Screw (Model#5.20800)
h. Flow Table (Model # 5.41030)
i. Horizontal Mill Wheel (Model #5.28020)
j. Bar Gate (Model #5.28031)
k. Sickle Gate (Model #5.28032)
l. Rotating Gate (Model #5.28035)
m. Round Flap (Model #5.28033)
n. Rectangular Flap (Model #5.28034)

6. Water Play Elements of Concrete
   a. Round Reservoirs (Model #5.22000 ff. 2 openings)
   b. (2) Round Water Basins (Model #5.24000 ff)
   c. Cobble Water Basin
7. Custom Treehouse (Custom Fabricated Item, Reference #1082-01-E01)
8. Climbing Structure (Custom Fabricated Item, #A6.51007)
9. Slide Section (Custom Fabricated Item, #3.64220, Reference #1082-01-E01)

B. General

1. Material: All the materials shall be structurally sound and suitable for safe play. Durability shall be ensured on all steel parts by the use of time-tested coatings such as zinc plating, galvanizing, Colors shall be as approved on shop drawing submittals.
2. Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F879 unless otherwise indicated (see specific product installation/specifications). All primary fasteners shall include a locking patch-type material that will meet the minimum torque requirements of IFI-125. Manufacturer to provide special tools for pinned tamperproof fasteners.
3. Metal components shall be thoroughly cleaned in a hot phosphatizing pressure washer, then primed with a water-based thermosetting solution. Primed parts shall be preheated prior to dipping in UV-stabilized, liquid polyvinyl chloride (PVC), then salt cured at approximately 400 degrees. The finished coating shall be approximately .080” thick at an 85 durometer with minimum tensile strength of 1700 PSI and a minimum tear strength of 250 pounds/inch.
4. All metal components shall be thoroughly cleaned and phosphatized through a five-stage power washer. Parts are then thoroughly dried, preheated and processed through a set of automatic powder spray guns where a minimum .002” of epoxy primer is applied. A minimum .004” of architectural-grade Super-Durable polyester TGIC powder is applied. The average ProShield film thickness is .006”.
5. Metal finish is formulated and tested per the following ASTM standards. Each color must meet or exceed the ratings listed below:
   a. Hardness (D3363) rating 2H
   b. Flexibility (D522) pass 1/8” mandrel
   c. Impact (D2794) rating minimum 80 inch-pounds
   d. Salt Fog Resistance (B117 and D1654) 4,000 hours and rating 6 or greater
   e. UV Exposure (G154, 340 bulb) 3,000 hours, rating delta E of 2, And 90 percent gloss retention

f. Adhesion (D3359, Method B) rating 5B
g. The Paint Line shall employ a “checkered” adhesion test daily

6. Rotationally Molded Polyethylene Parts: These parts shall be molded using prime compounded linear low-density polyethylene with a tensile strength of 2500 psi per ASTM D638 and with color and UV-stabilizing additives. Wall thickness varies by product from .187” (3/16”) to .312 (5/16”).
7. Permalene Parts: These parts shall be manufactured from ¾” high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI per ASTM D638. Five standard solid colors are available in two-color product with (2). 100” thick exterior layers over a .550” interior core of a contrasting color.
8. Recycled Permalene Parts: These parts shall be manufactured from ¾” high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI per ASTM D638. Available in a three-layer product with (2) .100” thick colored exterior layers over a .550” thick 100% recycled Black interior core. Five standard color options are available.
9. Footings: Unless otherwise specified, the bury on all footings shall be 36” below Finished Grade (FG) on all in-ground play events/posts. Other types of anchoring are available upon request.
10. Hardware Packages: All shipments shall include individual component-specific hardware packages. Each hardware package shall be labeled with a part number, description, a component diagram showing the appropriate component, package weight, a bar code linking the hardware package to job number, assembler’s name, date and time the package was assembled, work center number, and work order number.
11. Installation Documentation: All shipments shall include a notebook or packet of order-specific, step-by-step instructions for assembly, footing dimensions, concrete quantity for direct bury components, fall height information, area required information and detailed material specifications.
12. Packing List: All shipments shall include a packing list for each skid/container, specifying the part numbers and quantities on each skid or within each container.
13. Packaging: Posts shall be individually packaged in sturdy, water-resistant, mar-resistant cardboard boxes. Other components shall be individually wrapped or bulk wrapped to provide protection during shipment. Small parts and hardware packages will be placed in creates of shipment. The components and crates are then shrink-wrapped to skids (pallets) to ensure secure shipping.
14. Maintenance Kit: An order-specific maintenance kit shall be provided for each structure order. The kid will include a notebook or packet with a second set of installation documents and order-specific maintenance documentation with recommendations on how often to inspect, what to look for and what to do to keep the equipment in like-new Condition. The kit also includes touch-up primer, appropriate color touch-up paint, sandpaper, appropriate color touch-up PVC, graffiti remover and additional installation tools for the tamperproof fasteners.
15. Wood Posts: Post length shall vary depending upon the intended use. All posts shall be European Mountain Larch (Larix decidua) or Robinia (Robinia pseudoacacia).
    a. Quality Control
        1) Close year rings: poles must have at least 8 year rings in the outer 2cm
        2) Centered year rings: maximum pith eccentricity is 3cm
        3) Bark and sapwood is removed practically splinter-free
        4) Meets European standard for wood durability – EN 350

5) Open-air drying to reduce internal moisture before wood is used for construction (wood-destroying fungi require moisture >20% to survive)
6) Steel feet are added to most vertical posts made of larch
7) Vertical posts are cut with angled tops and covered in paraffin wax or steel caps to facilitate water runoff
8) Color- Natural weathered – grey

16. Steel or Aluminum Posts: All steel posts per manufacture specifications

17. Clamps: All clamps are finished and, unless otherwise noted, shall be die cast using a 369.1 aluminum alloy and have the following mechanical properties:
    a. Ultimate Tensile: 47,000 PSI
    b. Yield Strength: 28,000 PSI
    c. Elongation: 7% in 2 inches
    d. Shear Strength: 29,000 PSI
    e. Endurance Limit: 20,000 PSI

18. Each functional clamp assembly shall have an appropriate number of half clamps and shall be fastened to mating parts with (2) 3/8" x 1 1/8" pinned button head cap screws (SST) and (2) stainless steel (SST) recessed "T" nuts. A ¼" aluminum drive river w/stainless steel pin is used to ensure a secure fit to the post. Clamps have three functional applications and shall be named as follows:
    a. Offset hanger clamp assembly.
    b. Deck hanger clamp assembly
    c. Hanger clamp assembly

19. Cable: Compromised of six-stranded and tempered cable with a polypropylene core. The galvanized steel wire cores of the six strands are inductively fused to polyamide coating.
    a. On all other parts, i.e.: swing seats and hangers, grills, climber handholds, PVC belting material, hydraulic cylinders, etc., against failure due to corrosion/natural deterioration or manufacturing defects.

20. Warranty
    a. Richter's standard warranty guarantees its equipment against defective workmanship and materials from date of delivery to the installation site for up to five (5) years on wooden posts, up to ten (10) years on metal posts, two (2) years on movable parts and ropes, and three (3) years for all other parts. Acts of vandalism, typical wear and tear, improper use, incorrect installation, and acts of nature are excluded from the warranty. This warranty covers parts only. Failure to follow Richter's maintenance instructions invalidates the warranty.

2.02 SALVAGED EXISTING BENCHES

A. Existing benches to be salvaged or replaced shall be manufactured by Landscape Forms www.landscapeforms.com, PH 800-521-2546
   1. Model: Petoskey, Back Bench, Dual Embedded, Rod Insert, Color Black Finish

B. Or approved equal

2.03 TRASH RECEPTACLES

A. Shall be part number HA-P and HA2-PX manufactured by Bear Saver., 1390 S. Milliken Ave, Ontario, CA 91761, PH 909-605-1697, www.bearsaver.com or approved equal

1. Color: Black Texture

2.04 BIKE RACKS

A. Shall be the City of Boulder, Colorado standard Inverted “U” Bike Rack, See detail drawings

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Manufacturer and Installer of play equipment present, for compliance with requirements for site clearing, earthwork, site surface and subgrade drainage, and other conditions affecting performance.

1. Do not begin installation before final grading required for placing protective surfacing is completed, unless otherwise permitted by Construction Manager.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Verify locations of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements for each type and component of equipment.

B. Layouts: Prior to installation of concrete footings and slabs, perform layout of playground equipment units together with concrete installer, manufacturer and installer of playground equipment, and Landscape Architect.

1. Use approved Shop Drawings for layout work.

2. Concrete Work: Relate to and arrange cast-in-place concrete work together with work as specified in Division 3 Section 03 30 00 “Cast in Place Concrete”.

3.03 INSTALLATION

A. General: Comply with manufacturer's furnished written installation instructions and erection drawings, unless more stringent requirements are indicated.

B. Play Equipment

1. Assemble all components and units of playground equipment. Make all connections secure with tight fit.

2. Anchor playground equipment securely, positioned at locations and elevations as indicated on the approved Shop Drawings. Concrete footings shall be in accordance with Section 03 30 00.

3. Items damaged by transportation, installation or during the construction process, shall be removed and replaced at no additional cost to the Owner.
4. Remove all items and materials that might be hazardous for play.
5. All screws and bolts shall be re-tightened 6 weeks after play equipment installation.

3.04 FIELD QUALITY CONTROL

A. Arrange for playground equipment manufacturer's technical personnel to inspect playground and playground equipment and components at final completion. Manufacturer, on Manufacturer's letter head, shall certify inspections and that equipment is properly installed and shall perform in a safe manner.

B. Notify Construction Manager 72 hours in advance of date and time of final inspection.

3.05 ADJUSTING

A. Adjust movable playground equipment components to operate smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.

3.06 CLEANING

A. After completing playground equipment installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 32 30 00

SECTION 32 40 00 – LANDSCAPE BOULDERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

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

1.02 SUMMARY

A. Work of this Section includes but is not limited to the following:

1. Sourcing, furnishing, selective fabrication, delivery to site and installation of the following stone materials in sizes indicated:

    a. Boulder at Mounds
    b. Boulder Embankment
    c. Boulder Stepping Stone
    d. Riprap Seating Boulder
    e. Riprap Stepping Stones
    f. Salvaged Stone Steps
    g. Boulder at Weir
    h. Nature Play Boulders (large and small)

2. Installation of natural stone boulders and stepping stones in presence of Landscape Architect, including field adjustment of each boulder for aesthetic effect.
3. Protection of stone during transit, storage, erection and after installation.
4. Setting mortars and related setting accessories for complete installation.
5. Coordination and provisions for and interfacing with adjoining construction.
6. Cleaning of stone material before installation and after placement on-site prior to acceptance.

B. Related Sections include the following:

1. Division 31 - Section 31 00 00 “Earthwork”
2. Division 31 – Section 31 37 00 “Riprap”
3. Division 32 – Section 32 15 35 “Aggregate Paving”
4. Division 32 – Section 32 30 00 “Site Improvements”
5. Division 32 – Section 32 93 00 “Plants”
6. Division 32 – Section 32 91 13 “Planting Soils”
7. Division 3 – Section 03 30 00 “Cast-in-Place Concrete”
8. Division 32 – Section 31 11 00 “Base Courses (Pavement)

1.03 SUBMITTALS

A. General: Refer to and comply with Division 1 Section 01 33 00 “Submittal Procedures” for procedures and additional submittal criteria.

B. Statement of Qualifications: Submit to identify and exhibit landscape boulders installer 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 each stone type 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 boulders 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 Boulders. Include material certification and analysis reports.

3. For Cleaning Landscape Boulders: Submit product information and description of method(s) for cleaning stone boulder type installation during work and at completion.

D. Shop Drawings:

1. Submit Shop Drawings for the items indicated below. Shop Drawings shall include materials, profiles, plans, elevations, sections, details, method of assembly, connections, and installation.

a. Boulder at Mounds
b. Boulder Embankment
c. Boulder @ Weir
d. Salvaged Stone Steps
e. Nature Play Boulders

2. Setting Drawings: Submit setting drawings showing the relationship to adjoining construction and, after final selection, indicating the location of stone units and as indicated on Contract Drawings.

a. Stone Boulders and Stepping Stones: For stone boulders and stepping stones 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.

3. Coordination (Composite) Drawings:

a. 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.

4. Mock-up Layout for Boulder Mounds and Stepping Stones: Submit layout and detail shop drawing(s) for material and installation of Boulder Mounds and Stepping Stones to locate and confirm mock-up requirements as specified in Article “Quality Assurance” herein.

E. Samples for Initial Selection (Submitted at time of Contract Award):

1. For all stone items: Submit representative unit sample of stone material, in quantity to indicate the full range of material characteristics, color, and texture specified prior to submittal of sample “For Verification”.

F. Samples for Verification:

1. For Stone Boulders (Submitted prior to examination of Boulders at Quarry): Submit one (1) set of sample block units, at a minimum size of 14” high x 24” long x 18” depth in quantity to indicate the full range of material characteristics, color, and texture specified..
2. Mortar Color Sample

1.04 QUALITY ASSURANCE

A. Supplier Qualifications: Stone supplier shall be by a firm or firms that have successfully supplied 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.

B. Installer Qualifications: Installation of Stone Boulders and Stepping Stones shall be by a firm that can exhibit proof of a minimum of seven (7) years prior successful experience with stone installations of similar material, design, and extent to that indicated for this Project.

1. Stonework Foreman: Installation firm for Landscape Boulders of this Project shall have on staff a Supervising Foreman assigned full time to this Project, from time of mock-up installations, who shall have at least 10 years total stonework installation experience and with at least 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 of previous projects worked on.

2. Use 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 the specific requirements and methods needed for performance of the work in this Section.

C. Source Limitations for Stone: Obtain Stone Boulders and Stepping Stones from a single quarry with resources to provide materials and products of consistent quality in appearance and physical properties without delaying the work. Coordination with Riprap Quarry and color to match.

D. 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.

E. Field Samples/Mock-Ups for Stone Boulders: Construct at earliest possible time and at an approved location 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. Notify Construction Manager at least seven days in advance of dates and times when field sample/mockup will be constructed.
2. Construct to comply with the following requirements, using materials indicated for the completed work, including same base construction, special features for expansion joints, and contiguous work as indicated:

   a. Construct representative stone boulder placement sample/mockup in a location as approved by the Construction Manager. Install a minimum of 15 boulders including stacked units, complete with setting bed.
   b. For boulder units, prepare full size field assemblies for methods to demonstrate aesthetic effects and qualities of materials and execution, including installation of stacked units.
   c. Demonstrate the proposed range of aesthetic effects and workmanship.
   d. Obtain Landscape Architect's approval of field sample/mockup before starting Landscape Boulder installations of Project.
   e. Maintain mockup during construction in an undisturbed condition as a standard for judging the subsequent completed work.

3. Field Samples/Mock-Ups for Stone Boulders may be used as part of completed work if material and installation is approved by Landscape Architect, otherwise demolish and remove field sample/mock up at a time approved by the Construction Manager and when no longer required to serve as a standard of work.

G. 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.

1.05 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.

1.06 PROJECT/SITE 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 temperatures of 100 degrees F. (38 deg C.) and above.
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.).

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

B. Field Measurements: Coordinate stonework and related layouts with trades and work preceding stone installation and take additional field measurements as necessary to accommodate conditions.

C. Stain Prevention: Take care to minimize mortar spillage. Immediately remove mortar and soil to prevent them from staining the exposed face of stone.

1.07 SEQUENCING AND SCHEDULING

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

B. Stone boulder stones shall be installed after preparation of subgrades and installation of adjacent subsurface drainage, electric and water services, and structural soils.

PART 2 - PRODUCTS

2.01 STONE BOULDERS AND STEPPING STONES

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. Boulder Surface Finish: Natural weathered or split face finish with drill or tool marks on no more than one side of boulder.
4. Stone shall be uniformly consistent in 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. Stone Types: The following establishes acceptable stone material, color range, and finish under consideration for selection by the Landscape Architect. Comply with additional provisions of “Source Limitations for Stone” in Article “Quality Assurance” herein and provide specified stone materials as a “Basis of Design” (no substitutions):

1. Landscape Boulders (Glacial Erratic Stone): Provide Boulders of the sizes as indicated by Contract Documents matching grain, and colors of representative boulders as selected by Landscape Architect at stone material source. Boulders shall be round, no sharp corners and have a natural fractured face finish without tool or drill marks.
2. Stepping Stones: Provide Stepping Stones of the sizes as indicated under the Stone Schedule on the Contract Drawings matching grain and colors of representative stepping stones as selected by the Landscape Architect at stone material source.
3. Provide natural stone Landscape Boulders and Stepping Stones material from the following quarry:

    a. High Plains Stone Company Pawnee River Granite, 8084 Blakeland Drive, Littleton, CO 80125, 303-791-1862
    b. Glacier White, Butala Sand & Gravel, 9000 County Road 152, Salida, CO 81201, 719-539-2521
    c. Crystal Landscape Supplies, 970-669-3565
    d. Pioneer Sand Company. 970-223-4505
    e. Hall-Irwin, 888-795-7625
    f. Colorado Material, 303-682-2314
    g. Salvaged stone from site excavation that meets specified requirements.

C. Boulder Shapes and Sizes: Provide roughly rounded shaped boulders that comply with the size requirements by stone type as indicated on the Contract Drawings.

1. Boulder Embankment:

    a. Height: Between 1'-6" and 3'-0".
    b. Length: Between 1'-8" and 6'-0".
    c. Depth: Between 1'-0" and 2'-6".
    d. Maximum Taper: 8" end to end along any face.
    e. Stone Grain: Parallel to the longest side of the boulder.
    f. Size Distribution (Except "Specimen Boulders"):

        1) Provide a minimum of 20% of all boulders at the maximum length.
        2) Provide a maximum of 20% of all boulders at the minimum length.

2. Boulder Stepping Stones:

    a. Height: Between 1'-0" and 3'-0".
    b. Length: Between 1'-6" and 4'-0".
    c. Depth: Between 9" and 1'-6".
    d. Maximum Taper: 5" end to end along any face.
    e. Stone Grain: Parallel to the longest side of the boulder.
    f. Size Distribution (Except "Specimen Boulders"):

        1) Provide a minimum of 20% of all boulders at the maximum length.
        2) Provide a maximum of 20% of all boulders at the minimum length.

3. Riprap Stepping Stone:

    a. Height: Between 1'-6" and 3'-6".
    b. Length: Between 1'-8" and 5'-0".
    c. Depth: Between 2'-6" and 4'-0".
    d. Maximum Taper: 5" end to end along any face.
    e. Stone Grain: Parallel to the longest side of the boulder.
    f. Size Distribution (Except "Specimen Boulders"):

        1) Provide a minimum of 20% of all boulders at the maximum length.
        2) Provide a maximum of 20% of all boulders at the minimum length.

4. Riprap Seating Boulder:

    a. Height: Between 2'-6" and 4'-6".
    b. Length: Between 2'-6" and 8'-0".
    c. Depth: Between 1'-0" and 3'-6".
    d. Maximum Taper: 12" end to end along any face.
    e. Stone Grain: Parallel to the longest side of the boulder.
    f. Size Distribution (Except "Specimen Boulders"):

        1) Provide a minimum of 20% of all boulders at the maximum length.
        2) Provide a maximum of 20% of all boulders at the minimum length.

5. Boulder at Weir:

a. Height: Between 1'-6" and 2'-6".
b. Length: Between 1'-6" and 3'-0".
c. Depth: Between 1'-0" and 2'-6".
d. Maximum Taper: 8" end to end along any face.
e. Stone Grain: Parallel to the longest side of the boulder.
f. Size Distribution (Except "Specimen Boulders"):

1) Provide a minimum of 20% of all boulders at the maximum length.
2) Provide a maximum of 20% of all boulders at the minimum length.

6. Nature Play Boulders Small:

a. Height: Between 1'-6" and 2'-6".
b. Length: Between 1'-6" and 3'-6".
c. Depth: Between 6" and 2'-0".
d. Maximum Taper: 5" end to end along any face.
e. Stone Grain: Parallel to the longest side of the boulder.
f. Size Distribution (Except "Specimen Boulders"):

1) Provide a minimum of 20% of all boulders at the maximum length.
2) Provide a maximum of 20% of all boulders at the minimum length.

7. Nature Play Boulder Large:

a. Height: Between 1'-6" and 3'-6".
b. Length: Between 1'-8" and 7'-0".
c. Depth: Between 1'-6" and 3'-6".
d. Maximum Taper: 8" end to end along any face.
e. Stone Grain: Parallel to the longest side of the boulder.
f. Size Distribution (Except "Specimen Boulders"):

1) Provide a minimum of 20% of all boulders at the maximum length.
2) Provide a maximum of 20% of all boulders at the minimum length.

8. Landscape Boulder Seating:

a. Height: Between 1'-0" and 2'-6".
b. Length: Between 4'-0" and 8'-0".
c. Depth: Between 2'-6" and 4'-0".
d. Maximum Taper: 8" end to end along any face.
e. Stone Grain: Parallel to the longest side of the boulder.
f. Size Distribution (Except "Specimen Boulders"):

1) Provide a minimum of 20% of all boulders at the maximum length.
2) Provide a maximum of 20% of all boulders at the minimum length.

D. Provisions for Examinations at the Quarry: Landscape Boulders shall be made available for inspection by Owner, Construction Manager, and Landscape Architect prior to delivery to site.

1. Contractor shall be responsible for arranging and paying for all transportation, lodging, and meals associated with inspection trips to quarry sources by Owner, Construction Manager and Landscape Architect. Contractor shall assume a minimum of three quarry visits by 3 to 4 persons each visit.

E. 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, 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.

2.02 STONE BOULDER INSTALLATION MATERIALS

A. Boulder Fragment Infill: Provide fractured boulder fragments as required to infill gaps between boulders and for shimming to secure boulders in place.

1. Boulder Fragment Infill shall match approved boulder stone and shall not exceed 10% of total exposed boulder surfaces installed.
2. Boulder Fragment Infill pieces shall be as large as is practicable and, to the extent possible, installed so that the grain of the boulder fragment infill pieces matches the line and direction of the grain of adjacent boulders.

B. Portland Cement Setting Mortar Materials:

1. Portland Cement: Comply with ASTM C150, Type I or II. For joint mortar, provide of natural color or white as required to produce joint color required. 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, 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, 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.

C. Contractor shall provide a total of 50 (1/2" x 6"L) Stainless Steel Pins for boulders requiring anchoring.

D. Geogrid Membrane shall be Uni-axial Tensar RE, or approved equal. Refer to Section 02375 and Contract Drawings.

2.03 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.

A. with ASTM A167 to the size and dimensions as shown on the contract drawings.

2.04 RIVERSTONE

A. Riverstone shall be River Jack. Size shall be as shown on the Drawings. Color shall be as selected by the Landscape Architect form the full range of available colors.

PART 3 - EXECUTION

3.01 PREPARATION

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

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

C. Layout of Work: Accurately lay out Landscape Boulders 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.

D. Clean stone boulder units that have become dirty or stained by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clean water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.02 INSTALLATION

A. General:

1. Do not use stone boulder units with chips, cracks, voids, stains, discolorations, or other defects that might be visible in the finished work. If installed, remove and replace with stone units meeting specification requirements and approval of the Landscape Architect.
2. Execute the work by skilled mechanics, and employ skilled stone fitters.
3. Set stone in accordance with Contact Documents and final approved shop drawings. Provide boulder fragment stones to secure stone in place as required. Shim and adjust boulders as required for proper and correct setting of stone.
4. Adjust boulders as directed by Landscape Architect for aesthetic effect.

B. Setting Stone Boulder Units:

1. Install Boulder Base Mix per Section 32 91 13 – Planting Soils.
2. Place boulder units in accordance with the approved Shop Drawings, and the approved Mock-up as described under 1.04 Quality Assurance.
3. Allow for review and adjustment to placement of each boulder by Landscape Architect at time of installation.
4. Where necessary, anchor boulders with stainless steel pins and as indicated on the drawings.
5. Fill gaps greater than 2” between boulders with hand placed and mortared boulder fragments as required to provide a solid boulder face effect.
6. Joint mortar shall be deep raked so that boulders appear to be dry laid and shall be applied of color selected and approved by the Landscape Architect.

C. Setting Stepping Stones:

1. Install setting base per Section 32 91 91 – Planting Soils
2. Place Stepping Stones in accordance with approved Mock-up as described under 1.04 Quality Assurance.
3. Allow for review and adjustment to placement of each stepping stone by Landscape Architect at time of installation.

D. Setting Riverstones: Install stone as shown on the Drawings and in strict accordance with the approved Shop Drawings.

3.03 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 natural stone boulders 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.

3.04 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 natural stone landscape boulders that are defective, broken, chipped, stained, or otherwise damaged.

1. Replace in a manner that results in natural stone landscape boulders 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 stone boulders.

END OF SECTION 32 40 00

SECTION 32 91 13 – PLANTING SOILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 01 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. This Section specifies administrative and procedural requirements for subgrade preparation and manufactured planting soils including, but not limited, to the following:

1. Evaluation of prepared subgrade water infiltration.
2. Planting soil material acquisition.
3. Testing and analysis for specification conformance.
4. Inspection and testing of subgrade for preparation of subgrade.
5. Preparation of mixes and testing for conformance.
6. Installation and placement of drainage layer and planting soils.
7. De-compaction and re-compaction of soils.
8. De-compaction and amendment to existing turf areas.
9. Final in-place testing of soils.
10. Coordination with other contractors.
11. Clean-up.

B. References to other Sections are given that would duplicate provisions in this Section.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. Section 32 92 00 – Turf and Grasses

B. Section 32 93 00 – Plants

C. Division 31 00 00 - Earthwork

1.4 QUALITY ASSURANCE/DEFINITIONS

A. Definitions:
   1. Refer to Section 32 93 00 (Plants).
   2. ASA: American Society of Agronomy.

B. Testing/Testing Agency
   1. Refer to Division 31 00 00 Earthwork.
   2. Refer to Section 32 93 00 Planting
   3. Refer to this section, 1.5 B.

C. Contractor is solely responsible for quality control of the Work.

D. The landscape contractor shall be a firm having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of planting mixes in urban locations.
   1. The installing Contractor shall be the same firm that is installing planting as described in Section 32 93 00 – Plants.
   2. Installer Field Supervision: Installer to maintain an experienced, English speaking, full-time supervisor on Project site when any Planting Soil preparation work is in progress.
   3. The installer's crew shall be experienced in the installation of soil, grading and interpretation of grading plans in urban areas.

E. Soil work shall be performed by a firm that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.

F. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

G. Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Landscape Architect.

H. Pre-installation Conference: Conduct conference at project site prior to the start of any work related to Planting Soil preparation and shall meet the requirements of this Section 3.1(D).

I. Layout and Grading:
   1. Permanent benchmarks shall be established by a registered land surveyor or professional civil engineer, at the Contractor's expense. The Contractor shall maintain established bounds and benchmarks and replace them, if any are destroyed or disturbed.
   2. The Contractor shall maintain at the site, sufficient surveying equipment, to accurately excavate to the required subgrades and install soil to the required finish grade. The Contractor shall set wooden 1.5" x 1.5" grade stakes at intervals sufficient to establish excavation limits and final grade contours. Drive stakes solidly into the ground. Mark with a permanent marker. Stakes for soil depth areas and finished grades shall remain in place until planting

work is completed and a landscape punch list has been issued by the Landscape Architect.

1.5 TESTING, SUBMITTALS , MOCK-UPS AND INSPECTIONS

A. Certificates: Within 2 weeks of placement, contractor shall submit certification that all soil blend components and all soil blends meet all environmental standards of the City of Boulder for use in residential zones.

B. Testing for Planting Bed Soil, Turf Soil and Horticultural Subsoil: Testing is required at the following intervals:
1. Testing of individual components for all soil mixes. Tests are as described in Section 329113, 1.5, C.
2. After test results for components have been accepted, create sample mixes of each planting soil mix and perform tests described in Section 329113, 1.5, C.
3. After the test results for planting soil mixes have been accepted, and during the placement of planting soils, test every 500 cubic yards of soil mix delivered to the job site. Testing applies to all soil layers of the planting profile.
4. If sod is proposed for placement at lawn areas, prior to submitting sod for approval, submit sample of Sod Farm Growing Media and test analysis.

C. Test Reports: Submit certified reports for tests as described in this Section.
1. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System. Percent clay (0.002 mm) shall be reported separately in addition to silt (ASTM D-422-63, hydrometer method).
2. The silt and clay content shall be determined by a Hydrometer Test of soil passing the #270 sieve.
3. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH. Recommendations for pH adjustments and fertilizer soil amendments shall be included with all test reports.
4. Tests shall be conducted in accordance with Recommended Soil Testing Procedures for the Colorado at Colorado State University. Tests include the following:
   a. Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493, p. 59.
   b. Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493, p. 64.
   c. Test for soil Soluble Salts shall be by the 1:2 (v:v) soil:water Extract Method as described in Northeastern Regional Publication No. 493, p. 74.
   d. Test for Buffer pH by the SMP method
5. Certified reports on analyses from producers of composted organic materials are required, particularly when sources are changed. Analyses will include all tests for criteria specified in 2.01F.
6. Subgrade preparations must be inspected and approved in writing prior to placement of any planting soils according to Section 3.1 and Section 3.2 of this Specification.

D. Samples: Prior to ordering the below listed materials, submit representative samples to the Landscape Architect, Owner's Representative for selection and approval. Do not order materials until Landscape Architect's, Owner's Representative's approval has been obtained. Delivered materials shall closely match the approved samples.
   1. Organic amendment (Compost): duplicate samples of 1 gallon.
   2. Imported Base Loam: duplicate samples of 1 gallon.
   3. Coarse Sand: duplicate samples of 1 gallon.
   5. Planting Bed Soil, High Use Turf Soil and Horticultural Subsoil after approval of individual components: duplicate samples of 1 gallon.
   6. Sod Farm Growing Media: 1' by 1' section of sod to be used on the project, if sod is to be used.

E. Sources for Soil Components and Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of soil mixes.
   1. Landscape Architect and Owner's Representative shall have the right to reject any soil blender. Soil components must be approved in writing prior to delivery to site.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 31 Earthwork for overall material handling requirements.

B. In addition, the following provision is established: Material shall not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall, early spring or if frozen. Soil shall be handled only when the moisture content is compliant with Section 329113 1.6.H. The Landscape Architect and the Owner shall be consulted to determine if the soil is too wet to handle.

C. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

D. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.

E. Prohibit vehicular and pedestrian traffic on or around stockpiled or placed planting soil.

F. Planting Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than six feet high.

G. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access.

H. Soil Moisture Content
   1. Contractor shall not move, blend or grade soil when moisture content is so great that free moisture is apparent, nor when it is so dry that dust will form in the air or that clods will not break readily, nor when it is frozen. Apply water, if necessary, or allow to dry to bring soil moisture between 60% of optimum moisture content and optimum moisture content as determined by ASTM

D698 for compaction, grading and plantings.

2. Field Soil Moisture Test

   a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
   b. If the soil will not retain shape it is too dry and should not be worked.
   c. If the soil retains shape and will not crumble, it is too wet and should not be worked.
   d. If the soil glistens or free water is observed when the sample is patted in the palm of hand the soil is too wet and should not be worked.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General

1. It is anticipated that the planting soils at the project site will consist of amended existing topsoil and imported planting soil blends from off-site sources. Refer to the drawings for the delineation of soil types. All plant mix material shall fulfill the requirements as specified and be tested to confirm the specified characteristics.
2. Samples of individual components of soil mixes in addition to blended soil mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Comply with specific materials requirements specified.
   a. No base component material or soil components for soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Landscape Architect.
   b. As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments until approved.

B. Soil Testing and Soils Testing Report Submittal:

1. All testing of the soil mix components shall be carried out by the Soils Testing Laboratory. Recommendations for amending and/or correcting the soil mix will be provided to the Contractor after approval by the Landscape Architect.
2. Failure of any material by testing and/or amendment procedure to meet Specification requirements shall require the Contractor to seek another source for the failed material and the initiation of all testing procedures for the new replacement material shall immediately take place.
3. The Contractor shall be responsible for recognizing that these critical project materials warrant timely and serious attention, that the testing process to achieve Approved materials should be considered a lead time item, and that under no circumstance shall failure to comply with all specification requirements be an excuse for “staying on project construction schedule.”
4. Submit reports for each of the below samples: Submit sample from each proposed source for testing and approval. Deliver samples to both the testing laboratory and the project soil scientist and pay costs. Send report directly to Owner’s Representative.
   a. Base Loam (Imported Topsoil)
   b. Organic Amendment Materials (Compost)

c. Coarse Sand
d. Horticultural Subsoil
e. Planting Bed Soil

5. The Contractor shall schedule this testing in order to permit reasonable time for testing, evaluation, and approvals prior to scheduled installation. Allow for a minimum of 4 weeks to perform testing and obtain approvals.

C. Imported Base Loam

1. Imported Base Loam, as required for blending with sand and compost, shall be a naturally occurring soil formed from geologic soil forming processes without admixtures of sand or organic matter sources (composts). Base Loam, which has been contaminated by incorporation of subsoil shall not be acceptable for use. Base Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, *Cyperus Esculentus,* and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition. Base Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

	Percent Passing	
U.S. Sieve Size Number	Minimum	Maximum
10	---	100
18	85	100
35	70	95
60	50	85
140	36	53
270	32	42
0.002mm	3	6

4. The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 8 or less ($D_{80}/D_{30} < 8$). Maximum size shallbe one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition. The organic content shall be between 4.0 and 8.0 percent by weight. pH shall be between 5.8 and 7.0.
5. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

D. Coarse Sand

1. Sand for Planting Soil Blends, protection of filter fabric and for drainage as required, shall be uniformly graded medium to coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing Minimum	Percent Passing Maximum
10	100	--
18	60	80
35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.5

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. The ratio of the particle size for 70% passing (D_{70}) to the particle size for 20% passing (D_{20}) shall be 3.0 or less (D_{70}/D_{20} <3.0). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.
3. pH shall be less than 7.2.

E. Organic Amendment (Compost)

1. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.
   a. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.
   b. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.
   c. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32, and Commonwealth of Massachusetts 310 CMR 32.00 (for applications to soils with human activity).
   d. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve

according to procedures performed by the Soil Lab at Colorado State or equal as follows.

e. pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy *Methods of Soil Analysis*, Part 2, 1986.

f. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).

g. The compost shall be screened to 1/2 inch maximum particle size and shall contain not more that 3 percent material finer that 0.002mm as determined by hydrometer test on ashed material.

h. Nutrient content shall be determined by the Colorado State University Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil-required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.

F. Filter Fabric, as required, shall be Mirafi 140N or approved equivalent.

2.2 PLANTING SOIL MIXES

A. All existing vegetation shall be removed from stockpiles prior to blending. Uniformly mix ingredients by windrowing/tilling on an approved hard surface area or by alternately processing materials through a screening plant. All soil components and Organic Amendment shall be maintained moist, not wet, during mixing. Amendments shall not be added unless approved to extent and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable. Percentages of components are approximate and will be verified upon completion of individual test results for components of the various mixes.

B. After component percentages are determined by the Soil Scientist, each planting soil mix shall be tested for physical and chemical analysis. Component percentages may be modified at any time by the soil scientist dependent upon the results of testing of the various components or final blends.

C. Planting Bed Soil

1. Planting Bed Soil shall consist of a combination of approximately equal parts by volume Base Loam, Coarse Sand and Organic Amendment/Compost (1L:1S:1C). The following gradation for material passing a Number 10 Sieve shall be achieved in the final mix.

U.S. Sieve Size No.	Percent Passing Minimum	Percent Passing Maximum
10	100	
18	85	95
35	60	85
60	42	65

140	21	44
270	18	24
0.002 mm	2	4

2. Maximum size shall be one half-inch largest dimension. The maximum retained on the #10 sieve shall be 10% by weight of the total sample. The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 6 or less (D_{80}/D_{30} <6). The final mix shall have an organic content between 5 and 7 percent by weight. The final mix shall have a hydraulic conductivity of not less that 1.5 inches per according to test procedure ASTM D5856-95 (2000) hour when compacted to a minimum of 86 percent Standard Proctor ASTM D 698. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
3. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

D. Turf Soil
1. If additional Turf Soil is required, Base Loam, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of two parts by volume Sand to one part by volume Base Loam to one part by volume Compost (2S:1L:1C) to create a uniform blend which meets the following requirements.
2. Gradation for Material Passing the Number 10 Sieve:

	Percent Passing	
U.S. Sieve Size No.	Minimum	Maximum
10	100	100
18	70	90
35	45	72
60	26	40
140	14	20
270	10	13
0.002mm	2	4

3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
4. Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 4.2 or less (D70/D20 <4.2). Saturated hydraulic conductivity of the mix shall not be less than 4.0 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 88% Standard Proctor, ASTM 698.
5. Organic content shall be between 3.5 and 5.0 percent by weight.
6. pH shall be between 6.2 and 6.8
7. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron,

Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

E. Horticultural Subsoil

1. Horticultural Subsoil for the lower layer of planting soil in Planting Beds shall consist of a combination of approximately 2 parts by volume Coarse Sand to one part by volume Base Loam (2S:1L).
2. Gradation for material passing the #10 sieve:

	Percent Passing	
U.S. Sieve Size No.	Minimum	Maximum
10	100	
18	85	95
35	55	80
60	30	60
140	20	33
270	12	17
0.002mm	1	3

3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
4. Ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 6.5 or less ($D_{80}/D_{30} < 6.5$).
5. Saturated hydraulic conductivity of the mix: not less than 2 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 86% Standard Proctor, ASTM 698.
6. Organic content: between 1.5 and 3.0 percent by weight.

F. Sod Farm Growing Medium

1. If sod is required for lawns, it shall meet the following sod farm growing media requirements.
2. Soil in which sod was grown at the Sod Farm shall be USDA classified as sand and shall conform to the following grain size distribution for material passing the #10 sieve:

	Percent Passing	
U.S. Sieve Size Number	Minimum	Maximum
10	100	-
18	85	100
35	60	85
80	25	40
140	6	26
270	4	18
0.002mm	2	5

2. The maximum particle size shall be 1/2 inch.

3. The maximum retained on the #10 sieve shall be 10% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION EXAMINATION AND PREPARATION

A. Reference Other Sections as necessary.

B. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

C. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Landscape Architect.

D. Kickoff Meeting: At least 10 working days prior to the start of work, the contractor shall request a landscape construction kickoff meeting with the Landscape Contractor Owners Representative, Landscape Architect and any other parties involved with landscape construction. The contractor must demonstrate familiarity with this Section 329113 Planting Soils, and other relevant sections of the construction documents. The contractor shall articulate their understanding of of soil blending, subgrade preparation, soil placement and other steps outlined in the Specification.

E. Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of subgrade preparation, soil placement and planting. Any deficiencies shall be noted and related to the Landscape Architect in writing prior to acceptance of the subgrade by the Landscape Contractor. Deficiencies include, but shall not be limited to the following:
   1. Construction debris present within the planting areas.
   2. The subgrade is at incorrect depths for installing the designed soil profile and drainage layer.
   3. Incomplete irrigation and/or subsurface drainage installation.
   4. Incomplete lighting and exterior electrical installation.
   5. Conflict with underground utilities.
   6. Subgrade contaminated with oils, compressible material, silt or clay

F. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
   1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace slopes where required and maintain sides of slopes of excavations in safe condition until completion of backfilling. Provide protection measures as required for public safety.
   2. All subgrade areas to be filled with Sand Drainage Layer or Planting Soil shall be free of construction debris, refuse, vegetation, compressible or decay able materials, all stones greater than 2 inches, concrete washout or soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Such material shall be removed from the site.
   3. The subgrade must slope at a minimum of two percent towards the bottom of slopes and subdrains. Subgrade levels shall be adjusted as required to

ensure that all planting and lawn areas have adequate drainage.

G. Do not proceed with the installation of drainage layers or Planting Soils, until all utility work in the area has been installed.
   1. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.

H. Planting Soil Preparation: Refer to Section 329113, 2.2 for planting soil and mixtures. Examine soil and remove foreign materials, stones and organic debris over 1/2" in size. Remove all vegetation from stockpiles prior to blending. Mix-in fertilizers and amendments as required by tests and as approved by the Landscape Architect. All preparation and mixing shall be accomplished when the soil moisture content is compliant with Section 329113, 1.6.H and at a moisture content approved by the Landscape Architect. If lime is to be added, it shall be mixed with planting soil before fertilizer is added and mixed.

3.2 SUBGRADE INSPECTION AND PERCOLATION TESTING

A. After subgrade levels have been reached, the Landscape Architect shall de-compact and prepare the subgrade according to Section 3.5 and inspect soil conditions to evaluate subsurface drainage conditions. The Contractor shall carry out percolation tests according to the following procedures in locations identified by the Landscape Architect. The Contractor shall conduct one test per 300 square feet, and provide written test results to the Landscape Architect, Owner's Representative and Soil Scientist.

B. Percolation tests shall be performed according to the following test procedures.
   1. Utilize perforated canisters or buckets seven to ten inches in diameter and a minimum of six inches high.
   2. A test hole shall be hand dug at the soil horizon to be tested approximately one-inch larger than the diameter of the test canister and approximately six inches deep. The sides of the test hole shall not be smoothed.
   3. Place one-half inch of clean coarse sand in the bottom of the hole and place the canister firmly into the hole. The space around the canister shall then be filled with coarse sand. Tamp the coarse sand to firmly fill any void space around the test canister.
   4. Fill the canister with water to the soil horizon level and allow to drain until approximately one inch of water remains, or a minimum of 1 hour.
   5. Refill the canister to the soil horizon level. After the water level drops approximately one inch, start the test. Record time versus water level as the water level drops. The percolation rate is the length of time for the water level to drop per inch. The field scientist shall record the rate of percolation for a minimum of two hours or until the water level has dropped a minimum of three inches after the start of measurements.

3.3 MIXING OF PLANTING SOIL MIXES

A. Soil blends shall be produced with equipment that blends together each component in a thorough and uniform manner. This may be accomplished by a minimum of three handling events on a hard surfaced area with earth moving equipment or by

alternately passing soil components through a screener.

3.4 WORKING AROUND UTILITIES

A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

B. Known underground and surface utility lines are indicated on the utilities drawings – See Civil and Architect's plans. Contact the local Dig Safe organization and Harvard University Utilities, and give them their required time to respond and mark the property. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

C. Perform work in a manner that will protect utilities from damage. Hand excavate as required and provide adequate means of support and protection of utilities during soil installation operations. Maintain grade stakes set by others until parties concerned mutually agree upon removal. The Contractor shall repair all utilities damaged by soil operations at the Contractor's expense.

3.5 SUBGRADE PREPARATION AND BACKFILLING OF HORTICULTURAL SOIL LAYERS

A. Coordinate the following scarification work to eliminate subgrade compaction when located in lawn and planting areas. Maintain 12" clearance from any underground utilities during subgrade de-compaction. Subgrade de-compaction is not required in areas with Sand Underdrainage Layer.

1. Heavy Site Subgrade Compaction Mitigation:

a. Heavily compacted subgrade areas such as, but not limited to, temporary parking areas, material stockpile areas, temporary roadways, construction areas and areas around structures and other similar areas.

b. Prior to establishing the final subgrade of Earthwork material, these areas shall be dug up or ripped to a depth of (18) inches to break up the soil hard pan, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.

2. General Site Subgrade Compaction Mitigation for all general lawn and planting areas that are not heavily compacted and would be mitigated as specified in Item 1 above:

a. Immediately prior to placing Planting Soil, the entire subgrade shall be loosened to a minimum depth of 6-inches using the teeth of a backhoe or other suitable equipment, then re-compacted with the tracks of small construction equipment, the bucket of a backhoe, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.

b. After the subgrade soils have been loosened, re-compressed and inspected, Planting Soil may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and spread with the bucket of a backhoe from the edge of the loosened area. No rubber-tired equipment or heavy equipment except for a small bulldozer shall pass

over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.

B. Soil Placement Preparation:
1. Verify that the plumbing for the irrigation system has been installed and accepted.
2. Verify that the subgrade preparations have been reviewed and accepted, including percolation testing as required prior to placement of planting soils.
3. Notify the Landscape Architect of soil placement operations at least seven calendar days prior to the beginning of work.
4. Verify that the subgrade passes the minimum water infiltration requirement.
5. Do not proceed with the installation of Planting Soils, until all utility work in the area has been installed.
6. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
7. Do not begin Planting Soil installation until all drainage, irrigation main lines, lateral lines, subgrade preparations and irrigation risers shown on the drawings are viewed and approved by the Landscape Architect.
8. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and/or plastic sheeting as directed to cover existing asphalt, concrete, metal and masonry work.
   a. Clean up any soil or dirt spilled on any paved surface, including at the end of each working day.
   b. Any damage to the paving or architectural work shall be repaired by the Contractor at the Contractor's expense.

C. Placement of Planting Bed Soil, Turf, and Horticultural Subsoil:
1. Placement of Planting Bed Soil and plant stock shall be carried out simultaneously to prevent excessive traffic over soil lifts and to maintain the integrity of the soil layers. The contractor shall install plants simultaneously with the installation of the lower soil layers. The upper soil layers shall not be installed before all plants are installed and before the acceptance by the Landscape Architect.
   a. After subgrade preparation or installation of Sand Drainage Layer and approval, in areas of tree and shrub planting with rootballs 12" in diameter or greater, place and compact Horticultural Subsoil as described in Section 3.5 C.
   b. After inspection and approval of Horticultural Subsoil, place trees and shrubs in locations shown on the plans and at the proper elevations.
   c. Place and compact Planting Bed Soil around trees and shrubs as described in Section 3.5 C.

2. Planting Bed Soil, High Use Turf Soil and Horticultural Subsoil shall be placed in lifts not to exceed 8 inches in thickness and compacted to meet minimum and maximum requirements as specified below:
   a. A transition zone shall be formed between the prepared subgrade, Horticultural Subsoil, Turf Soil and Planting Bed Soil by placing one inch of the upper-layer soil and raking into the lower soil to a two-inch thickness.

b. Horticultural Subsoil shall be compacted to between 84 and 87 percent Standard Proctor, except soils beneath the rootballs shall be compacted to between 87 and 90 percent Standard Proctor to create a firm pedestal and prevent settlement of the rootballs.
c. Planting Bed Soil shall be compacted to between 82 and 85 percent Standard Proctor.
d. Turf Soil and Restored Turf Soil shall be compacted to between 86 and 88 percent Standard Proctor.
e. In all cases, the soil being placed shall be in a dry to damp condition. No wet soils shall be placed. Soil moisture content must be compliant with Section 329113 1.6.H. All testing of in-place density for planting materials shall be made by the soil scientist or according to ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6398-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon Method, or ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

3. Prevention of compacted soils can be accomplished by beginning the work in corner, against walls, or the center of isolated beds, and progressing outwards towards the borders.
4. Planting Soils and Horticultural Subsoil shall never be moved or worked when wet or when frozen. Obtain approval form Landscape Architect if moisture content of soils are in question.
5. The Contractor shall place barricades or steel plates as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.
6. After planting and turf soil has been spread, it shall be carefully prepared by hand raking. Stones and debris over one inch in any direction shall be removed from the premises. Fine grade planting beds to a smooth even surface with loose uniformly fine texture. Remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas that can be planted immediately after grading. Maintain the finished surfaces at the grades shown and spread additional soil to correct settlement or erosion. Surface drainage shall be maintained. Soil shall be damp and free from frost during fine grading operations.

D. Renovated Turf Areas

1. In areas of renovated turf, as delineated on the plans, the turf shall be replaced and the turf planting soils shall be de-compacted, soil amendments added, and re-compressed and re-graded to match the adjacent grades and grading plan.
2. The contactor shall strip and dispose of the existing turf with a sod cutter or equivalent equipment.
3. The existing turf soil shall be de-compacted to 12” in depth using an air spade or alternate equipment, including hand tools, that prevents damage to existing tree roots. The Landscape Architect shall inspect this work and provide written acceptance of de-compaction of existing turf soil.
4. Soil amendments shall be added to the turf soil as required by soil testing. Amendments shall be hand raked into the upper 2 inches of de-compacted turf soil.
5. The contractor shall re-compress the prepared renovated turf soil with the tracks of a loaded skid steer or equivalent equipment.
6. Place blended high use turf soil as needed to adjust grades according to the

grading plan.

7. Replace irrigation and re-seed or place approved sod according to the plans.

3.6 PROTECTION

A. The Contractor shall protect landscape work and materials from damage due to landscape operations, operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged Planting Soil installation work immediately.

B. Provide all means necessary, including fences, to protect all soil areas from compaction and contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any area, which becomes compacted, shall be tilled to the extent determined by the soil scientist and recompressed to the density ranges specified. Any uneven or settled areas shall be filled and re-graded. Soil that becomes contaminated shall be removed and replaced with specified soil material.

C. Phase the installation of the planting soil blends such that equipment does not have to travel over already installed planting soil.

D. Apply filter fabric coverings planking or other engineering controls over soil to collect dust and debris in any area where the Contractor must work after the installation of Planting Soil.

E. Till compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Soil Scientist or Landscape Architect. Over-compact or contaminated Planting Soil shall be tilled or replaced by the Contractor at no expense to the Owner.

3.7 CLEAN-UP

A. During installation, keep pavements clean and work area in an orderly condition.

B. Keep the site free of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.

C. All trash and debris shall be kept in a central collection container. Do not bury trash and debris in back-fill.

D. Once installation is complete, remove any excess soil from pavements or embedded in fixtures.

3.8 COORDINATION AND EXCESS MATERIALS

A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent toplacement.

B. Excess Planting Soil Mixtures and Materials: Remove the excess planting soil mixture and materials from the site at no additional cost to the Owner unless other wise

requested.

3.9 POST-INSTALLATION TESTING

A. In-place density testing is required in all areas. Placed planting soils must be inspected for compaction level by the soil scientist or by the following acceptable Density Test Methods: ASTM D1556 Density of soil and rock in place using Sand Cone Method", ASTM D6398-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon method, or ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. In-place density testing of Sand Based Structural Planting Soils must be tested by ASTM Methods.

B. All lawn and planting soils must be capable of infiltrating water at a minimum rate of 1.5 inches per hour after placement and compaction. Provide shovel dug test holes 8” deep at each planting bed and a minimum spacing of 500 square feet in lawn areas, according to the methodology for percolation tests provided in Section 3.2 of this Specification. The Landscape Architect or Owners Representative must witness tests. Provide documentation of test results to Soil Scientist or Owners Representative.

Any planting soil or subgrade that fails to meet the minimum infiltration rate must be re-worked and re-compacted until the soil meets the minimum infiltration capacity at no additional cost to the Owner.

END OF SECTION 32 93 00

SECTION 32 92 00 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Organic Soil Amendment.
2. Fertilizers.
3. Native Grass Seeding.
4. Straw Mulching.
5. Drought Tolerant Sodding.
6. Warranty – Guarantee for sodded and seeded areas.
7. Initial maintenance.

B. Related Sections:

1. Section "31 00 00" for Earthwork.
2. Section “32 93 00” for Plants
3. Section “31 13 00” for Selective Tree and Shrub Removal and Trimming
4. Section “31 91 13 for Planting Soils

1.3 DEFINITIONS

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

B. Planting Soil: Existing or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments, reference section 31 91 13 for Planting Soils

C. Sub-grade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

D. Sub-soil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms

1.4 SUBMITTALS

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

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

1. Certification of each seed mixture for turf grass sod, identifying source, including name and telephone number of supplier.
2. All brands furnished shall be free from noxious seeds such as Russian or Canadian Thistle, Coarse Fescue, European Birdweed, Johnson Grass and Leaf Spurge.

C. Samples for Verification: Provide 1 gallon zip lock bag of the following”

1. Soil Amendment (compost).

D. Product Certificates: For soil amendments and fertilizers , from manufacturer / supplier 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.

E. Material Test Reports: For specified soil amendment only. Standardized ASTM D 5268 for existing native surface topsoil and imported or manufactured topsoil is not required.

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

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful seed / sod establishment. Company must have a license from the State of Colorado.

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

B. Soil-Testing Laboratory Qualifications: Not required.

C. Topsoil Analysis: Existing topsoil to be stripped, stockpiled and re-spread. Testing of this stockpiled material is not required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers, showing percentage of seed mix, year of production, net weight, date of packaging and location of packaging.

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

Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within twenty-four (24) hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

1.7 REGULATORY REQUIREMENTS

A. Comply with codes and ordinances of local regulatory agencies for fertilizer and herbicide composition and regulations of State of Colorado, the City of Boulder.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one (1) of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Warm season native grass: June – August.
2. Cool season native grass and Sod: March – June and September thru November.

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

1.9 GUARANTEE / WARRANTY

A. See 3.7 – Native Seed and 3.10 – Sodding, below.

1.10 MAINTENANCE SERVICE

A. Initial Sod Area Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3, below. Begin maintenance immediately after each area is planted and continue until acceptable sod is established, but for not less than the following periods:

1. Turfgrass Sod: Initial planting thru date of Substantial Completion and subsequent turnover to the City of Boulder Parks Operations.

2. Turnover of sodded areas to the City of Boulder does not relieve the Contractor of any Guarantee - Warranty requirements and/or “Satisfactory Turf” provisions stipulated in
3.10 below.

B. Initial Native Seed Area Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is seeded and continue until an acceptable stand of native grass is established, but for not less than the following periods:

1. Native Seeding: Initial Seeding thru Substantial Completion, and subsequent turnover to the City of Boulder Parks Operations.
2. Turnover of native seeded areas to the City of Boulder does not relieve the Contractor of any Guarantee - Warranty requirements and/or “Satisfactory Seed” provisions stipulated in 3.7 below.

PART 2 - PRODUCTS

2.1 TURF GRASS SOD

A. Turfgrass Sod: Certified Approved Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than ninety-five (95) percent germination, not less than eighty-five (85) percent pure seed, and not more than one-half (1/2) percent weed seed:

1. Full Sun: Hybrid bluegrass – drought tolerant Kentucky bluegrass cultivars available from one of the following growers:
   a. Big Foot Turf Farm - 970.534.0436 Contact: Steve Frye – Sales-Estimator Product: ‘Thermal Blue’
   b. Korby Sod, LLC – 970.568.7633 Product: ‘Vortex’
   c. Graffs Turf Farm, Inc. – (970) 867-8873 Product: ‘Reveille Hybrid Bluegrass’

2.2 NATIVE GRASSES

A. Native Grass Seed: Fresh, clean, dry, new seed, mixed species as follows:

3 Table 1. Playa Garden/Wetland Seed Mix

Common Name and Variety	Scientific Name	PLS/ Lb Acre*
American sloughgrass	*Beckmannia schizachne*	0.5
Inland saltgrass	*Distichlis spicata*	0.5
Fowl mannagrass	*Glyceria striata*	4
Switchgrass	*Panicum virgatum*	1
Nuttall's alkaligrass	*Pucinellia nutalliana*	0.2

Prairie cordgrass	*Spartina pectinata*	1
Total		**7.2**

*Drill seed, double rate if broadcast

Table 2.Upland/Riparian Seed Mix.

Common Name and Variety	Scientific Name	PLS/ Lb Acre*
Black-eyed Susan	*Rudbeckia hirta*	0.2
Blue flax	*Adenolinum lewisii*	0.2
Blue grama	*Bouteloua gracilis*	4.0
Buffalograss	*Buchloe dactyloides*	6.0
Canada goldenrod	*Solidago canadensis*	0.8
Common perennial gaillardia	*Gaillardia aristata*	0.3
Inland saltgrass	*Distichlis stricta*	1.7
Mintleaf beebalm	*Monarda fistulosa*	0.2
Narrowleaf penstemon	*Penstemon angustifolius*	0.2
Nuttall sunflower	*Helianthus nuttallii*	0.2
Purple meadowrue	*Thalictrum dasycarpum*	0.2
Rocky Mountain beeplant	*Cleome serrulata*	0.2
Sand dropseed	*Sporobolus cryptandrus*	4.0
Sideoats grama	*Bouteloua curtipendula*	5.0
Slender wheatgrass	*Elymus trachycaulus*	2.7
Spotted joepyeweed	*Eupatoriadelphus maculatus*	0.2
Spreading thermopsis	*Thermopsis mollis*	0.2
Switchgrass	*Panicum virgatum*	1.3
Upright prairie coneflower	*Ratibida columnifera*	0.2
Western wheatgrass	*Pascopyrum smithii*	3.0
White prairie clover	*Dalea purpurea*	0.2
Total		**31.0**

*Drill seed, double rate if broadcast.

See 3.5 B. below for seeding rates.

A. Seed Suppliers:

1. Arkansas Valley Seed Co. – 877.907.3337
2. Pawnee Buttes Seed, Inc. – 800.782.5947
3. Aquatic and Wetland Company – 999 Weld road 25, Fort Lupton, CO 80621; 303-442-4766

4. Alpine Ecological – Andy Herb – owner; 303-586-5014
5. Fort Collins Wholesale Nursery – 2224 N. Shields Street, Fort Collins, CO 80524; 970-484-1289
6. Arbor Valley Nursery – 18539 County Rd. 4, Brighton, CO 80603
7. Country Lane Nursery (owned by Arbor Valley) – 2979 N State Highway 83, Franktown, CO 80116; 303-688-2442

B. Provide the latest crop available in accordance with Colorado Department of Agriculture Seed Laws, Chapter 35, Article 27.

C. Compensate for percentage of purity and germination by furnishing sufficient additional seed to equal the specified pure live seed product. The formula for determining the quantity of pure live seed (PLS) shall be:

Pounds of Seed (Bulk) X Purity X Germination =Pounds of Pure Live Seed (PLS)

3.2 TOPSOIL

A. Topsoil: Onsite / Stockpiled topsoil.

1. Re-use surface soil stockpiled onsite. Verify suitability of stockpiled soil to produce topsoil. Clean surface soil of roots, plants, sod, stone, clay lumps and other extraneous materials harmful to plant growth.

3.3 ORGANIC SOIL AMENDMENTS

A. Compost: Fully composted, stable, mature product and weed-free product.

1. Organic Soil Amendments shall be Class 1 as defined by the Rocky Mountain Region Organics Council as follows:

   a. Minimum Stability Indicator – Stable to Very Stable
   b. Maturity Indicator Expressed as AmmoniaN / NitrateN Ratio - < 4
   c. Maturity Indicator Expressed as Carbon to Nitrogen Ratio - < 12
   d. Maturity Indicator Expressed as % of Germination / Vigor – 80+ / 80+
   e. pH Range – 6.0 to 8.4
   f. Soluble Salts – 0 – 5 mmhos / cm
   g. Contractor to provide laboratory submittal documenting the following:

      1) Bulk Densities.
      2) % Inorganics
      3) Moisture
      4) Particle Size Distribution
      5) Primary Nutrients
      6) Secondary Nutrients
      7) Trace Elements
      8) Organic matter per cubic yard

9) Chemical Contaminants – Submittal should show that the product meets or exceeds the US EPA Class A standard, 40 CFR 503.13 tables 1 & 3 levels.

B. Rate: See 3.3 C. below.

3.4 FERTILIZER

A. General: Fertilizer shall be commercial type, of uniform composition, free flowing, and conforming to applicable state and federal laws.

B. Fertilizer for sodded areas only:

1. Commercial fertilizer - Provide each of the following materials in a blended product:

a. Ammonium sulfate - (21-0-0 + 24S)
b. Di-Ammonium Phosphate (DAP) – 18-46-0
c. Iron (dry source for blend).

2. Dry, pelletized or granular, uniform in composition and a free flowing product. Do not use material which has caked, segregated, exceeded the expiration date of application, or be otherwise damaged.
3. Thoroughly mixed by the manufacturer. Clearly identify the contents of each container. Do not use materials and containers previously opened, exceeding the expiration date for application or otherwise damaged.

3.5 MULCHES

A. Mulching Material: Straw, dry, free from foreign matter detrimental to plant life

3.6 PESTICIDES AND HERBICIDES – not required.

3.7 EROSION-CONTROL MATERIALS – not required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive turf and native grass for compliance with requirements and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION, GENERAL

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and

plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 SOIL AND FINISHED GRADE PREPARATION

A. Limit sub-grade preparation to areas to be planted with native seed or sod. Verify major drainage channels are completed and in place. Do not start work until the site is acceptable. Once landscape / fine grading has commenced, the landscape contractor shall be responsible for bringing all grading to final line and grade.

B. Stockpiled Topsoil: Spread topsoil to a minimum depth of 4” in all areas to receive native seed or sod. Place topsoil during dry weather and on dry, unfrozen subgrade. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

C. Organic Soil Amendment (compost) – for type, see 2,4 above.

1. Native Seeded Areas: Spread organic amendment at a rate of 3 CY / 1,000 sq. ft.
2. Sodded Areas: Spread organic amendment at a rate of 5 CY / 1,000 sq. ft.

D. Sub-grades: Loosen sub-grade to a minimum depth of twelve (12) inches overall (8” of existing subgrade and 4” of new topsoil). Remove stones and clods larger than three-quarters of an inch (3/4”) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has re-compacted subsoil.

E. Finish / Fine Grading: Grade disturbed planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus one-half (1/2) inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

1. Reduce elevation of planting soil to allow for soil thickness of sod.
2. In seeded areas, reduce elevation of finished surface to ½” below the adjacent pavement / curb elevation.

F. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

G. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.4 FERTILIZING

A. Do not proceed with fertilization in adverse weather and unsuitable ground conditions. Examples of these respective conditions may be wind, precipitation, frozen and untillable ground or conditions detrimental to the effectiveness of the application.

B. Apply fertilizer in a manner to assure uniform distribution, light watering is acceptable for dispersion.

C. In cases where work progress is stopped due to the above conditions, fertilization will begin again, when appropriate conditions exist. The application will begin again with a reasonable overlapping of the previously applied area

3.5 NATIVE SEEDING

A. Definitions.

1. Weeds: Include Common Mallow, Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel and Brome Grass.

B. Seeding Rates:

1. Native Grass Seed:

a. Type 1 - 25 PLS / acre.

C. Seed areas indicated on Drawings and areas disturbed by construction. Re-work previously prepared areas that have become compacted or damaged by rains or traffic.

D. All seeding shall be installed by drilling method only. See F. below for additional provisions. Small areas of restoration may be broadcast seeded if directed by City of Boulder.

E. Do not proceed with seeding in adverse weather and unsuitable ground conditions. Examples of these respective conditions may be wind, precipitation, frozen or untillable ground or conditions detrimental to the effectiveness of the application.

1. Cool Season Turf Seed - shall be installed between April 15 and September 1 – Not applicable for this particular project.
2. Warm Season Seed – shall be installed between May 1 and August 15.

3.6 SEEDING APPLICATION

A. Seed areas indicated on drawings and areas disturbed by construction.

B. Re-work previously prepared areas that have become compacted or damaged by rains or traffic.

C. Broadcast or hydro seed in areas as indicated on plans. Broadcast seed in two opposite directions. Rake in seed after broadcasting.

D. Restore fine grade after seeding as requested by the owner’s representative..

E. Cover seed to depth of 1/4 inch by raking or dragging.

F. Firm seeded areas with a roller weighing maximum of 100 lbs. per foot of width.

G. Seed application rates shall be as specified.

H. Do not sow immediately following rain, when ground is too dry, when ground is frozen or untillable, or during windy periods.

I. Selection of the time of seeding shall be Contractor's responsibility, consistent with germination and erosion control requirements. Optimal seeding time is mid May through early September.

3.7 NATIVE SEEDED AREA MAINTENANCE

A. Maintain and establish native seeded areas by watering, weeding, mowing, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch as required.

B. Native Seed Establishment Period:

1. Water seeded areas as needed, minimum of two (2) times per day, until native seed is es-tablished. Water so that no erosion or movement of seed or mulch occurs. Hand water as necessary to prevent movement of seed.
2. Native Seed establishment period shall begin upon the notice of "Conditional Acceptance" given by the Owner's Representative in writing and continue until the grass is established.
3. Post "KEEP OFF GRASS" signs until seed is established.

C. Watering: Use sprinkler irrigation system to keep seed bed uniformly moist.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water seeded areas with fine spray at a minimum rate of 1/2 inch per week until fully established, unless rainfall precipitation is adequate.
3. Where irrigation is not available, the Contractor shall be responsible for hand watering until satisfactory conditions as described in section 3.7 are met.

D. Provide weed control as required so that planting is reasonably free of weeds and undesirable grass species, diseases and insects. Broadleaf weed control product is not allowed. Provide a mowing to 6" depth during the fall season for additional weed control.

3.8 SATISFACTORY NATIVE SEEDING / WARRANTY - GUARANTEE

A. Native seeding installations shall meet the following criteria as determined by Owner's Representative:

1. At end of guarantee / warranty period (see below), a healthy, uniform, close stand of seed has been established, free of weeds and surface irregularities, with coverage as described below:

a. Required coverage for native seed areas shall be twenty five (25) viable live seedlings of the species specified per square foot as measured from five (5) feet directly overhead. Determination of required coverage will be based on a

random sampling of the entire project area, and shall consist of a minimum of five samples, each two (2) square feet in area. Bare spots are defined as those areas larger than one (1) square foot which do not meet the required coverage. After the inspection it is the Contractor's responsibility to perform the required maintenance within one (1) week to insure a healthy established seeding condition.

B. Warranty – Guarantee Period: A full two (2) years from the date of Substantial Completion. Once the satisfactory native seed establishment is accepted (anticipated to occur in the summer of 2013), the Owner's Representative shall issue a written notice of Final Acceptance. The warranty - guarantee period extends for one (1) growing season after Final Acceptance or the summer of 2014.

3.9 SODDING

A. Lay sod within twenty-four (24) hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to sub-grade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.

C. Saturate sod with fine water spray within two (2) hours of planting. During the first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

1. Schedule all watering with the City's Project Manager for approval.

3.10 TURF (SOD) AREA MAINTENANCE

A. Maintain and establish sodded areas by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and re-plant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Keep sodded areas uniformly moist to a depth of four (4) inches until rooting has occurred.

1. Water turf with fine spray at a minimum rate of one (1) inch per week unless rainfall precipitation is adequate.

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

1. Mow grass to a height of 3 to 3.5 inches.

D. Turf Post-fertilization: Not required.

3.11 SATISFACTORY SODDED TURF / WARRANTY - GUARANTEE

A. Installations shall meet the following criteria as determined by Owner's Representative:

1. Satisfactory Sodded Turf: At end of maintenance period (Substantial Completion), a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Warranty – Guarantee Period: A full two (2) years from the date of Substantial Completion. Once the satisfactory sod establishment is accepted (anticipated to occur in the spring-summer of 2013), the Owner's Representative shall issue a written notice of Final Acceptance. The warranty - guarantee period extends for one (1) growing season after Final Acceptance or the spring - summer of 2014.

1. Use specified materials to re-establish sodded areas that do not comply with requirements and continue maintenance until sod is satisfactory to the Owner's Representative.

3.12 PESTICIDE APPLICATION – not required.

3.13 CLEANUP AND PROTECTION

A. Promptly remove soil and debris, created by lawn work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after lawn is established.

C. Remove non-degradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

SECTION 32 93 00 - PLANTING

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. Trees.
2. Shrubs.
3. Soil Amendments
4. Perennial, Herbaceous Plants
5. Tree-stabilization materials.
6. Warranty and Maintenance.
7. Edgings.
8. Mulch

B. Related Requirements:
1. Section "31 00 00" for Earthwork.
2. Section “32 92 00” for Turf and Grasses
3. Section “31 13 00” for Selective Tree and Shrub Removal and Trimming

1.03 REFERENCES

A. ANLA: American Nursery & Landscape Association. (Formerly: AAN – American Association of Nurserymen)

B. ANSI: American National Standards Institute.

C. AOAC: Association of Official Agricultural Chemists.

D. ASTM: American Society for Testing Materials.

1.04 APPLICABLE STANDER

A. American National Standards for Tree Care Operations, ANSI A300. American National Standards Institute, 11 West 42nd Street, New York, N.Y. 10036.

B. American Standard for Nursery Stock, ANSI Z60.1. American Nursery and Landscape Association, 1250 Eye Street. NW, Suite 500, Washington, D.C. 20005.

C. Horticultural Standards, American Nursery & Landscape Association.

D. Hortus Third, The Staff of the L.H. Bailey Hortorium. 1976. MacMillan Publishing Co., New York.

E. Standardized Plant Names, American Joint Committee on Horticultural Nomenclature, 1942 edition.

F. American Society for Testing Material (ASTM).

G. International Society of Arboriculture.

H. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1.05 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a 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 type and size of plant required.

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

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

F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

G. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

H. Planting Area: Areas to be planted.

I. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

J. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

K. Root Flare: Also called “trunk flare”. The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

M. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

N. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

O. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
   2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
   3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 100 plants are required, include a minimum of ten photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:
   1. Ground Cover: Three samples of each variety and size delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
   2. Partially decomposed, milled leaves: 1.0 kg of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
   3. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
   4. Tree-stabilization Materials: Manufacturer's standard size, to verify model selected.

C. Product Schedule:

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
   1. Manufacturer's certified analysis of standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Test Reports for Mulch

D. Test Reports for existing soil at designated Planting Areas
   1. Test for chemical characteristics (pH, fertility, nutrient reserves, heavy metal, salinity)
   2. Test for physical characteristics (texture, particle size distribution, percent organic matter)

E. Planting Schedule: Indicating anticipated planting dates for plants

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

G. Warranty: Sample of special warranty.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
   1. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
   2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

B. Plant Materials: Provide quality, size, genus, species, and variety of exterior plants indicated. Provide only healthy, vigorous stock, grown in a recognized nursery acceptable to the Landscape Architect and free from disease, insects, eggs, larvae, and other defects. Provide plants in strict compliance with the recommendations of the following:
   1. ANSI Z60.1, American Standard for Nursery Stock, latest edition.
   2. American Association of Nurserymen, Horticultural Standards.
   3. American Joint Committee on Horticultural Nomenclature, Standardized Plant Names, 1942 edition.
   4. International Society of Arboriculture.

C. Inspection: Landscape Architect and Owner's Representative will inspect plant materials at place of growth before planting for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect and Owner's Representative retains right to inspect plant materials 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 even if previously inspected and approved. Remove and replace rejected plants immediately from Project site at no change in Contract Amount.
   1. Selection: All plants shall be tagged in the nursery by the Landscape Architect and the Owner's Representative prior to digging of plants. The Landscape Architect and Owner's Representative shall place seals on selected plants at the nursery. Seals shall remain on plants until the acceptance of the work. At least three weeks prior to expected planting date, request, in writing, the Landscape Architect's inspection of plant material at the nursery. The Landscape Architect and Owner's Representative shall make their own travel arrangements.
   2. Photographs: At the Landscape Architect's option and/ or request, the Contractor shall supply the Landscape Architect with photographs of plants for the project.
      a. The photographs shall be taken at the nursery source. Photographs shall include images showing the full range of characteristics of each plant including detailed photographs of the bark, the base of the tree (rootball crown), leaves, branching structure, form, and habit. Images shall include a scale figure or measuring device to indicate true size.
      b. Contractor shall label each photograph with the plant species botanical name, nursery name, and date of photograph.
   3. Nursery Source: The Landscape Architect shall have the right to reject any nursery source if he/ she determines, before, during or after inspecting or receipt of plants, any of the following:
      a. The nursery stock does not meet quality standards set forth herein.
      b. The nursery stock does not meet the intended visual characteristics of the plants as determined by the Landscape Architect.
      c. The nursery cannot supply the specified plant(s) or an acceptable substitute cultivar or species.

d. The nursery's cultural practices or maintenance procedures do not meet specified standards.
e. Infestation with pest or disease.

D. Fall hazard: Dig and install all plants within their proper planting seasons as recognized by the State Cooperative Extension Service in which the project is situated.

E. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Tree and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.

F. Preinstallation Conference: Conduct conference at the Project site with the Associate Landscape Architect and via phone conference or onsite with the Design Landscape Architect.

G. Plant Sources: The Contractor shall submit to the Landscape Architect any questions regarding the source of any plant. The Contractor may be locate the plant material at the following nurseries, but is not limited to these sources. The Contractor shall confer with the Landscape Architect to determine which plants have been tagged at which nursery source:
1. Arkansas Valley Seed Co. – 877.907.3337
2. Pawnee Buttes Seed, Inc. – 800.782.5947
3. Aquatic and Wetland Company – 999 Weld road 25, Fort Lupton, CO 80621; 303-442-4766
4. Alpine Ecological – Andy Herb – owner; 303-586-5014
5. Fort Collins Wholesale Nursery – 2224 N. Shields Street, Fort Collins, CO 80524; 970-484-1289
6. Arbor Valley Nursery – 18539 County Rd. 4, Brighton, CO 80603
7. Country Lane Nursery (owned by Arbor Valley) – 2979 N State Highway 83, Franktown, CO 80116; 303-688-2442
8. Alameda Wholesale Nursery, 1950 W. Dartmouth Ave. Englewood, CO 80110-1311, Phone: 303-761-6131
9. Colorado Tree Farm Nursery, 7440 Templeton Gap Rd. Colorado Springs, CO 80923 levi@coloradotreefarmnursery.com, 719-598-TREE (8733)
10. Honey Creek Nursery, 66301 E 320 Rd, Grove, OK 74344, (918) 786-4280
11. Little Valley Nursery, 13022 E. 136th Ave, Brighton CO 80601, 800-221-3241
12. The Tree Farm, 11868 Mineral Rd, Longmont, CO 80504, (303) 652-2961

1.09 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from damage, injury and theft.

C. Sequence deliveries to avoid delays, but minimize on-site storage.

1. On-site storage space is extremely limited and is restricted to a 24-hour period for any one material, plant or group of plants. On site storage is permissible only with written notice from the Construction Manager and Landscape Architect.
2. Deliver materials and plants only after preparations for planting have been completed and accepted, including but not limited to: subdrainage system, irrigation, rough grading, utilities, decompaction or remediation of soils. The Landscape Architect shall determine if the site is acceptable for planting.

D. 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.

E. Handle planting stock by root ball.

F. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery or if plants are to be stored off – site set exterior plants in shade, protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil or mulch.
2. Do not remove container-grown stock from containers before time of planting.
3. Stored plant material shall be watered and misted several times a day if necessary to maintain proper root ball moisture and to reduce transpiration in sunny or windy locations.
4. For plants stored on-site more than 12 hours, the Contractor must keep a maintenance log. The log shall include information on the watering, misting, and protection of plants. The date, time, type of maintenance and name of maintenance personnel shall be included in the log.

G. No plant shall be stored more than four weeks without written acceptance by the Landscape Architect.
1. For plants that must be stored in cold weather, provide full insulation and protection of rootballs. Protect rootballs from cold damage.
2. All plants shall be stored at the Landscape Contractor's facilities.
3. Landscape Contractor shall fully maintain stored plants.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
1. Notify Owner no fewer than 15 days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Owner' written permission.

C. Sequence of Planting: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise approved by the Landscape Architect. Complete landscaping work as quickly as possible on portions of the site as they become available for landscaping.

1. When planting trees and shrubs after plant beds, protect beds and promptly repair damage caused by planting operations.

D. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
1. Deciduous (container) - Spring Planting: March 15 to May 1, Fall: Oct. 1 to Nov. 30
2. Deciduous (B&B) - Spring Planting: March 15 to May 1, Fall: Oct. 1 to Nov. 30
3. Evergreens - Spring Planting: March 30 to May 1, Fall: Oct. 1 to Nov. 30
4. Groundcover - Spring Planting: April 15 to June 1, Fall: Oct. 1 to Oct. 30
5. Perennials - Spring Planting: April 15 to June 1, Fall: Oct. 1 to Oct. 30

E. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
   b. Structural failures including plantings falling or blowing over.
   c. Faulty performance of bamboo structure.
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Periods from date of Substantial Completion:
   a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
   b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
3. Include the following remedial actions as a minimum:
   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   b. Replace plants that are more than 25% dead or in an unhealthy condition at end of warranty period.
   c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.12 LINES AND GRADES

A. The Contractor shall provide his own lines and grades for the work required.

B. Grades: If present, protect and maintain grade stakes and location stakes until removal is acceptable to Landscape Architect and all parties involved in this project. If grade stakes are not present, establish grade stakes to ensure that grades shown on the Drawings are being met.
1. Before planting, the Contractor shall stake out all trees and plants for review and acceptance by the Landscape Architect.

1.13 MAINTENANCE SERVICE

A. Initial Maintenance Service for Tree, Bamboo and Ground Cover: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
   1. Maintenance Period: 12 months from date of planting completion.

B. Initial Maintenance Service for Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

C. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.14 MAINTENANCE AND ACCEPTANCE OF LANDSCAPE MATERIAL

A. SEED. During vegetation establishment, the seeded area should be inspected regularly. If areas of erosion or “bald spots” in the seeded areas are noted during an inspection, the area should be repaired immediately. On-going environmental commitments frequently are attached to a construction project’s letting documents. The applicability of the commitments may extend beyond the project’s conclusion, and must be continued.

B. The contractor shall be responsible to providing overhead irrigation to areas that are seeded as part of the project yet not covered by overhead irrigation. The contractor shall be responsible for ensuring a health cover as described below.

C. A uniform perennial vegetation cover with 98% density (compared to the vegetation prior to project construction) is required to close the storm water permit. Mowing of any newly seeded area may be necessary if weed infestation or shading of the planted seedlings by tall weeds occurs. NDOR promotes mowing as necessary to control weeds during the establishment period.

D. Year 1 Evaluation: Cover crop grows within 2 weeks of planting (except late fall or dormant plantings). Seedlings should be apparent within the drill rows. Native grass seedlings may only be 4-6 inches tall. Mow as necessary if a flush of growth of weeds occurs (pigweed, sunflower, etc.).

PART 2 - PRODUCTS

2.01 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
   1. Tree and Shrubs with damaged, crooked, or multiple leaders; crossing trunks; or with stem girdling roots will be rejected.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Grade: Provide plants of specified height, caliper, sizes and grades complying with ANSI Z60.1 for type of plants required.
   1. Larger Stock: Plants larger than required may be used if approved by Landscape Architect, if root ball is proportionately larger, and if there is no change in Contract Price. The root ball must fit into planting space without being shaved.
   2. Undersize Stock: Not more than 10% of plants smaller than required may be used if approved by Landscape Architect, if equal number of oversize plants are provided to make average size equal or greater than size required, and if undersize plants are larger than the average size of the next lowest size grade.

C. Provide plants of sizes, container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

D. Plant Character: All plants, except custom grown plants as shown on the drawings, shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. Form and size shall comply with ANSI Z60.1.
   1. Deciduous Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated.
   2. Multistem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.
   3. Deciduous Shrubs: 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.
   4. Evergreen Trees and Shrubs: Well-balanced evergreen plants, of type, height, spread, and shape required, complying with ANSI Z60.1.
   5. Broadleaf Evergreens: Well-balanced broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.
   6. Groundcover and Vines: Provide groundcover and vines of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.
   7. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.
   8. Bulbs: Bulbs shall be Top Size for species specified as defined by ANSI Z60.1, firm of flesh, free from decay and disease. Bulbs shall be certified as being grown for the season in which they will be installed.

E. Trunk: The height of the trees (measured from the crown of the roots to the tip of the top branch) shall be not less than the minimum size designated. The trunk of each tree shall be a single trunk growing from a single un-mutilated crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire or other causes. No pruning wounds shall be present having a diameter exceeding one inch and such wounds must show vigorous bark on all edges. Plants shall not be pruned prior to delivery. No trees with double-leaders or twin-heads shall be acceptable. The Contractor shall reject such plants at time of delivery by the nursery/supplier unless such plants were selected by the Landscape Architect as indicated by tags and seals.

F. Rootballs: All plants to be moved balled and burlapped, must be moved with the root systems as solid units with balls of earth firmly wrapped with untreated biodegradable eight ounce burlap, firmly held in place by a stout cord, drum laced, or boxed, or in containers. The diameter and depth of the balls of earth must be sufficient to encompass the fibrous and root feeding system necessary for the

healthy development of the plant. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during the process of planting or after the burlap, staves, ropes or platform required in connection with its transplanting have been removed. The plants and balls shall remain intact during all operations. Burlap for containing rootballs shall be untreated, made from biodegradable natural fibers. Inspect root crown for girdling roots. Plants with girdling roots will be rejected. Remove all wire baskets. Root-Ball Depth: Root flare shall be visible before planting.

G. Container Stock: Container stock shall have a full container of well developed root system. Plants loose in the container are not acceptable. The surface of the root zone shall be free of circling or kinked roots. Staked plants must be self supporting when unfastened from the stake. When removed from the container, the root ball shall be free from numerous circling roots. Large matted roots at the sides or bottom of the container will not be accepted. Container grown plants may be accepted for balled and burlapped material if approved by Landscape Architect.

H. Seed: Apply upland seed mix in all areas disturbed during construction except where wetland seed mix is applied. Overlap the seed mixes a minimum of 2 feet. Seed tags must be submitted to PLANT ECOLOGIST and Landscape Architect.
   1. No fertilizer shall be added.
   2. Native seed may be drilled or broadcast. Seed which is broadcast shall be hand raked immediately following seeding to cover with 1/8” to ½” of topsoil. Seeding rates shown should be doubled if broadcasted. Broadcast wetland seed mix as shown on plans.

I. Live Stakes or Bare-Root. Live willow cuttings must be collected and installed in dormant condition (usually before April 15). Willows shall be cut from the existing communities within the Boulder Creek drainage basin. It is the responsibility of the contractor to obtain the quantities of stakes and store them in an appropriate manner until planting. Live stakes must be placed in water so that the cut ends are completely covered and stored in a cool location.
   1. Cuttings will be harvested with sharp pruning shears. Willow cuttings will be between ½ inch and 1 inch in diameter. Willow cuttings will be approximately 3 to 4 feet long. When harvesting willow stakes make sure to cut to the bottom of the stake or pole at 45 degrees and cut top of stake or pole square. Cuts are to be made eight (8) to ten (10) inches above the ground.
   2. Stakes shall be planted using a piece of rebar to create a vertical hole approximately 2 to 3 feet deep. Approximately 2/3 of the stake shall be inserted into the hole so that the stake is in contact with the water table. After the willow stake is inserted, the hole shall be backfilled with native soils and lightly tamped to prevent air pockets. The stake shall then be watered to help fill in the air pockets. Willow stakes shall be planted 12 inches on center within the areas shown on the LANDSCAPE PLAN.
   3. Plant right side up.

J. Labeling: Label at least ten plants of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

K. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.02 PLANTING MULCH

A. Mulch: Provide brown shredded pine bark mulch to an average depth of 3” at the base of all trees, 4’ diameter.

2.03 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

C. Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

2.04 2.02 PLANTING SOIL MIXTURE

A. See Section 32 91 13 “Planting Soils” for planting soil mixture requirements. The Contractor shall strictly adhere to soil specification composition for each section of the Work.

B. Coordinate installation of soil mixes and plants to meet requirements of this Section and Section 32 91 13 “Planting Soils”.

2.05 SOIL AMENDMENTS

A. Soil Amendments shall not be used except as approved by the Landscape Architect. Also refer to Section 32 91 13 “Planting Soils” for additional requirements. Where applicable please provide the following amendments as described herein:
   1. Manure: Provide well rotted, unleached manure containing not more than 25% by volume of straw, sawdust or other bedding materials and containing no ingredients harmful to plants.
   2. Bonemeal: Provide finely ground commercial raw bone meal having at least 1% nitrogen and at least 23% phosphoric acid.
   3. Fertilizer: Provide “Healthy Start”, manufactured by Plant Health Care Products, Inc. or approved equivalent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive plants
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install 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.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Apply antidesiccant to bamboo and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
   1. If deciduous tree or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

E. Wrap trees, bamboo and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.03 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches:
   1. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
   2. Maintain supervision of excavations during working hours.
   3. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Subsoil removed from excavations may not be used as planting soil.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees, bamboo or shrubs are encountered in excavations.
   1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes, 24 inches (600 mm) apart, into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree, bamboo or shrub planting pits.

E. Fill excavations 3 times in a 24 hour period with 500 mm of water and allow water to percolate. If water persists after an additional 24 hour period notify Landscape Architect.

3.04 TREE PLANTING

A. Planting balled and burlapped stock: Inspect all plants and determine if flare of trunk is improperly buried. Expose flare of trunk by removing excess fill on top of rootball. Set balled and burlapped stock plumb with crown of properly exposed rootball 2”-3” higher than specified finished grade. Remove burlap and twine from trunk to prevent girdling. Completely remove drum lacing and wire baskets. Fold down burlap 1/3’ from top. Biodegradable burlap can be left in place. Keep root balls intact; plants with broken or damaged root balls shall be rejected and immediately removed from the

site. Keep root balls damp and protected from damage due to sun and wind.Set container-grown stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent planting soil.

1. Backfilling: After trees have been placed in staked locations, and as directed by Landscape Architect, backfill excavations with soil mix layers to levels shown on Drawings and described in Section 329113. Backfill in 3-4" layers and consolidate each layer with water to eliminate voids and air pockets before placing subsequent layers. Continue until backfill has reached specified finished grade show on the Drawings. Water thoroughly when excavation is backfilled and continue watering until saturation.
2. Watering: Flood all plants with water twice within the first 24 hours after planting.
3. Watering Dish and Mulch: Dish top of planting soil around each tree as shown in the Drawings to allow water to seep into the root zone. Cover planting soil dish with mulch as shown in the Drawings.
4. Anti-Desiccant: Spray anti-desiccant to provide adequate film over trunks, branches, stems and foliage. If trees are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting. Use anti-desiccant only if approved by Landscape Architect and Owner.
5. Staking and Guying: Stake and guy trees immediately after planting to maintain trunk plumb. Adjust and reset stakes and guys during maintenance period as necessary. Remove stakes and at the end of the warranty period.

B. Planting Container Stock: Plant container grown stock the same as specified for balled and burlapped stock, but remove containers completely with a cutter acceptable to Landscape Architect.

1. Root Pruning: After removing plant from the container, the Contractor shall inspect the root ball for kinked, matted or circling roots. If these conditions are present, the Contractor shall prune to remove cleanly any kinked, matted or circling roots with sharp clean hand pruners. The Contractor shall also scarify the sides of the rootball to prevent a rootbound condition.

C. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.05 TREE PRUNING

A. Prune, thin, and shape trees, bamboo, shrubs, and vines as directed by Landscape Architect.

B. Do not apply pruning paint to wounds.

C. Conform to section 31 13 00 Selective Tree and Shrub Removal and Trimming

3.06 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated by the Drawings.

B. Dig holes large enough to allow spreading of roots.

C. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

F. Protect plans from the hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.07 FINE GRADING

A. Prior to fine grading, Contractor shall verify that the rough grading, under drainage system, planting soil mixes and irrigation system have been accepted.

B. Fine Grading: Set sufficient grade stakes for checking the finished grades. Stakes must be set at the bottom and top of slopes and the centers of plant beds. Grades shall be established which are accurate to 1/10th of a foot either way. Connect contours and spot elevations with an even slope. All grading will insure drainage away from structures.

1. After planting soil mix has been spread, it shall be carefully prepared by scarifying and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over one inch in diameter shall be removed from the planting soil. Planting soil shall also be free of smaller stones in excessive quantities as determined by the Landscape Architect.

2. Fine grade planted areas to smooth, free draining, even surfaces with fine texture. Roll, rake and drag areas to flatten ridges and fill depressions, except as select areas shown on drawings. Control moisture content to maintain optimum conditions, but do not create a muddy condition.

3. Rolling - Typical: Roll the entire area with a hand roller weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional planting soil and the surface shall be regraded and rolled until presenting a smooth and even finish to the required grade or to the shapes and configurations as shown on the details.

4. Maintenance and Restoration: Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to lawn planting.

3.08 TREE STABALIZATION

A. Root-Ball Stabilization: Install at-or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.
   1. Stakes and Guys: Provide 2” x 2” cedar and/or 3” diameter bamboo stakes for all balled and burlapped trees, per tree or as shown on the Drawings. Quantity and material of stakes shall be as shown on the drawings. Tie shall be “Arbor Tie” manufactured by NEPTCO or as specified on drawings.
      a. Install stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation. Saw stakes off at horizontal stake.

b. Install screws through horizontal hold-down and penetrating at least 1 inch (25 mm) into stakes. Predrill holes if necessary to prevent splitting wood.
c. Install second set of stakes on other side of root trunk for larger trees as indicated.

3.09 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Mulch in Planting Areas: Apply 2-inch in planting areas as indicated in the Drawings. Do not place mulch within 2 inches of trunks or stems.

B. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.

3.10 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees, shrubs, and other plants free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.12 CLEAN UP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.13 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 32 93 00

SECTION 32 93 01 – IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Work of this Specification Section generally includes the installation of a complete irrigation system as shown on the drawings. The contractor shall include all labor, permits, licenses, inspection tools, facilities, transportation and equipment necessary for the installation of a complete system according to the plans and specifications. No substitutions of the procedure or materials shall be made concerning these documents without the written consent of an approved equal by the City. The work shall comply with the requirements of all legally constituted authorities having jurisdiction.
   2. All work in this section shall be coordinated with all utilities and trades responsible for their installation.
   3. Work called for on the drawings and details shall be installed whether or not specifically mentioned in the specifications.
   4. Installation of the irrigation system shall be done under the supervision of a City of Boulder Parks and Recreation irrigation maintenance staff person.

B. Related Sections include the following:
   1. EARTHWORK – SECTION 31 20 00
   2. FINISHED GRADING – SECTION 31 22 19
   3. SOIL PREPARATION – 32 91 00
   4. TURF AND GRASSES – SECTION 32 92 00
   5. PLANTS – SECTION 32 93 00

1.2 SEQUENCING AND SCHEDULING

A. The installation of pressurized irrigation mainline and associated equipment including, but not limited to mainline, quick couplers, etc shall be installed at the completion of earthwork activities and prior to final grading.

B. Installation of non-pressurized irrigation, including but not limited to, laterals, heads, etc. shall be installed after finished grading activities.

C. The irrigation system shall be fully inspected and tested prior to the finished grading activities. This includes, but is not limited to, the following:
   1. Pressure testing on irrigation equipment including point of connection, mainline, heads
   2. Coverage inspections and tests on all watering equipment.

D. The contractor shall be responsible and cover the cost of all work associated with adjustments to the system to ensure proper function as indicated by the specifications and drawings.

1.3 REFERENCES

A. Perform work in accordance with all applicable laws, codes, ordinances, and rules and regulations.

B. Conform to requirements of reference information listed below except where more stringent requirements are shown, required, or specified in the Contract Documents.
   1. American Society for Testing and Materials (ASTM) – Specifications and Test methods
   2. Underwriters Laboratories (UL) – UL Wires and Cables

1.4 QUALITY ASSURANCE

A. Experience and Observations
   1. See the SPECIAL CONDITIONS section of the contract documents for necessary experience relating to the installation of a complete irrigation system.
   2. Irrigation Contractor shall schedule a Pre-Construction meeting to review in detail schedule, installation procedures, individuals in charge, submittals, quality control procedures, etc. The meeting shall be schedule not less than 10 days prior to the commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to the meeting date.
   3. Work shall be performed in accordance with the best standards of practice relating to the various trades. The contractor shall be highly skilled and proficient in the installation of irrigation systems of this magnitude. The contractor shall coordinate installation of irrigation system with other trades on the project. A contractor's Superintendant shall oversee the installation of the irrigation system and be available on a daily basis. In addition, the City will assign a Parks and Recreation irrigation maintenance staff member to specifically oversee and monitor the installation of the irrigation system.
   4. No materials of any kind shall be installed on the project unless they have been approved by the City. The City reserves the right to observe installation of the irrigation system at any time and to reject any and all materials or workmanship that does not meet project specifications and standards. All re-work necessary to meet the project standards and specifications shall be done at no additional cost to the City.
      a. Before final acceptance of the project, the contractor shall show evidence to the City that all submittals, etc. have been received by the City.
      b. Contractor shall give the City fourty-eight (48) hours notice with request for staking or field observation or inspections. Head and valve staking must be approved prior to commencement of installation. Contractor to verify site conditions before commencing with work. Contractor shall notify City in writing of any site irregularities prior to commencing work. Initiation of irrigation implies contractor acceptance of existing conditions.

1.5 SUBMITTALS

A. Operating and Maintenance Manual(s)
   1. Index sheet of Contractor's addresses and phone numbers.
   2. A PDF file containing a list indicating manufacturer, model number, and description of all materials and equipment that were used in the installation of the irrigation system.
   3. Operating and maintenance instructions of all equipment with shutdown and start-up procedures for the irrigation system.

B. As-Built (Record) Drawings

1. Before the final acceptance of the irrigation system the contractor shall submit a 'hard-copy' reproducible drawing set of the as-built irrigation system. The drawings shall at a minimum locate all equipment and piping as listed in the irrigation schedule on the plans. The contractor shall further be responsible for locating equipment and materials listed below in 1.5-B-3.
2. In addition to the hard-copy drawing set, the contractor shall also supply an AutoCAD (.dwg) file(s) of the installed irrigation system. The AutoCAD version shall be version 2010 or later. The AutoCAD file shall at a minimum locate all equipment and piping as listed in the irrigation schedule on the plans. The contractor shall further be responsible for locating equipment and materials listed below in 1.5-B-3.
3. In addition to and including equipment and materials shown on the irrigation plans and details; hard-copy drawings and AutoCAD files shall indicate and locate the following materials and equipment:
   a. Controller location
   b. Backflow / reduced pressure assembly
   c. Routing of sprinkler pressure lines
   d. Sprinkler control valves
   e. Manual drains
   f. Moisture sensors
   g. Drip line blow-out stubs
   h. Air-relief valves
   i. Control wiring routing if not with the pressure main line
   j. Isolation valves
   k. Two-wire grounding / surge arrestors
   l. Sleeving including sizes, quantity, and approximate depth
   m. Locations of all unused/spare sleeving, size, quantity, and approximate depth
   n. Master valve
   o. Two-wire splices
4. Drawings and electronic files should include the connection to the existing water line and any other requested items.
5. As-built drawings should be updated weekly. The City reserves the right to request As-Built drawings at any point during the installation of the irrigation system. The City further reserves the right to inspect the installation of the irrigation system as is shown on the As-Built drawings.
6. The Contractor shall work with the City to determine if the City will require valves to be numbered and sequenced. In the event that the City requests that the Contractor number and sequence the valves and other equipment, numbering shall be shown on the As-built drawings.
7. Drawings shall clearly identify valves and corresponding lateral lines or drip zones.
8. As-Builts will be a condition of acceptance of the completed irrigation system.
9. The City will not approve any pay requests if the As-Built drawings are not current or complete.
10. The City reserves the right to reject the As-Builts if they are not legible or contain the proper equipment.

C. Controller Chart
1. The Contractor shall supply a controller chart for each automatic controller that has been installed. The chart may be a reproduction of the As-Built drawings. The controller chart should identify area of coverage for each remote control valve using a distinctly different color.
2. Once accepted, the controller chart shall be sealed in plastic and able to be folded and stored in the controller cabinet.

1.6 DELIVERY, STORAGE AND HANDLING OF MATERIALS

A. Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage. Storage shall include protecting PVC piping from sunlight using tarpaulins, or equal, covering stored pipe.

B. Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle which allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.7 JOBSITE CONDITIONS

A. Contractor shall be responsible for contacting utility companies to stake locations of all utilities on the property. Request City, in writing to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities that were not staked are encountered and damaged by Installer, Owner shall repair them at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

B. All trees, shrubs, flowers, fences, buildings, walks, roadways, and other property shall be protected from damage. Any damage to property shall be repaired or replaced to the City's satisfaction at the Contractor's expense and at no additional cost to the City.

C. Open trenches left exposed shall be flared and barricaded as per O.S.H.A. regulations by contractor.

D. All trenching and other work within three feet of the drip line of existing trees shall be done by hand so as not to damage tree roots or limbs. All trenches shall be no less than one foot from the trunk of any tree.

E. Promptly notify City of unexpected sub-surface conditions.

F. Replacement of Paving or Curbs – Damage caused by trenching, crossing existing and/or proposed roadways, paths, curbing shall be kept to a minimum and all damaged areas shall be restored to their original condition at the contractor's expense. This will include compaction of sub-grade to ninety-five percent (98%) compaction of T-180.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General Piping
   1. Pressure Lines (downstream of backflow) 3" diameter and larger – Class 200, Gasketed

2. Non-pressure Lines less than 3” diameter – schedule 40, Solvent Weld
3. Sleeving under in non structural applications: 4” and 6” (ie. sidewalks, etc) – SDR 35
4. Sleeving in structural applications: Greater than 6” (ie. roads, emergency access sidewalks, etc.) – Dual wall HDPE pipe
5. Dripperline – As specified on the drawings
6. Drip Supply Tubing – 80 psi NSF polyethylene (1” diameter)

B. Brass Pipe and Fittings
1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
   a. Teflon Tape – All brass male threaded fittings and nipples shall receive wrapping of
   b. Teflon tape applied to threaded surfaces per pipe manufacturer’s recommendations.
2. Fittings - Medium brass, screwed 125-pound class.

C. Plastic Pipe and Fittings
1. Identify all pipe with following indelible markings.
   a. Manufacturer’s name
   b. Nominal pipe size
   c. Schedule of class
   d. Pressure rating
   e. NSF (National Science Foundation) seal of approval
   f. Date of extrusion
   g. All wording on pipe shall be installed facing upward within trench
2. Solvent Weld Pipe – Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B, Type 1, Grade 1.
   a. Fittings - Standard Wright, Schedule 40, injection molded PVC; complying with ASTM D1784 and D2466, cell classification 12454-B.
      1) Threads – Injection molded type (where required)
      2) Tees and ells – Side gated
   b. Threaded Nipples – ASTM D2464, Schedule 80 with molded threads
   c. Thread Sealant – All All PVC male threaded fittings and nipples, excluding marlex fittings, shall receive non-hardening thread sealant/paste containing no petroleum distillates applied to threaded surfaces per pipe manufacturer’s recommendations
   d. Joint Cement and Primer – Purple Primer. Hot or Cold 727 cement applied per manufacturer’s instructions.
3. Gasketed End Pipe (Mainline piping) - Manufactured from virgin Polyvinyl Chloride compound in accordance with ASTM D2241 and ASTM D1784; cell classification 1254-B, Type 1,Grade 1.
   a. Fittings (changes in direction - 2" and larger) - Ductile iron, grade 65-45-12 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477.
   b. Gaskets - Factory installed in pipe and fittings, having a metal or plastic support within gasket.
   c. Mechanical restraints – ductile iron fittings secured with IPS ductile iron, knuckle-type restraints.
   d. Lubricant – As recommended by manufacturer of pipe.
   e. Service Tees - Schedule 40 PVC Socket x Socket x SR FIPT (steel reinforced)
4. HDPE Flexible Plastic Pipe – Manufactured from virgin polyethylene in accordance with ASTM D2239, with a hydrostatic design stress of 630 psi and designated as PE 2306.

a. Fittings - Insert type manufactured in accordance with ASTM D2609; PVC Type 1 cell classification 12454-B.
b. Clamps – All stainless steel worm gear screw clamps or Pinch-type clamps.

5. Self-tapping saddle type and barb lateral line fittings.
   a. Use for connections to spray heads, rotors, changes in direction, and other applications as approved by the City.

D. Dripperline
   1. As specified on the drawings.

E. Isolation Valves
   1. Isolation Valves for 1 inch through 2 Inch Pipe - Bronze construction; stainless, full port opening ball; IPS threads, and non-rising stem with slot-type operator.

F. Pressure Reducing Valve
   1. Bronze. High capacity water pressure reducing valve. Size per drawings. Install in ground prior to RPA.

G. Master Valve
   1. As specified on the drawings. No substitutions allowed.

H. Commercial Fertilization Equipment
   1. As per drawings. No substitutions. Install in super jumbo Carson valve box.

I. Quick Coupling Valves
   1. Brass two-piece body designed for working pressure of 150 PSI; operable with quick coupler. Equip quick coupler with locking rubber cover.

J. Valve Boxes
   1. Gate Valves, Quick Coupling Valves, Drain Valves, Drip Line Blow-out Stubs, Two-wire path surge arrestors/ground rods - Carson #910-10 box with bolt-down lid.
   2. Two-Wire Cable Splice box - Carson #910-12 box with bolt-down lid.
   3. All valve boxes shall be green-colored lids unless otherwise specified.

K. Two-Wire Cable
   1. Low Voltage:
      a. Dual, parallel, tin-coated solid copper conductors (12 ga.) each with PVC insulation, contained with polyethylene jacket – Paige P7072-D. (Two runs of conventional irrigation wiring is NOT acceptable).
      b. Cable jacket colors: Leg #1 – Blue
      c. Two-Wire (cable to cable) and two wire to de-coder splice shall be made with 3M DBR/Y-6 waterproof splice kits.
      d. Decoder to valve selonoid connection shall be made with 3M DBR/Y-6 waterproof splice kits.
   2. High Voltage – Type required by local codes and ordinances, of proper size to accommodate needs of equipment serviced.

L. Automatic controller – Size and type as shown on the Drawings and mounted as detailed.

M. Electric Control Valves – Size and type as shown on the Drawings having manual flow adjustment and manual operation nut with internal bleed.

N. Sprinkler Heads and Rotors – As indicated on the Drawings.

1. Sprinklers and rotors shall be installed using saddle type fittings.

PART 3 - EXECUTION

3.1 SITE CONDITIONS, LANDSCAPE PLAN REVIEW, AND COORDINATION

A. Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor's expense.

B. Contractor is responsible to notify City of any field conditions that vary from the conditions shown on the Irrigation Construction Documents. If Contractor fails to notify City of these conditions, Contractor will be held responsible for all costs associated with system adjustments required due to the change in field conditions.

3.2 VERIFICATION OF STATIC PRESSURE

A. Contractor shall field verify the static pressure at the project site, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to Consultant. If Contractor fails to verify static water pressure prior to commencing work or ordering irrigation materials, Contractor shall assume responsibility for all costs required to make system operational and the costs required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant replacement costs.

3.3 INSPECTION – Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected

A. EARTHWORK operations shall be completed and approved by Owner before installation of pressurized equipment. Staking or installation of any non-pressurized irrigation equipment shall begin after FINISHED GRADING operations.

B. Underground Utilities shall be installed prior to installation of irrigation system. If irrigation installation takes place prior to utility installation, Contractor shall notify Owner of this condition in writing prior to commencement of irrigation installation.

3.4 PREPARATION

A. Staking shall occur as follows:
1. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact City 48 hours in advance and request review of staking. Proposed locations of all trees shall be field staked by Contractor and approved by City prior to Consultant review of irrigation staking. City will advise installer as to the amount of staking to be prepared. City will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.

2. Contractor shall contact City if field spacing varies by +/- 10% of the spacing shown on the irrigation plans. If Contractor fails to notify City of variances exceeding 10%, Contractor assumes full responsibility for the costs associated with any required system modifications deemed necessary by the City.
3. If Project has significant topography, freeform planting beds, or other amenities, which could require alteration of irrigation equipment layout as deemed necessary by Consultant, do not install irrigation equipment in these areas until City has reviewed equipment staking.

B. Sleeving – Install sleeving under asphalt paving and concrete walks, prior to concrete and paving operations, to accommodate piping and wiring.
1. Provide for a minimum cover of 18-24 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.
2. Piping located under areas where asphalt of concrete paving are with structural applications (ie roads, alleys, or sidewalks designated for emergency vehicles) will be installed using a flow-fill material. Other backfill materials will not be accepted.
3. In non-structural paving conditions compact backfill material in 6” lifts at 95% maximum density using manual or mechanical tamping devices.
4. Piping under existing walks or concrete placement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at no cost to the City. Obtain approval to cut or break walks and/or concrete from the City.

C. Trenching
1. Trenching shall not begin until EARTHWORK – SECTION 31 20 00 has been completed. Irrigation system to be installed and tested prior to commencement of final grading.
2. Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.
3. Clearances
   a. Piping 3 Inches and Larger - Make trenches of sufficient width (12 inches minimum) to properly assemble and position pipe in trench. 2” minimum horizontal clearance for mainline and lateral lines up to 2”. 4’ Clearance for mainline and lateral lines larger than 2”.
   b. Piping Smaller than 3 Inches - Trenches shall have a minimum width of 6 inches.
   c. Line Clearance - Provide not less than 6 inches of horizontal clearance between each line and not less than 12 inches of clearance between lines of other trades. Vertical “stacking” of multiple runs of irrigation piping within common trench is not acceptable.
4. Pipe and Wire Depth
   a. Pressure Supply Piping (Mainline) – 24” from top of pipe
   b. PVC Sleeving – Road/Street/Drive – 24 inches minimum/28 inches maximum depth of cover as measured from top of sleeve to bottom of road surfacing material. Pedestrian and Bicycle paths/walks – Depth shall equal depth of piping and/or wiring to be contained within sleeving as indicated on plan as measured from top of sleeving to top of path/walk.
   c. Non-pressure Piping – 8” minimum from top of pipe.
   d. Two-wire Cable – Install horizontal to installed mainline pipe.
   e. Drip Supply Piping – 12” from top of pipe.
5. Non-pressurized irrigation lines 1 ½” and smaller shall be installed using a vibratory plow or similar device. Pipe shall be installed to a minimum depth of 8”. Contractor shall make every effort to minimize compaction of finished grade. City of Boulder reserves the

right to require required removal or remediation of compacted soils at no expense to the City. City of Boulder reserves the right to verify depth of lateral line and require installation at correct depth at no additional cost to the City.

3.5 INSTALLATION

A. Locate equipment as near as possible to locations designated. Consultant shall review and approve deviations prior to installation.

B. PVC Piping – Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40 degrees Fahrenheit. Install manual drain valve at low points and dead ends of pressure supply piping to insure complete drainage of system. Installation of multiple runs of piping in common (joint) trench is not allowed. When pipe installation is not in progress, or at the end of each day, close pipe ends with tight plug or cap. Perform work in accordance with good practices in prevailing pipe trades.
   1. Solvent Weld PVC Pipe - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.
   2. Gasketed End Pipes
      a. Lay pipe and make pipe to fitting or pipe to pipe joint, following OR70 recommendations (Johns-Manville Guide for Installation of Ring-Tite Pipe), or pipe manufacturer's recommendations.
      b. Ductile iron, gasketed fittings (changes in direction, reducers, dead end caps) shall be secured with knuckle-type restraints. Restraints shall be tightened to manufacturer specifications utilizing a torque wrench.
      c. Install per drawings. Construct 1 ½" compacted recycled concrete 'thrust-blocks' behind all mechanically restrained gasketed fittings, tees, bends, reducers, line valves, and caps in accordance with pipe manufacturer's recommendations. Contact City prior to placing thrust-blocks for observation of thrust-block excavation and initial placement. Thrust-block bearing surface shall be calculated based on the tables below.

THRUST BLOCK SIZING GUIDE:

Thrust developed per 100 PSI pressure (lbs. force) for various fitting configurations.

Pipe Size	Fitting 90 deg.Elbow	Fitting 45 deg. Elbow	Valves, Tees Dead Ends
3	1,000	600	800
4	1,800	1,100	1,300
6	4,000	2,300	4,900
8	7,200	4,100	7,100
10	11,200	6,300	7,900
12	16,000	9,100	11,300

Approximate bearing strength of typical soils.

Soil Type	Lbs/ft 2
Mulch, Peat, etc.	0
Soft Clay	500
Sand	1,000

Sand and Gravel	1,500
Sand and Gravel with Clay	2,000
Sand and Gravel Cemented with Clay	4,000
Hard Pan	5,000

C. HDPE Flexible Pipe
   1. Install non-pressurized lateral lines and related equipment after FINISHED GRADING activities.
   2. HDPE pipe shall be installed using a vibratory plow or similar device to a minimum depth of 8”.

D. Dripperline
   1. Make all fitting connections as per manufacturer’s recommendations.
   2. Secure all insert-type fittings with stainless steel worm-gear clamps (one per joint).
   3. Install drip line blow-out stubs at all dead ends of drip tubing.
   4. Flushing – After tubing has been installed, but prior to making final connections and backfilling trench, thoroughly flush dripperline under full head of water pressure through open ends of the line. Maintain flushing for 5 minutes through all blow-outs.

E. Two-Wire Decoder Cable
   1. Low Voltage Wiring:
      a. Bury two wire cable between controller and electric valves in pressure supply line trenches, strung as close as possible to main line pipe to be consistently be located below top of pipe and to one side of pipe, or in separate trenches.
      b. Provide a 36 inch expansion loop at every pressure pipe angle fitting and every 500 feet. Expansion loop shall not be taped.
      c. Provide minimum 18 inches loop at every valve bank.
      d. Make all splices and electric control valve connections using 3M Company DBR/Y-6 waterproof wire splice connector kits.
      e. Install all cable splices not occurring at control valve in a separate splice valve box.
   2. High Voltage Wiring for Automatic Controller:
      a. Provide electric power and connection to automatic controller.
      b. All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by a licensed electrician.

F. Automatic Controller
   1. Install controller in accordance with manufacturer's instructions as detailed and where shown on Drawings.
   2. Program valve decoders in numerical sequence to operate in sequence as shown on the Drawings.
   3. Owner shall approve final location of controller prior to installation.
   4. Each controller shall be a dedicated separate ground wire and grounding rod or grounding plate as detailed unless otherwise on the Drawings.
   5. All above ground conduit shall be rigid galvanized with appropriate fittings. All below ground conduit shall be schedule 40 PVC.
   6. Exposed bare ends of copper wiring connected to terminal strips shall not exceed 3/8” except where longer exposed length is required to complete connection.

G. Electric Control Valves

1. Install cross-handle four inches below finished grade where shown on the Drawings as detailed. Where grouped together, allow at least 12 inches between the valve box and sides. When installed adjacent to curbing and walks allow 24 inches between valve box and curb / sidewalk. Install each remote control valve in a separate valve box with box centered over valve assembly. Multiple valves are permitted in large boxes provide proper clearance around valves is maintained. Seek approval of City where Contractor seeks to install more than one valve in a box.
2. Install valve boxes flush with finish grade. Valve boxes that do not meet finished grade will be required to be raised or lowered to meet grade. Extensions in this application are not acceptable.
3. Valves and valve boxes shall be located parallel to sidewalks where appropriate. Maintain consistent valve box spacing. Multiple valve boxes shall be aligned and parallel.
4. Connect valve solenoid wire leads to valve decoder per manufacturer's recommendations.

H. Quick Coupling Valves
1. Install quick coupling valves on a swing joint assembly as indicated on the Drawings. Install plumb and flush to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees. Quick coupling valves to be installed on mainline at 200 ft. max intervals.
2. Install recycled concrete in quick coupler valve box to top of wing assembly.

I. Drip Valve Assemblies
1. Install drip valve assembly as shown in the Drawings.

J. Drain Valves
1. Install manual drain valve(s) as shown on the drawings and at low points in pressure mainline(s) as dictated by field conditions. Provide a three cubic foot sump for drain valve.

K. Valve Boxes
1. When installed adjacent to curbing and walks allow 24 inches between valve box and curb / sidewalk. Install each remote control valve in a separate valve box with box centered over valve assembly. Multiple valves are permitted in large boxes provide proper clearance around valves is maintained. Seek approval of City where Contractor seeks to install more than one valve in a box.
2. Install valve boxes flush with finish grade. Valve boxes that do not meet finished grade will be required to be raised or lowered to meet grade. Extensions in this application are not acceptable.
3. Valves and valve boxes shall be located parallel to sidewalks where appropriate. Maintain consistent valve box spacing. Multiple valve boxes shall be aligned and parallel.
4. Valve box extensions are not acceptable except for master valves, flow sensors, or other irrigation equipment installed at depth of pressure mainline.
5. Install recycled concrete sump after compaction of all trenches. Place final portion of recycled concrete inside valve box after valve box is backfilled and compacted. Install recycled concrete to bottom of valve assembly.

L. Gate Valves
1. Install where shown on the Drawings.

M. Sprinkler Heads
1. Install sprinkler heads where designated on Drawings or where staked. Set to finished grades per plans.

2. Spacing of heads shall not exceed the maximum indicated on the Drawings unless re-staked or otherwise directed by the City. In no case shall the spacing exceed maximum recommended by the manufacturer.
3. Install bodies on swing joints. No risers will be accepted.
4. Adjust part circle heads for proper coverage. Adjust heads to correct height after sod is installed. Plant placement shall not interfere with intended sprinkler head coverage, piping, or other equipment. City may request adjustments without within the specifications coverage patterns viewed in the field without additional cost to the City.

N. Backfilling
1. Do not begin backfilling operations until required system tests have been completed. Backfill shall not be done in freezing weather except with review and approval by the City. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finished graded prior to walk through of system by City.
   a. Mainline backfill – Mainline backfill shall be ‘squeege’ bedding material. Minimum 6” above pipe. Minimum 2” below pipe.
   b. Lateral line backfill – Lateral line backfill shall be ‘squeege’ material. Minimum 6” above pipe. Minimum 2” below pipe.
2. Excavated material is generally acceptable to use for remaining section of pipe backfill. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfilling shall be hauled away. Contractor shall be responsible for providing acceptable backfill material if excavated material is not suitable or insufficient to complete backfilling, compaction and final grade requirements.
3. Do not leave trenches open for a period of more than 48 hours. Open excavations shall be protected in accordance with O.S.H.A. regulations. All trenches required to be left open overnight shall have orange construction fencing with staking installed. Fencing shall enclose all side of open trenches.
4. Compact backfill to 90% maximum density determined in accordance with ASTM D155-7 utilizing the following methods:
   a. Mechanical tamping
   b. Puddling or ponding. Puddling or ponding shall not be allowed within 20’ of a building or foundation walls.

O. Piping Under Paving
1. Piping under paving without the use of a sleeve will not be permitted.
2. See SLEEVING under part 3.4 of this SECTION.

P. Water Supply and Point of Connection
1. Water supply shall be extended as shown from the water supply lines.

3.6 FIELD QUALITY CONTROL

A. Flushing
1. After piping and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthermost valves. Cap after flushing.
2. Lateral piping shall be flushed with head swing joints installed (without heads in place). Heads to be installed after flushing sequence. Lateral line flushing shall conform to mainline flushing procedure above.

B. Testing – Conduct tests in presence of City. Arrange for testing 48 hours in advance. Supply force pump and all other test equipment.
   1. After backfilling and installation of all control valves, fill pressure supply line with water and pressurize to 130 psi. for a period of 4 hours. Pressure testing of pressure supply line utilizing compressed air is not acceptable.
      a. Leakage, pressure loss – Test is acceptable if pressure loss does not exceed 1 psi over the 4 hour period.
      b. Leaks – Detect and repair leaks
      c. Retest system until rest pressure can be maintained for duration of test.
      d. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours with pressure loss not exceeding 5 psi.

C. Walk-Through for Final Completion
   1. Arrange for Consultant's presence 48 hours in advance of walk-through.
   2. Show evidence to Consultant that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
   3. Electrically operate each zone, in its entirety for City at time of walk-through to insure correction of all incomplete items.
   4. Items not deemed acceptable by the City shall be reworked to complete satisfaction of the City.

3.7 ADJUSTING

A. Upon completion of installation, 'fine-tune' entire system by regulating valves, adjusting patterns and break-up arms, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings, and other site features as much as possible. Heads of same type shall be operating at same pressure +/- 7%.

B. If it is determined that irrigation system adjustments will provide coverage, and improved water distribution as determined by the City, Contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to the City. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.

C. All sprinkler heads shall be set perpendicular to finished grades as shown in the drawings.

D. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional costs to the City.

3.8 IRRIGATION SYSTEM AUDIT

A. Irrigation system shall be audited by an Irrigation Association Certified Landscape Irrigation Auditor with City Staff in attendance. System must meet or exceed an average, minimum 65% DU (Distribution Uniformity) coefficient. Testing and calculations shall be in conformance with Irrigation Association audit standards and requirements. Written results of audit shall be submitted to City. Cost of audit and any additional testing shall be paid by Contractor.

3.9 CLEANING

A. Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at no additional cost to Owner, all trash, debris and excess soil generated by installation of irrigation system.

END OF SECTION 32 93 00

SECTION 33 40 00 – STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping and concrete structures for storm sewer system, roof drainage, and culverts

B. Riprap for channel lining, outlet protection and rock check dams

1.2 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

1.3 REFERENCES

A. ACPA - American Concrete Pipe Association

B. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

C. ASTM C150 - Portland Cement

D. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

E. ASTM C478 – Precast Concrete Structures

F. ASTM C497 - Testing Concrete Pipe, Manhole Sections, or Tile

G. ASTM A48 - Gray Iron Castings

H. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

I. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

J. ASTM C33 - Concrete Aggregates

K. ASTM C478 - Precast Reinforced Concrete Manhole Sections

L. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District (UDFCD)

M. Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction

1.4 DESIGN REQUIREMENTS

A. Comply with applicable requirements of ASTM C76

B. Comply with City of Boulder, Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District (UDFCD), and CDPHE Stormwater and/or Groundwater Discharge Permit and related storm design criteria. If standards conflict, the more stringent criteria shall govern.

1.5 SUBMITTALS

A. Submit under provisions of Division One Specifications

B. Shop Drawings: Provide drawings with pipe and structure details, design standards, reinforcement, dimensions, etc. Provide additional detailed information (including elevations, fittings, specialty materials or fabrications, etc.) for special or custom features, structures, junctions and/or pipes. Provide pipe-laying schedule.

C. Product Data: Provide sufficient data on features, pipe, joints, gasket material, lubricant and accessories to verify compliance with specifications.

D. Manufacturers Certificate: Certify that pipe, meets or exceeds specified requirements. Confirm all materials comply with applicable standards.

E. Test Reports: Submit all shop and field test reports in accordance with Division One Specifications Product Data:

F. Provide sufficient data to verify compliance with these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery
   1. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun

B. Storage
   1. Store pipe, fittings and gaskets in clean locations protected from environmental conditions such as: (direct sunlight, mud.. etc)
   2. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months
   3. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging
      a. Do not stack pipe higher than 5 feet

C. Handling
   1. Handle so as to insure installation in sound undamaged condition.
   2. Use equipment, tools and methods for unloading, reloading, hauling and laying that do not damage pipe or cause an impact. Damaged pipe will be cause for rejection
   3. Use hooks or straps with broad, well padded contact surfaces for lifting sections of pipe

1.7 ENVIRONMENTAL REQUIREMENTS

A. Weather limitations: Do not install piping over frozen surfaces or in standing water.

PART 2 GENERAL PRODUCTS

2.1 PIPE MATERIALS

A. Comply with City of Boulder standards and specifications for public storm sewer products.

B. General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated

C. Fittings: Furnish bends, ells, tees, wyes, couplings and other fittings of the same type and class of material having equal or superior physical and chemical properties as acceptable to the Engineer

D. Reinforced Concrete Pipe: ASTM C76,
   1. 12-inch RCP Class V, with modified tongue-and-groove compression gasket joints complying with ASTM C443.
   2. 15-inch RCP Class IV (Class V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.
   3. 18-inch thru 24-inch RCP Class III (Class IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.
   4. 24-inch thru 36-inch RCP Class II (Class III, IV or V when specified on plans), with modified tongue-and-groove compression gasket joints complying with ASTM C443.

E. PVC Sewer Pipe: ASTM D3034, Type PSM, SDR 35 with PVC, elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

F. HDPE Sewer Pipe: smooth interior, corrugated exterior piping conforming to ASTM D 2412, ASTM D 3212, AASHTO specifications M252 and M 294, joints to conform to ASTM F 477.

G. Perforated PVC Sewer Pipe: ASTM D3034, Type PSM, SDR 35 with PVC, elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

2.2 MATERIALS

A. Comply with City of Boulder standards and specifications for public storm sewer products.

B. Plugs and Caps: Use pipe plugs or caps provided by the pipe manufacturer and approved by the Engineer for pipe stubouts.

C. Cleanouts: Provide as indicated, pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word “STORM”.

D. Reinforcement
   1. Reinforcing Steel: ASTM A615 Grade 60
   2. Welded Wire Fabric: ASTM A185

E. Concrete: Refer to Division Three Specifications
   1. Minimum compressive strength: 4000 psi at 28 days
   2. Cement: ASTM C150, Portland Cement, Type II
   3. Aggregates: ASTM C33, free of deleterious substances

F. Gaskets: ASTM C923
   1. Mastic: FS SS-S-210A, "RAM-NEK" or accepted substitution
   2. Rubber: Neoprene, 40$\pm$ 5 hardness when measured by ASTM D2240, Type A durometer

G. Inlet Gratings and Manhole Rings and Covers
   1. Cast iron, heavy duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces
   2. Provide bike/pedestrian-safe grates where such traffic is anticipated
   3. Set grate on frame such that openings maximize inlet intake
   4. Covers to seat at all points on ring
   5. Covers to be cast with "STORM" in 2" tall flush letters
   6. Manhole covers to receive asphalt varnish coating hot dip applied at foundry, 6 mils thick

H. Manhole Height Adjustment: Use precast concrete grade rings

I. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade

J. Water: Clean and free of deleterious substances

K. Grout:
   1. Non-Shrink, Non-Metallic Grout: Factory premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 4000 psi in one day and 8000 psi in 7 days
   2. Epoxy Grout: Three Component Epoxy Resin System
      i) Two liquid epoxy components
      ii) One inert aggregate filtered component
      iii) Each component furnished in separate package for mixing at job site

2.3 CONCRETE CATCH BASINS AND MANHOLES

A. Comply with City of Boulder standards and specifications for public storm sewer products.

B. Precast Concrete Units:
   1. Manufacturers: Carder Concrete Products, Amcor Precast, or accepted equal
   2. Specification: ASTM C478 and C789, wall “B
   3. Minimum wall thickness: greater of 6 inch 1/12 of internal diameter
   4. Reinforced
   5. Grade rings as required
   6. Cast steps into units.

C. Precast Units or Cast-in-place as shown. Use concrete that will attain a 28-day compressive strength of not less than 4,000 psi with a cement content of not less than 6 sacks per cu. yd. Openings to be precast per plan or sawcut in field.

D. Cast-in-place Concrete Units: As shown on the drawings complying with the City of Boulder and Colorado Department of Transportation drainage and design standards.

E. Manhole Steps: Aluminum, drop-front type with polypropylene coating applied by manufacturer, Type MA Industries Inc. "PS2-PF" or equal.

2.4 PVC PLASTIC INLINE DRAINS AND DRAIN BASINS

A. Manufacturer: Nyloplast America Inc. or accepted substitution.

B. Inline drains and drain basins shall be manufactured from PVC pipe stock, utilizing a thermo molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212.

C. Surface drainage products shall meet the mechanical property requirements for fabricated fittings as described in ASTM F794, F949 and F1336.

D. Inline drain and drain basin adapters and accessories
   1. Adaptable to SDR-35 PVC piping.
   2. Watertight adaptors.

E. Cast iron or ductile iron frames and grates:
   1. Light –traffic rated
   2. Pedestrian rated
   3. Hinged and locking

4. Made specifically for use with the specified inline drains and drain basins
5. Painted black
6. ASTM A-48-83 Class 30B or A536 grade 70-50-05 grade iron
7. Size indicated on the drawings

2.5 CONCRETE FABRICATION

A. Comply with City of Boulder standards and specifications for public storm sewer products.

B. Vault/Manhole Sections
1. Precast concrete dimensions as shown on plans
2. Minimum manhole inside diameter: 48 inch
3. Precast lid and Cones: Same or greater reinforcement and wall thickness as vault or manhole section with capability for H20 loading
4. Vault Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
5. Manhole Joints: Keylock type with double mastic gaskets, each joint to set equally and tightly
6. Access opening: Minimum 24 clear or as indicated
7. Pipe connection: As indicated on Drawings
8. Pipe knockout: As indicated on Drawings
9. Precast concrete, monolithic base or cast-in-place base
10. Manhole steps: 12 inch on center, vertical alignment above largest bench or open area

C. Grating and Metal Frame: As specified on drawings

2.6 SOIL MATERIALS

A. Comply with City of Boulder standards and specifications for public storm sewer products.

B. Furnish pipe bedding and cover as specified in Section 31 00 00 – Earthwork.

C. Riprap Materials:
1. Hard, dense, durable stone, angular in shape and resistant to weathering
2. Minimum specific gravity of 2.5
3. Material may be approved by Engineer, if by visual inspection, the rock is determined to be sound and durable
4. Engineer may require Contractor to furnish laboratory test results if the material appears to be marginal or unacceptable
5. Tested material shall meet the following requirements for abrasion resistance or compressive strength:

Test	Test Method	Requirement
Abrasion Resistance by Los Angeles Machine	ASTM C 535	50% loss, max
Unconfined Compressive Strength of Drilled Core Specimen	AASHTO T 24	2500, min

6. Contractor shall provide a five ton sample of riprap indicating the compliance to required material soundness and gradation specifications if requested by the Engineer.
7. Gradation:

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	Mean Particle Size,d_{50} (Inches)
Type L	70-100	15	9

	50-70 35-50 2-10	12 9 3	
Type M	70-100 50-70 35-50 2-10	21 18 12 4	12
Type H	70-100 50-70 35-50 2-10	30 24 18 18 6	18

8. Granular Riprap Bedding:
   a. 3/4" – 1" Crushed rock – AASHTO 57/67

Sieve Size (Inch)	Percent Passing by Weight
1	100
3/4"	90-100
1/2"	25-60
3/8"	20-55
NO. 4	0-10
NO. 8	0-5
NO. 200	0-2

D. Pipe Bedding:
   1. Refer to Section 31 00 00 – Earthwork
   2. Minimum 6 inch deep, unless specified otherwise

E. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
   2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
   3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
   4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
   5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

PART 3 EXECUTION

3.1 REGULATORY REQUIREMENTS

A. Comply with City of Boulder standards and specifications for public storm sewer installation.

3.2 PIPE PREPARATION

A. Shape trench and place bedding as specified in Section 31 00 00 and as shown on the drawings.
   1. Dig bell or coupling holes
   2. Do not support pipe on blocks or mounds of earth.
   3. Provide uniform and continuous bearing and support for full length of pipe between bell holes
   4. Minor disturbance over a maximum length of 18 inches near the middle of each length of pipe will be permissible by the withdrawal of pipe slings or other lifting tackle

B. Alignment and Grade
   1. Except as indicated on the Drawings, lay all pipe straight and at a uniform grade.
   2. Use batter boards to determine and check pipe subgrades.
   3. Other methods of maintaining alignment and grade may be acceptable if approved by the Engineer.

3.3 PIPE INSTALLATION

A. Inspect pipe and accessories for defects before lowering into trench.

B. Replace any defective, damaged or unsound pipe.

C. Carefully lower pipe, fittings, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage. Do not dump or drop pipe or accessories into trench.

D. Pipe embedment shall be as specified in Section 31 00 00 for pipe.

E. Protect from lateral displacement by placing the specified pipe embedment material.

F. Do not lay pipe in water, under unsuitable weather conditions or under unsuitable trench conditions

G. Joint to form true and smooth line.

H. Remove any pipe not making a good fit.

I. Begin pipe laying at the lowest point unless reverse laying is accepted by Engineer.

J. Utilize implements, tools and facilities as recommended by the manufacturer and/or catch basins if required to remove debris.

K. Keep pipe clean during and after laying.

L. During construction, close all open ends with watertight expandable type plugs.
   1. At the end of each day's operations.
   2. Whenever pipe ends are left unattended.
   3. Deposit adequate backfill on pipe to prevent flotation.
   4. Do not use wood, burlap or other similar temporary plugs.

M. Remove and re-lay any pipe which has floated.

3.4 PRECAST STRUCTURE PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for manholes is correct

D. Excavation and Backfill: Refer to Section 31 00 00 - Earthwork for requirements

E. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections

F. Rock Subbase: Remove water, excavate, and place 1 1/2 inch rock 6 inch minimum depth, vibrate for compaction

3.5 CATCH BASINS

A. Construct catch basins to the sizes and shapes indicated, and to conform to requirements of authorities having jurisdiction.
   1. For precast units, set in place to accurate elevations on firm, solid bed, plumb and level.
   2. Pipe openings, elevations and alignment per plans
   3. Seal and grout all pipe penetrations
   4. Set cast iron frames and gratings to the elevations indicated.

3.6 PLACING MANHOLE SECTION OR CAST-IN PLACE BASE

A. Place base pad, trowel top surface level to accept manhole section with uniform bearing all around

B. Place sufficient non-shrink grout on base to ensure watertight fit between first manhole section and base or place first manhole section directly in wet concrete

C. Place manhole sections plumb and level, trim to correct elevations

D. Clean ends of sections and place double mastic gasket

E. Fill inside and outside of joint completely with non-shrink grout and trowel smooth

F. Cure non-shrink grout using approved methods

G. Set cover rings and covers level without tipping, to correct elevations or set cover rings and covers with slight tip to match cross slope of finished surface where directed by Engineer

H. Completed manholes shall be rigid and watertight

I. Coordinate with other sections of work to provide correct size, shape, and location

3.7 PREFORMED GASKETS

A. Remove and replace manhole sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.8 MANHOLE INVERT

A. Place concrete in bottom of manhole and form smooth transition. Trowel smooth and brush for non-skid finish. Slope bench 1 inch per foot for drainage to invert.

B. Invert shape to conform to radius of pipe it connects

C. Remove all rough sections or sharp edges which tend to obstruct flow or cause material to snag. Remove all grout droplets from invert

D. Construct in conformance with standard drawings

3.9 MANHOLE RINGS AND COVERS

A. Place rings in bed of non-shrink grout on top of manholes

B. Ensure no infiltration will enter manhole at this location

C. Carry non-shrink grout over flange of ring

D. Set top of ring flush with all surfaces subject to foot and vehicular traffic

E. Set top of ring 6 inches above surfaces in open, unraveled, non-pedestrian areas

F. Use precast grade rings for height adjustment

3.10 CONNECTION TO EXISTING MANHOLES

A. Maintain flow at all times

B. Prior approval of proposed method for maintaining flow must be obtained from Engineer

C. Cover area around new pipe with non-shrink grout and or waterstop gasket to ensure a watertight structure

D. Make connection during low flow periods

3.11 GROUT

A. PREPARATION
1. Non-Shrink, Non-Metallic Grout, General Use
   a. Clean concrete surface to receive grout
   b. Saturate concrete with water for 24 hrs prior to grouting and remove excess water just prior to placing grout
   c. Cold weather conditions
      i) Warm concrete, substrate and base plate to 40 deg F, or above; store grout in warm area
      ii) Follow manufacturer's recommendations for cold weather application
   d. Hot weather conditions
      i) Use cold mixing water and cool base plate if possible; store grout in cool area
      ii) Follow manufacturer's recommendations for hot weather application
   e. Apply to clean, sound surface
   f. Apply latex bonding agent to hardened concrete, mix-in-grout, or as directed by Engineer
2. Epoxy Grout: Apply only to clean, dry, sound surface
   a. Patching cavities in concrete including, but not limited to, tie holes, and structural and equipment support

B. APPLICATION
1. Non-Shrink, Non-Metallic Grout
   a. Mix in a mechanical mixer
   b. Use no more water than necessary to produce flowable grout
   c. Provide air vents where necessary to eliminate air pockets
   d. Place in accordance with manufacturer's instructions
   e. Where exposed to view finish grout edges smooth

f. Protect against rapid moisture loss by immediately covering with wet rags and polyethylene sheets or curing compound
g. Wet cure grout for 7 days, minimum
h. Maintain the temperature at a minimum of 40 deg F until grout reaches 3000 psi
i. After placement of grout, eliminate excessive external vibration

2. Epoxy Grout
   a. Mix and place in accordance with manufacturer's instructions
   b. Completely fill all cavities and spaces around dowels and anchors without voids
   c. Obtain manufacturer's technical assistance as required to insure proper placement

3.12 RIPRAP

A. Do not place riprap over frozen or spongy subgrade surfaces.

B. Place riprap at pipe outlets and in channels as indicated on plans. Top of riprap to match invert of outlet pie and channels.

C. Excavate and prepare subgrade.

D. Place geotextile fabric per plans under all bedding. Place bedding and place riprap on bedding per plans.

E. Material may be machine placed and then arranged as necessary by use of a Gradall with multi-prong grapple device or by hand to minimize voids. Dumping alone is not sufficient to achieve properly placed riprap.

3.13 FIELD QUALITY CONTROL

A. Field inspection and testing including a lamp test will be performed for every section of pipe after backfill has occurred
   1. Contractor shall furnish suitable assistance to the Engineer
   2. A minimum of 75% of a true circle will be required to indicate a properly constructed line
   3. Contractor will repair any section not passing the lamp test.

B. Request inspection immediately after placing cover over pipe.

C. Backfilling and testing as required per Section 31 00 00 - Earthwork.

END OF SECTION 33 40 00

BID PROPOSAL FORM

BID NO: **16-2016**
BID OPENING: **2:00 PM, Wednesday, May 25, 2016**
PROJECT: **Boulder Civic Area Park Development Plan**

OWNER: **City of Boulder (hereinafter "the owner")**

PROPOSAL SUBMITTED BY: _____
(hereinafter "the bidder") **Contractor (PRINT)**

_____
Address

_____ _____
Telephone # **Date**

_____
Email:

PART 1: TERMS AND CONDITIONS

The undersigned Bidder, in compliance with the Advertisement to Bid, having examined the General Contract Conditions, Special Provisions, Special Conditions, Specifications, and Drawings, and any and all Addenda thereto; having investigated the location of, and conditions affecting the proposed work; herby proposes to furnish all labor, materials and supplies, and to construct and perform all work for the Project in accordance with Contract Documents, within the time set forth and the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents of which this Bid Form is a part.

The undersigned Bidder does hereby declare and stipulate that this bid is made in good faith without collusion or connection to any person or persons bidding for the same work, and that it is made in pursuance of, and subject to, all terms and conditions of the Instructions to Bidders, the Specifications and Drawings, and all other Bidding Documents, all of which have been examined by the undersigned.

The Bidder also agrees that if awarded the Contract, to provide insurance certificates within ten (10) working days of the date of Notification of Award. Submittal of this proposal will be taken by the Owners as a binding covenant that the bidder will be prepared to start the Project within 10 working days after the Notification to Proceed.

RECEIPT OF ADDENDA: the undersigned Bidder acknowledges receipt of the following Addenda to the Advertisement to Bid, Specifications, Drawings and other Contract Documents.

Addendum No(s)._____ By: _____

Boulder Civic Area Park Development Plan
Base Bid
Bid Quantity: Lump Sum

Base Bid: Contractor Proposed Notice to Proceed Date

0.0 The **Base Bid** is the price to provide, without limitation, the materials, labor, equipment, supervision and services for complete and operable systems and improvements described in the proposed Contract Documents, with a Notice to Proceed date of the Contractor's choice, and a final completion date of not later than **December 31, 2018**.

Each Contractor must clearly specify its proposed Base Bid Notice To Proceed/Commencement Date; calendar days to Substantial Completion; and the proposed Substantial Completion date on the Bid Form. Failure to do so may be grounds for rejection of the Bid by the City, at its sole discretion.

0.1 Contractor Proposed Notice to Proceed/Commencement Date **(Base Bid)**:

(date in words) _____

0.2 Calendar days to Substantial Completion **(Base Bid)**:

(calendar days in words) _____

0.3 Proposed Substantial Completion Date **(Base Bid)**:

(date in words) _____

ITEM	DESCRIPTION	UNIT	QTY.	UNIIT PRICE	PRICE
Base Bid: Lump Sum Price					
0.0	Total Base Bid Price: (price in words) _____	LS	1		$
Bid Alternatives					
1.0	Comply with the requirements of S.C.6.1 Attachment One – Materials Management Plan (price in words) _____	LS	1		$
2.0	Remove, store and reinstall the public art as described in S.C.6.2 Attachment Two – Art Removal and Storage. (price in words) _____	Ls	1		$
3.0	Commencement of work with Notice to Proceed Date on August 29, 2016 as described in SC.7 Base Bid and Alternates Alternate 3.0 (price in words) _____	LS	1		$
3.1	Calendar days to Substantial Completion **(Alternate 3.0)**: (calendar days in words) _____				
3.2	Proposed Substantial Completion Date **(Alternate 3.0)**: (date in words) _____				
4.A	Library Plaza as described in SC.7 Base Bid and Alternates Alternate 4.A (price in words) _____	LS	1		$
4.B	Centennial Walk as described in SC.7 Base Bid and Alternates Alternate 4.B (price in words) _____	LS	1		$
4.C	North and South Peace Garden as described in SC.7 Base Bid and Alternates Alternate 4.C (price in words) _____	LS	1		$
4.D	Concrete Mow Curb as described in SC.7 Base Bid and Alternates Alternate 4.D (price in words) _____	LS	1		$
4.E	Cordwood Seat Walls and Posts as described in SC.7 Base Bid and Alternates Alternate 4.E (price in words) _____	LS	1		$

The City of Boulder reserves the right to make the award on the basis of the bid deemed most favorable, to waive any formalities or technicalities and to reject any or all bids. It is further agreed that this bid may not be withdrawn for a period of sixty (60) calendar days after closing time.

Attest:

_____ _____

Authorized Signature

_____

Name & Title (Print)

APPENDIX 2: CONSTRUCTION FORMS

Form 1	Bid Bond
Form 2	Contractor/Subcontractor Qualification Form
Form 3	Contractor/Subcontractor Verification Form
Form 4	Notice of Award
Form 5	Contract for Construction in the City of Boulder, Colorado
Form 6	Performance Bond
Form 7	Labor and Material Bond
Form 8	Work Directive
Form 9	Change Order
Form 10	Field Order
Form 11	Application for Payment
Form 12	Certificate of Substantial Completion
Form 13	Certificate of Occupancy
Form 14	Final Inspection Report
Form 15	Payment of Boulder Sales and Use Tax
Form 16	Claim Release
Form 17	Affidavit that All Claims are Satisfied
Form 18	Surety's Consent to Final Payment
Form 19	Guarantee Period Inspection Report
Form 20	Proposed Subcontractors
Form 21	Schedule of Manufacturers and Suppliers

[Form 1]

BID BOND

Witness:

_____, as principal, hereinafter called the "bidding contractor," and _____, as "surety," a corporation properly organized under the laws of Colorado or authorized to do business in Colorado, hereby obligate themselves to the City of Boulder, as obligee, hereinafter called the "city," in the penal sum of _____ dollars ($_____), which penal sum shall secure the obligation of the bidding contractor to enter into contract with the city for the work associated with

_____

_____

_____,

Project Number _____, if the bidding contractor is so selected by the city.

If the city accepts the bid of the bidding contractor, and if the bidding contractor properly executes a contract with the city to perform the work covered by the award, then this obligation shall be null and void.

In the alternative, if the bidding contractor refuses to enter into contract with the city for work described in the bid, but rather pays to the city the difference between the bidding contractor's stated bid amount and the actual amount bid by an alternate bidding contractor, who is accepted by the city, then this obligation shall be null and void.

EXECUTED on this _____ day of _____, 20___.

_____
(Contractor)

By: _____
(President)

_____
(Surety Company)

By: _____
(Attorney-in-Fact)

[Form 2]

CONTRACTOR/SUBCONTRACTOR QUALIFICATION FORM

I. General Information

Your Company:

Name: _____

Address: _____

How long have you been in business? _____

How long have you been in business under the present business name? _____

What former name(s), if any, has your company operated under in the past five (5) years?

_____

What is the largest contract you have been awarded in the past twelve (12) months?

_____

II. Information: Previous Construction Contract

Provide the following information for three 3) contracts you have performed, or are currently performing, within the past five (5) years. At least two (2) contracts must be completed. If you have performed any contract with the City of Boulder, or County of Boulder, or State of Colorado, include information about the least one (1) such contract.

Contract 1

Owner _____
Name

_____ _____
Address Phone

Date Begun _____ Date Completed _____ Dollar Amount _____

Description of Work _____

Architect _____
Name

_____ _____
Address Phone

Surety for Performance Bond: _____

_____ _____
Address Phone

Surety for Labor and Material Bond: _____

_____ _____
Address Phone

Insurance Company: _____
Name

_____ _____
Address Phone

Major Subcontractor: _____
Name

_____ _____
Address Phone

Major Supplier: _____
Name

_____ _____
Address Phone

Are there any lawsuits, claims, or disputes resulting from this project? If so, please describe:

_____

* * * * *

<u>Contract 2</u>

Owner _____
Name

_____ _____
Address Phone

Date Begun _____ Date Completed _____ Dollar Amount _____

Description of Work _____

Architect _____
Name

_____ _____
Address Phone

Surety for Performance Bond: _____

_____ _____
Address Phone

Surety for Labor and Material Bond: _____

_____ _____
Address Phone

Insurance Company: _____
Name

_____ _____
Address Phone

Major Subcontractor: _____
Name

_____ _____
Address Phone

Major Supplier: _____
Name

_____ _____
Address Phone

Are there any lawsuits, claims, or disputes resulting from this project? If so, please describe:

_____

* * * * *

Contract 3

Owner _____
Name

_____ _____
Address Phone

Date Begun _____ Date Completed _____ Dollar Amount _____

Description of Work _____

Architect _____
Name

_____ _____
Address Phone

Surety for Performance Bond: _____

_____ _____
Address Phone

Surety for Labor and Material Bond: _____

_____ _____
Address Phone

Insurance Company: _____
Name

_____ _____
Address Phone

Major Subcontractor: _____
Name

_____ _____
Address Phone

Major Supplier: _____
Name

_____ _____
Address Phone

Are there any lawsuits, claims, or disputes resulting from this project? If so, please describe:

_____

III. Describe the work you normally perform with your own forces:

_____

_____

_____

_____

IV. Have you, or any officer or partner of your organization, when working for another organization, failed to complete any work awarded to you or such officer or partner? If so, attach a separate sheet of explanation.

V. Are there any claims or law suits against your organization, against predecessor organizations of your organization, or against any officer or partner who currently works for your organization which have been brought during the previous five years? If so, attach a separate sheet of explanation.

VI. Resumes

Provide resumes for at least two (2) persons with your company. One resume should be for an officer of the company: president, vice-president, etc. The second resume should be for an operations manager of the company who has had experience directing a job as a contractor or superintendent. An operations manager may also be an officer of the company.

Officer: _____
Name

Operations Manager: _____
Name

VII. Trade References:

1.

2.

3.

4.

5.

VIII. Bank References:

1.

2.

3.

4.

5.

IX. Name of Bonding Company and name and address of agent:

X. Attach a financial statement, audited if available, (consolidated if the contractor is part of an affiliated group), including contractor's latest balance sheet and income statement showing the following items:

A. Current Assets (*e.g.*, cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory, and prepaid expenses):

B. Net Fixed Assets:

C. Other Assets:

D. Current Liabilities (*e.g.*, accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries, and accrued payroll taxes):

E. Other Liabilities (*e.g.*, capital, capital stock, authorized and outstanding shares par values, earned surplus, and retained earnings):

Name of firm preparing financial statement and date thereof:

Is this financial statement for the identical organization named in Part I on page one?_____

If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (*e.g.*, parent-subsidiary).

Will this organization act as guarantor of the contract for construction?

[Form 3]

CONTRACTOR/SUBCONTRACTOR VERIFICATION FORM
(For Internal Use Only)

Name of Contractor

_____

Name of Owner of Project

_____

I. Project History

Contact the following parties to determine their evaluation of the contractor or subcontractor (hereinafter referred as "contractor").

1. Owner _____ Date Contacted _____

Are you satisfied with the work? yes_____ no_____

Would you contract with this contractor again? yes_____ no_____

_____

_____

2. Architect _____ Date Contacted _____

Are you satisfied with the contractor's performance of the work? yes_____ no_____

Are there any lawsuits, claims, or disputes which have resulted from this contract, or which are now pending, or from any other contract with the contractor on which you were the architect?

_____

_____

Would you work with this contractor again in the future? yes_____ no_____

3. Surety: Performance Bond

Are there any outstanding lawsuits, claims, or disputes which resulted from this contract, or which are now pending, or from any other contract on which you were a surety for this contractor?

_____

_____

Would you bond this contractor again on a future project? yes_____ no_____

Comments: _____

_____

_____

4. Surety: Labor and Material Bond

_____ _____

Name Date Contacted

Are there any outstanding lawsuits, claims, or disputes which resulted from this contract, or which are now pending, or from any other contract on which you were a surety for this contractor?

_____

_____

Would you bond this contractor again on a future project? yes_____ no_____

Comments: _____

_____

_____

5. Insurance Company

_____ _____

Name Date Contacted

Are there any outstanding lawsuits, claims, or disputes which resulted from this contract, or which are now pending, or from any other contract on which you provided insurance for this contractor?

_____

_____

Would you insure this contractor again on a future project? yes_____ no_____

At higher insurance rates? yes_____ no_____

Explain: _____

_____

_____

6. Subcontractor

_____ _____

Name Date Contacted

Have you been completely paid? yes_____ no_____

Are there any outstanding lawsuits, claims, or disputes which resulted from this project, or which are now pending, or from any other work performed for this contractor?

_____

_____

Would you work for this contractor again on a future project? yes_____ no_____

7. Supplier

_____ _____

Name Date Contacted

Describe the materials you supplied to the contractor:

_____

_____

Were you paid promptly? yes_____ no_____

Are there any outstanding lawsuits, claims, or disputes which resulted from this or any other project on which you have provided materials for this contractor?

_____

_____

II. Evaluation

Contractor is Approved: yes _____ yes, but with reservation _____ no _____

Need Further Information:_____

_____

_____

_____

_____

[Form 4]

NOTICE OF AWARD

DATE: _____

FROM: _____

TO: _____

_____

_____

Project Number: _____

This notice certifies that the contractor listed above has been selected to perform the work. The beginning date of the contract shall be the date the purchase order is issued, which shall be the official notice to proceed.

Signed:

_____ _____

Project Manager Date

_____ _____

Contractor Date

[Form 5]

CONTRACT AGREEMENT FOR CONSTRUCTION IN THE CITY OF BOULDER, COLORADO

This Agreement, made and entered into this _____ day of _____, 20___, between the City of Boulder, Colorado, hereinafter called the "city," and _____, hereinafter called the "contractor." The city and the contractor, for the consideration hereinafter named, agree as follows:

Part One: The Contract Documents

The contract documents consist of this contract agreement, the general conditions, the special conditions, the bid proposal, the drawings and specifications, and change orders, addenda and other documents which may be required or specified.

Part Two: The Work

The contractor shall perform all the work required by the contract documents as specified by Bid No. _____ and Addenda No. _____, attached hereto.

Part Three: Liquidated Damages for Failure to Complete Work on Time

The contractor hereby agrees to be liable for liquidated damages in the sum of _____ DOLLARS ($ _____) per day for each and every day that substantial completion of the work is delayed past the established time limit or limits, including due allowance for any extension of time agreed to by the city. The liquidated damages herein specified shall only apply to the contractor's delay in performance, and shall not include litigation or attorneys' fees incurred by the city, or other incidental or consequential damages suffered by the city due to the contractor's performance. If the city charges liquidated damages to the contractor, this shall not preclude the city from commencing an action against the contractor for other actual harm resulting from the contractor's performance which is not due to the contractor's delay in performance.

Part Four: Contract Price

The city shall pay the contractor in current funds for the performance of the work, subject to additions and deductions by change order as provided in the contract documents, the contract price of _____ DOLLARS ($_____), as set forth in the bid proposal of the contractor dated _____, as amended by _____, dated _____.

Part Five: Appropriations

[mark the clause or clauses which apply]

[ ] The city has appropriated funds to pay the contractor for its work under this contract that are equal to or greater than the contract price stated above. (To be used for construction projects that are scheduled to be completed within one fiscal year.)

[ ] The amount of funds appropriated to pay the contractor for its work under this contract is $_____. Before the contractor commences any work for which the city has agreed to pay a sum in excess of the appropriated amount stated above, the city shall provide the contractor with a written assurance that funds equal to or in excess of the additional sum have been lawfully appropriated. (To be used for phased construction projects occurring over more than one fiscal year where funds sufficient to pay the full contract price are expected to be appropriated by the city for fiscal years subsequent to the one in which the work commenced.)

[ ] The funds to be used to pay the contractor for its work under this contract have been raised by issuing bonds. Appropriations by the city to pay the debt on those bonds may occur subsequent to the date of this contract. The city shall provide the contractor with a written assurance that each such appropriation has been lawfully made shortly after it occurs. (To be used for construction projects funded by bonded indebtedness.)

Part Six: Affidavit of Compliance with Affirmative Action Requirement

The contractor has read a copy of Section 12-1-3, B.R.C. 1981, which relates to nondiscrimination, and agrees to comply with its terms so long as the contractor is under contract with the city.

Part Seven: Warranty of NonCollusion

By executing this contract, the undersigned warrants that:

1) The contractor has not allowed any competing bidder or employee or agent thereof to see the contractor's bid or to know of its contents.
2) The contractor has not discussed the contents of its bid with any competing bidder, or any other person who a reasonably prudent person would believe would be likely to transmit information to a competing bidder.
3) The contractor has drafted its bid independently of any competing bidder.

Failure to abide by the above provisions relating to collusion shall render the contractor liable to the city for damages including, without limitation, payment of the bid bond as liquidated damages. In addition, the city may void any contract entered into with a bidder guilty of collusion. If the bidder has engaged in any practice which might be suspected to be collusive, please explain below:

_____

_____

_____

Part Eight: Addresses of Contracting Parties

Correspondence may be sent to the following addresses:

City/Project Manager: _____,

P.O. Box 791, Boulder, Colorado, 80306. Telephone: _____

Contractor: _____,

_____

[address], Telephone: _____

This agreement shall be binding upon the heirs, executors, administrators, successors, and assigns of each of the parties hereto.

In witness whereof, the contractor hereunder places its signature in agreement, and the city has caused this agreement to be signed by the city manager and countersigned by the director of finance and record, purchasing agent, and city attorney.

CONTRACTOR:

By: _____ Date: _____

President

ATTEST:

By: _____

Secretary

STATE OF COLORADO)
) SS
COUNTY OF BOULDER)

Before me, _____, a notary public in and for the County of Boulder, State of Colorado, personally appeared _____, known to me personally to be the person(s) whose signatures(s) appear hereon and who subscribed their signature(s) in my presence this _____ day of _____, 20___.

Witness my hand and official seal.

_____

(SEAL) Notary Public

My commission expires:_____

THE CITY OF BOULDER, COLORADO

By: _____ Date: _____
City Manager

ATTEST:

_____ Date: _____
City Clerk

By: _____ Date: _____
Purchasing Agent

Approved as to form:

By: _____ Date:_____
City Attorney

[Form 6]

PERFORMANCE BOND

_____, as principal, hereinafter called the contractor, and _____, as surety, with general offices in _____, a corporation organized under the laws of the State of _____, and authorized to transact business in the State of Colorado, are hereby bound unto the City of Boulder, Colorado, as obligee, hereinafter called the city, in the penal sum of_____ DOLLARS ($_____) in United States currency, for the payment of which sum the contractor and surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

The condition of the obligation is that the principal and the City of Boulder, Colorado have entered into a certain Contract, dated _____, for the construction of a project described as

_____

_____

_____

located in Boulder County in the State of Colorado. Said work of construction to be done according to the requirements of said contract;

NOW THEREFORE**,** if the said principal shall at all times duly and faithfully discharge its, his or their duties under said contract, and shall duly and faithfully perform all the obligations thereof, and shall and will indemnify and save harmless the City of Boulder, Colorado, and all persons as provided by the Statutes of the State of Colorado, from any and all damages or loss which the said City of Boulder, Colorado or any persons as provided by the Statutes of the State of Colorado may or shall suffer by reason of the default of the principal or anyone acting for him as subcontractor or otherwise in the performance of this contract, or by reason of any failure on the part of said principal, his agents, servants or employees, his subcontractor or subcontractors, or any of them, in the performance of said contract or any portion thereof, these presents shall become void, otherwise to be and remain in full force and effect.

The City of Boulder, Colorado shall be under no obligation, except as expressly provided by statute, to withhold any sums due the said principal under the terms of this contract, or to protect in any other way the surety or sureties, claimants or others.

No representation or statement of the principal made to the surety or sureties in application for this bond, or otherwise, shall be read into or be a part of this bond or binding in any way on the obligee herein.

No assignment by principal to surety of the proceeds of such contract shall be binding, except as to any net surplus after paying all claims chargeable by law or by said contract, against the proceeds thereof.

No extension of time of performance of said contract or delay in the completion of the work thereunder shall invalidate this bond or release the liability of the surety thereunder.

EXECUTED on this _____ day of _____, 20___.

_____
(Contractor)

Attest:

_____

By: _____
(President)

_____
(Surety Company)

By: _____
(Attorney-in-Fact)

[Form 7]

LABOR AND MATERIAL BOND

_____, as principal, hereinafter called contractor, and _____, as surety, with general offices in _____, a corporation organized under the laws of the State of_____, and authorized to transact business in the State of Colorado, are hereby bound unto the City of_____ _____, Colorado, as obligee, hereinafter called city, in the penal sum of _____ DOLLARS ($_____) in United States currency, for the payment of which sum the contractor and surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

The condition of the obligation is that the principal and the City of Boulder, Colorado have entered into a certain Contract, dated _____, for the construction of a project described as _____

_____

_____

located in Boulder County in the State of Colorado. Said work of construction to be done according to the requirements of said.

NOW, THEREFORE, if the said principal, his sub-contractor or sub-contractors, and each and all of them, shall duly pay for all labor, materials, and other supplies used or consumed in the performance of the work contracted to be done or any part thereof, and if the said principal shall also fully indemnify and save harmless the City of Boulder, and all persons as provided by the Statutes of the State of Colorado, from any and all damages or loss which the said City of Boulder or any persons as provided by the Statutes of the State of Colorado, may or shall suffer by reason of the default of the principal or anyone acting for him as sub-contractor in connection with such payments, these presents shall become void, otherwise to be and remain in full force and effect.

The City of Boulder shall be under no obligation, except as expressly provided by statute, to withhold any sums due the said principal under the terms of this contract, or to protect in any other way the surety or sureties, claimants or others.

No representation or statement of the principal made to the surety or sureties in application for this bond, or otherwise, shall be read into or be a part of this bond or binding in any way on the obligee herein.

No assignment by principal to surety of the proceeds of such contract shall be binding, except as to any net surplus after paying all claims chargeable by law or by said contract, against the proceeds thereof.

No extension of time of performance of said contract or delay in the completion of the work thereunder shall invalidate this bond or release the liability of the surety thereunder.

EXECUTED on this _____ day of _____, 20___.

Attest: _____
(Contractor)

_____

By: _____
(President)

_____
(Surety Company)

By: _____
(Attorney-in-Fact)

[Form 8]

WORK DIRECTIVE

Work Directive No. _____

Date _____ Project Name _____

Project Number _____ P.O. Number _____

CITY: CITY OF BOULDER, COLORADO

CONTRACTOR: _____

The CONTRACTOR is directed to proceed promptly with the following change(s):

Description: _____

Attachments: _____

If a claim is made that the above change(s) have affected the Contract Price or Contract Time, any claim for a Change Order based thereon will involve one of the following methods of determining the effect of the change(s).

Method of determining change in Contract Price:

Time and Materials

Unit Prices

Cost plus fixed fee

Other _____

Method of determining change in Contract Time:

CONTRACTOR's records

ENGINEER's records

Other_____

Estimated (increase) (decrease) in Contract Price: $_____. If the change involves an increase, the estimated amount is not to be exceeded without further authorization .

Estimated (increase) (decrease) Contract Time: _____ days. If the change involves an increase, the estimated time is not to be not to be exceeded without further authorization.

APPROVED: _____
CONTRACTOR

_____
PROJECT MANAGER

[Form 9]

CHANGE ORDER #

Project Number _____ P.O. Number _____

Date: _____

FROM: CITY OF BOULDER, COLORADO

TO: _____
_____
_____

Quantity	Item	Unit Cost	Total
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above items of construction shall be (added) (subtracted) at the unit costs as agreed.

(Increase) (Decrease) $ _____

Original contract amount _____
Previous contract amount _____
Amount this change order _____
Revised contract amount _____

Original substantial completion date _____
Previous substantial completion date _____
Contract period increase/decrease
by this change over _____
Revised substantial completion _____

Original final completion date _____
Previous final completion date _____
Contract period increase/decrease
by this change over _____
Revised final completion date_____

If this modification causes an increase in the contract price, it constitutes compensation in full to the contractor and its subcontractors and suppliers for all costs and mark-ups directly and indirectly attributable to the charges ordered herein, for all delays, impacts and disruptions related thereof, and for the performance of the changes within the stated time.

If this change order causes the aggregate amount due the contractor under the contract to exceed the original contract price, the city hereby assures the contractor that funds sufficient to cover the cost of the change have been lawfully appropriated.

Change Order Prepared By _____ Date: _____

Change Order Approved By _____ Date: _____
Contractor

Order Approved By _____ Date: _____
Project Manager

Change Order Approved By _____ Date: _____
Department Head

[Form 10]

FIELD ORDER

Project No. _____ Date _____

To: _____, Contractor

From: _____, Project Manager

_____, Authorized City Representative

The work shall be prosecuted as follows:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Signed:

_____ _____
Project Manager Date

[Form 11]

APPLICATION FOR PAYMENT

Number _____ Date _____ P.O. Number: _____

OWNER: CITY OF BOULDER
PROJECT: _____
CONTRACTOR: _____

FOR WORK ACCOMPLISHED THROUGH THE DATE OF: _____

Work Completed

Item	Amount
Original Contract Amount	$_____
Net Change by Work Directives or Change Orders Thru Work Directive	$_____
Revised Contract Amount	$_____
Amount Earned to Date Thru Pay Estimate	$_____
Retainage (%)	$_____
Subtotal	$_____
Less Previous Payments	$_____
Amount due this payment	$_____

CONTRACTOR'S CERTIFICATION

The undersigned CONTRACTOR certifies that all previous progress payments received from the OWNER in connection with this contract have been applied to discharge obligations incurred as a result of this work and that title to materials and equipment incorporated in the work or otherwise listed in or covered by this APPLICATION FOR PAYMENT will pass to the OWNER free of all liens, claims, security interests, and encumbrances (except as covered by a BOND acceptable to the OWNER) at the time of payment.

REQUESTED: _____ _____
CONTRACTOR DATE

RECOMMENDED _____ _____
OWNER'S REPRESENTATIVE DATE

APPROVED: _____ _____
OWNER DATE

[Form 12]

CERTIFICATE OF SUBSTANTIAL COMPLETION

This certifies that the building or structure known as _____, project no. _____:

1. has been inspected by the project manager or another duly authorized official of the City of Boulder, and

2. the work or portion thereof is substantially complete as defined in Appendix I (45) and section 713 of the general conditions.

Description of work or portion thereof which is substantially complete:

_____

_____

_____

Address or Location: _____

Contractor: _____

Address of Contractor: _____

The following items still need to be completed:

Item	Expected Completion Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

The Contractor's guarantee (*see* section 716) shall begin on _____.

Responsibility for payment of the following items shall be placed upon:

Security: _____

Maintenance: _____

Heat: _____

Utilities: _____

_____

_____

Damage to the Work: _____

_____

Insurance: _____

Comments: _____

_____

_____

_____

Date of Substantial Completion: _____.

Signed:

_____	_____
Project Manager	Date
_____	_____
Contractor	Date

[Form 13]

CERTIFICATE OF OCCUPANCY

This certifies that the building or structure known as _____, project no. _____:

1. Has been inspected by the project manager or another duly authorized official of the City of Boulder; and

2. That it complies with the provisions of the City Building Code for the Fire Zone and the Occupancy Group on which it is located.

Description of Building or Structure: _____

_____

_____

Address or Location: _____

Contractor: _____

Address:

_____

Building Permit No.: _____

Fire Zone: _____

Occupancy Group: _____

Construction Type: _____

Witness my hand and seal this _____ day of _____, 20___.

_____
Project Manager

[Form 14]

FINAL INSPECTION REPORT

Project No. _____ Date: _____

To: _____, Contractor

From: _____, Project Manager

The City of Boulder has performed its final inspection of the work, and accepts the work subject to the contractor's performance of the following repairs or replacements:

_____
_____
_____
_____
_____
_____
_____
_____
_____

The city does/does not [circle] hereby finally accept the work.

The contractor agrees that the performance bond shall remain in effect during the guarantee period through _____, 20_____. The contractor further agrees to maintain in effect all insurance required under article 3, except for builder's risk, and to procure additional bonds, as required by the city, to cover any extension in the guarantee period necessitated by defects in the work which are discovered during the guarantee period.

The project manager does/does not [circle] hereby certify that the contractor is eligible to receive final payment for the work.

Signed:

_____ _____
Project Manager Date

_____ _____
Contractor Date

[Form 15]

PAYMENT OF BOULDER SALES AND USE TAX

I. Pursuant to section 907 of the general conditions of the City of Boulder construction contract, the contractor has elected to pay Boulder sales and use taxes according to the following method:

Check One

_____ Estimated Percentage Basis (contracts over $50,000)

_____ Estimated Percentage Basis (contracts under $50,000)

_____ Actual Basis on Monthly Return Sales. Tax License Number _____

II. Sales and Use Tax Due

Original Contract Price $_____

(+) or (-) Change Orders (+) _____ (-) _____

Equals Total Contract Amount (=) _____

Boulder Sales and Use
Tax Due on Contract (*see* section 907
General Conditions.) _____

Less Boulder Sales and Use
Tax Paid by Contractor on permit
or to vendors. (-) _____

Equals Net Sales and Use Taxes
due by Contractor (=) _____

Sales and Use Taxes Paid
by Contractor on this date _____

III. The Boulder Sales and Use Tax Division hereby certifies that, _____ (the contractor) for _____ (project number) has paid in full all Boulder Sales and Uses Taxes due under this contract.

Signed: _____ _____
Contractor Date

_____ _____
Sales and Use Tax Division Date

[Form 16]

CLAIM RELEASE

For valuable consideration, the sufficiency of which is hereby acknowledged, the undersigned hereby releases the City of Boulder and waives all right to file a claim for labor, services, machinery, tools, equipment, or materials furnished prior to _____, 20___, to _____, the contractor, for the work performed on the City of Boulder project no. _____, located at _____, in the City of Boulder, Boulder County, Colorado.

In the event an employee or agent or other person hired by the undersigned to perform the work under the contract brings a claim against the city for payment of labor or materials, or both, the undersigned agrees to indemnify the city and to satisfy fully any such claim brought against the city unless such claim is due to an act of the city or an A/E hired by the city to design or oversee the work, or any agent or employee thereof.

This release is valid only if check no. _____, drawn by _____ on the _____ bank, for $_____, dated _____, 20__, is paid.

_____
Supplier or Subcontractor

By: _____
President

Date: _____

_____
Contractor

By: _____
President

Date: _____

[Form 17]

AFFIDAVIT THAT ALL CLAIMS ARE SATISFIED

We, _____, as contractor, and _____, as surety, do hereby state that all subcontractors, vendors, persons, or firms who have furnished labor, materials, apparatus, fixtures, rental machinery, supplies, tools, or equipment for the City of Boulder project no. _____, located at _____, have been fully paid or satisfactorily secured, and that all city taxes have been paid. If any claims previously known or unknown to the contractor or surety are brought against the contractor, surety, or the City of Boulder for work performed on project no. _____, the surety hereby agrees to pay such claims, or to defend any action brought to satisfy such claims, and to indemnify fully the City of Boulder against liability for any such claims, unless such claims are due to an act or omission of the city or A/E hired by the city to design or oversee the work, or any agent or employee thereof.

_____	_____
Contractor	Surety
_____	By: _____
Signature	Attorney-in-Fact
_____	_____
Date	Date

STATE OF COLORADO)
) SS
COUNTY OF BOULDER)

Before me, _____, a notary public in and for the County of Boulder, State of Colorado, personally appeared _____, known to me personally to be the person(s) whose signature(s) appear hereon and who subscribed their signatures(s) in my presence this _____ day of _____, 20___.

Witness my hand and official seal.

My commission expires:

(SEAL)

_____
Notary Public
Address:

[Form 18]

SURETY'S CONSENT TO FINAL PAYMENT

The undersigned surety agrees to release the City of Boulder for liability for claims filed against the contractor pursuant to Section 38-26-107 C.R.S. by any supplier within ninety (90) days of the final settlement as set forth in section 912 of the general conditions.

The undersigned surety further agrees to release the city for liability for claims filed against the contractor pursuant to Sections 38-26-105 and 106 C.R.S. by any person who supplied equipment or materials or performed labor for the work within six (6) months following the date of substantial completion.

The undersigned surety further agrees to release the city for liability for claims filed against the city within six months of the date of substantial completion by third persons because of personal or property damage suffered by such claimants pursuant to section 913.

In consideration therefor, the city agrees to make final payment to the contractor of all amounts which have been retained by the city, except such amounts which are the subject of a dispute between the city and the contractor.

Signed:

_____	_____
City Manager	Date
_____	_____
City Attorney	Date
_____	_____
Surety	Date

By: _____
Attorney-in-Fact

[Form 19]

GUARANTEE PERIOD INSPECTION REPORT

The project manager performed the guarantee period inspection on _____, 20___, for Project Number _____, which guarantee was originally due to expire on _____, 20___.

The project manager hereby determines that the project has/has not [circle] satisfactorily met the conditions required to pass the guarantee period inspection.

The project manager has identified the following items of work which are defective and must be repaired or replaced:

_____

_____

_____

_____

_____

_____

_____

_____

_____

The guarantee period shall be extended [circle] for only the items listed above until the following date: _____, 20___.

Signed:

_____	_____
Project Manager	Date
_____	_____
Contractor	Date

[Form 20]

PROPOSED SUBCONTRACTORS

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

[Form 21]

SCHEDULE OF MANUFACTURERS AND SUPPLIERS

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____

Name _____Phone No. _____
Address _____
City _____State _____Zip Code _____