ARCHITECTS AND ENGINEERS

DESIGN AND CONSTRUCTION

STANDARDS AND PROCEDURES

DRAWINGS • SPECIFICAIONS • CONTRACT DOCUMENTS

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SALT LAKE COUNTY

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Design & Construction Standards and Procedures

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SALT LAKE COUNTY

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INTRODUCTION

Salt Lake County, a political body of the state of Utah, has more than one hundred eighty different facilities throughout the County consisting of office buildings, health clinics, fire stations, jails, recreational complexes, libraries, senior centers, waste management centers and parks. Contrasting needs and uses make it impossible to establish a single, all-inclusive, set of facility programming, design and construction procedures and standards that will apply to every project. However, specific minimum procedures and standards have been identified as relating to all Salt Lake County projects. This compilation of instructions to architects and engineers has been developed for Salt Lake County Facilities Management Division. In addition, much of it will be helpful to administrators and planners of other government entities regularly involved in the design and construction of facilities.

For all major design and construction projects, a specific building program will be prepared by a consulting architect or engineer stating the specific needs to be met and the scope of the project. The building program is intended to be used in conjunction with this compilation for all design and construction projects. Both documents are equally binding in the preparation of plans and specifications. The same subject may be treated in the building program and in these instructions. If a conflict does occur, the conflict must be brought to the attention of the authorized County project representative.

The architect/engineer assigned the task of programming or design shall be responsible for careful review of all material contained herein. These procedures and standards are the product of many years of experience by the Facilities Management Division and other personnel of Salt Lake County. Where these procedures are standards apply, strict compliance is expected.

Salt Lake County has a commitment to sustainable building practices and as such all new construction and major retrofit projects for all County facilities and buildings shall be evaluated for applicability and designated to meet, at a minimum LEED® Gold level certification with emphasis on energy efficiency. The certification process requires each project to incorporate sustainable practices to earn LEED® credit points. For more information on attaining LEED® credit points please review United States Green Building Council (USGBC) documentation. The projects designated as exempt from LEED® Certification are strongly encouraged to incorporate the applicable LEED® credits with an emphasis on strategies that minimize carbon footprint and maximize energy efficiency. Throughout this document efforts associated with the above shall be referred to as **High Performance Standards**.

This document should be kept intact and should not be separated for the various aspects of architecture and construction. The procedures and standards herein are dynamic in nature and thus are subject to constant review and change. Changes will be updated in electronic format, and will be available in electronic format or hard copy through Salt Lake County. It is the responsibility of the consultant to obtain the most recent approved version of this document. For

requirements which change during the project design and construction project, the authorized County project representative will determine applicability.

GENERAL REQUIREMENTS

These requirements are intended to assist the architect/engineer in performing the specific duties identified in the architect/engineer agreement for each specific project. The architect/engineer should carefully and frequently review all duties indicated in the contract.

Definitions

Architectural Program
Architectural program shall qualitatively and quantitatively define project concept and scope to include: total facility identity and purpose; organization and service requirements; individual and space descriptions; project concept; preliminary project cost estimate; preliminary code analysis; mechanical, electrical, plumbing, civil, environmental, structural and FF&E general scope.

FF&E
Furnishings, Fixtures & Equipment

Development of an FF&E Manual: The design team shall assist in the selection and specification of new furniture, fixtures and equipment and/or reuse of existing furniture, fixtures, and equipment for Owner approval. This shall include furniture, fixture and equipment layouts for all spaces and areas of the building. Provide the Owner with an FF&E schedule that includes item name, manufacturer, series, style, dimensions, finish, fabric, yardage, color, quantity, owner or contractor supplied and pricing for bidding purposes. Utilize state contracts where possible. Provide a detailed cost estimate for the FF&E package.

Compile and design a sign package for all interior and exterior signage. Way finding will be a critical component of the facility and signage should clearly delineate the flow of the building and its services. It is anticipated that the following will be but not limited to the sign package: interior and exterior building signage.

Integrated Design
Design process that incorporates thinking and working across disciplines, from the earliest stages in the process, to achieve whole-system solutions that maximize building performance and return on investment. Incorporates ideas from the engineering and specialty consultants, as well as future building occupants, during feasibility and conceptual design phases so that decisions can be informed by critical insight.

PDT
Project Development Team (PDT). The group of County representatives that will direct a project's activities along with the County Project Manager. This team will consist of agency representatives, user groups and other County personnel. On a case by case basis, community representatives may be part of the PDT.

Project Manager
Herein, unless designated otherwise, the term Project Manager shall refer to the project representative from the Salt Lake County Facilities Management Division.

PSC
Performance Standard Criteria. Requirements, set forth in each section of this document, that distinguish between regular or Baseline Criteria, and High Performance Criteria for project design and construction. The Performance Standard for each project shall be designated by a County Project Manager prior to the design process. For more information on High Performance Criteria see Section 18113.

Scope
The portion of work to be completed by the design team or the contractor during construction.

Sub-Consultants
Sub-Consultants used on the project shall be those individuals and firms listed in the architect's/engineer's project proposal or as agreed to by the County representative. Any changes made in sub-consultants shall be subject to approval of the County representative.

County Representation

All County design and construction projects will be accomplished under the direction of The Facilities Management Division. A specific County project manager will be assigned to each project and will direct the projects activities along with a Project Development Team (PDT). This team will consist of agency representatives, user groups and other County personnel. The architect/engineer will be required to report to and coordinate all activities through the County project manager.

Performance Standard Criteria (PSC)

Before solicitation for A/E consultant services for each project, the Facilities Management Division shall designate whether the project will utilize criteria, defined in the sections of this document, for Baseline Performance Standards, or High Performance Standards.

<u>Baseline Performance Standards:</u>
Criteria defined in the basic text throughout this document. This designation will generally apply to projects which are industrial or which may be considered support buildings, such as storage or maintenance facilities.

<u>High Performance Standards:</u>
Criteria identified throughout sections of this document which specify minimum requirements for public or civic buildings in general – See Introduction Part A. These requirements shall be implemented in order to achieve maximum value and energy performance for all public Salt Lake County facilities.

Exemption. The Salt Lake County Facilities Management Project Manager may determine exemption from any of these standards on a case by case basis. Exemption shall be based on unique site, project, or existing conditions. Proposed exemptions shall be reviewed by the Project Manager on each project. The County project manager will present the proposed exemption to the PDT for review and comment.

Integrated Design

The success of any building project depends upon thinking and working across disciplines to achieve whole-system solutions that maximize building performance and return on investment. All too often in a traditional design process, the consultants and end user are not included in the beginning stages, and decisions are made without critical insight into nuances that may affect the way the building will actually be constructed or occupied. This often results in systems being engineered late in the design process that could have been optimized had they been implemented in the earliest stages. It also results in poorly coordinated drawings, change orders, delayed fit out, schedule challenges, resource consumption, and cost impacts that could be avoided through the inclusion of all team members early in the project. Integrated design is the involvement of all team members in the earliest phases of the process.

Why Integrated Design?
Effectively integrated design is the key to creating buildings that do a better job of serving their occupants, their owners, the community, and the environment. When all pertinent disciplines interact early in the design process, there are opportunities to align technical systems and design elements, integrating not only the team process, but also the building itself. This can result in the downsizing of mechanical equipment, avoidance of unnecessary materials and operational systems, and a design that can be built more efficiently and functions more effectively. Integrated design also allows a more successful approach to sustainability that is not seen as merely an add-on option or alternative path. Rather, the result is a design that is beautiful, environmentally appropriate, economically viable, and exceptionally functional.

Essential Process Elements

1. Use knowledge of integrated design process to guide the design team from the beginning of the programming process. The integrated design process should also be implemented at the beginning of schematic design, and continue as a regular tool through all project phases.
2. Use Design charrettes to bring the team together at the outset of the project to:
    - Become acquainted with the County standards and how to implement them.
    - Provide a forum for input from team members, stakeholders, the consultants, and the County.
    - Define project goals and establish priorities within the context of the County standards
    - Gain shared understanding of potential related to all design strategies
    - Gain shared understanding of potential for interdisciplinary synergies and opportunities to collaborate
    - Develop building strategies, concepts, and recommendations that will inform the design process and facilitate truly integrated high-performance results. These should include both general project goals and specific parameters for the site, design, materials, technologies and systems.
    - Determine and set goals for the particular LEED® credits that the project will strive to obtain.
3. Consider the use of available tools including but not limited to daylight simulations, energy modeling, life-cycle cost spreadsheets, comparisons of materials options, site analysis, acoustic analysis, etc. to assess contribution of alternate design concepts to financial and environmental performance.

4. Clarify the roles of all design-team members, from the architect and owner, to all of the engineers and agents, early in the design process.
5. Involve an independent commissioning agent early in the process to improve the agent's understanding of the design intent, to minimize possible implementation errors that might result from lacking forethought or clarity in the construction documents, and to facilitate streamlining post-construction commissioning. Refer to the information in the commissioning section of the standards for further information and requirements.
6. Hold regular meetings of the full project team, including architect, consultants, commissioning agent, and owner for design/project reviews that assess and guide the effort towards achieving design intent.
7. Each team meeting should result in a list of clearly defined and clearly assigned next steps, actions, and responsibilities for moving towards the achievement of related project goals.
8. Early in the design process establish methods for regular document distribution. Determine format (i.e. hard copy or electronic, including specific file formats), frequency (i.e. weekly, semi-monthly, monthly, at the middle and end of design phases, etc.), and method of delivery (i.e. hand-delivery, e-mail, FTP, etc.).
9. Review project budget and schedule at each team meeting throughout the process so all consultants and owner have a clear understanding of the potential impacts of all design decisions.
10. Each consultant is encouraged to visit the project site early in the process and should investigate and document the site conditions relevant to their scope of work.

Specialty Consultants

The architect/engineer shall obtain the service of an acoustical consultant on projects involving auditorium acoustics, unusual sound or vibration isolations, or other related problems. This consultant shall meet the approval of the County. If additional fees are necessary, this will be negotiated.

The architect/engineer shall coordinate with the County's commissioning agent throughout the entire design process.

Project Initiation

The architect/engineer shall be responsible for orchestrating the project's complete development including pre-design activities listed below.

1. Organize and develop a complete Design Team; and, identify the project team leader, primary staff and major sub-consultants through all normal project phases. The team leader of the consultant architect/engineer shall participate in all regularly scheduled project meetings during each phase of the project.

2. Thoroughly review all contractual responsibilities; and assign, schedule, list and distribute each phase service assignment to meet the various stated project objectives.

3. Obtain the project scope and/or program; investigate, analyze, evaluate and define all project variables; and, verify the primary project goal, major objectives and various other requirements with the County's officially designated Project Development Team. Strictly adhere to all officially adopted Architectural Programs unless instructed otherwise in writing.

4. Identify the Building Authority having jurisdiction over the design and construction of the proposed project; research, itemize and analyze all regulatory ordinances, facts and conditions regulating such construction activity; and, establish the orderly achievement of each and every conditions regulating such construction activity; and, establish the orderly achievement of each and every condition and obligation as may be required for the timely development of the project through the occupancy phase.

5. The delivery method for the bid documents shall be design-bid-build unless otherwise directed in writing by the County project manager. Design-build is not allowed for any portion of the work.

Progress Payments

The architect/engineer may submit monthly progress payment applications in accordance with the contract and the work performed to date. All payment requests shall include a complete breakdown of total fees shown as percentages and dollar amounts and shall specifically identify the percentage and dollar amount of requested fees. All invoices shall be accompanied by a completed standard Salt Lake County payment request form signed by the proper individual representing the consulting firm.

FEASIBILITY STUDIES AND BUILDING PROGRAM REQUIREMENTS – Section C

Feasibility Studies

1. Project Objectives. A feasibility study should begin with a definition of the basic goals and objectives for the given project, including possible project site(s), proposed building type(s) and size(s), general site and parking requirements, and the level of sustainability to be achieved in the project. This information will be provided by the County.

2. Site Assessment. Based on the provided project objectives, a site assessment should be performed and should include studies of building footprints on the proposed site(s), with parking and landscape areas shown and evaluated for feasibility. Issues such as public access, delivery and service zones, and relationships to neighboring structures should be addressed. Alternatives should be explored based on direction and feedback from the County, with pros and cons provided for each respective approach. The LEED® credit options that each site provides (i.e. SSC1 Site Selection, SSC2 Development Density and Community Connectivity, etc.) should be reviewed and incorporated into the Site Assessment. A Preliminary zoning analysis shall be completed.

3. Scope Alternatives. Scope alternatives should be explored as required by the County project manager, identifying where a proposed project can be modified in order to better meet the objectives. For example, an alternative may be presented in which a project scope is reduced to better fit within a site with significant constraints, or high parking demands.

4. Cost Analysis. Costs should be presented with each respective alternative and should be as detailed as the available project information allows. Costs will not only be used for future financial planning and project funding, but as comparisons against each alternative provided. Any special cost issues that should be considered in order to make a project feasible for a given site should also be identified with each alternative.

5. Identify the feasibility of infiltration of storm water and/or the use of impervious pavement. Determine the feasibility for the use of recycled base course for use with new pavements.

Building Programming

Limit the Architectural program to the following areas of definition: 1) executive summary; 2) total facility identity and purpose; 3) organization and service requirements; 4) individual and space descriptions; 5) project concept development; 6) preliminary project cost estimate; 7) preliminary code analysis; 8) mechanical, electrical, plumbing, civil, environmental and structural

narratives; 9) FFE scope and purchase responsibilities. Include charts and diagrams to clarify all written descriptions.

Executive Summary

1. The executive Summary should include a concise statement of the programming task, a short description of any alternatives that were evaluated during the process and a statement of the final outcome or proposed direction.

Facility Identity and Purpose

1. State the authority and areas of responsibility of all participants in the project through all phases of its development.

2. Provide a description of the prime objective of the project and that which will be accomplished by the proposed project development.

3. Provide a brief justification for the development of the new facility to accommodate both existing and projected new functions. Provide a general explanation of the facility's contribution to both the community and the organization itself. Justify expanded services and/or increased capacity, or where previously separated activities are now being combined, provide more detailed descriptions.

4. Identify LEED goals complying with minimum requirements.

5. Include an assessment of their present location, area limitations, association with other functions within the program & a projection of their potential growth, if any.

6. Provide the identity of all users of the proposed project. Include total occupant loads for this facility or a combination of separate facilities. Occupant and user groups to identify include but are not limited to:

   a. Management
   b. Operations and Maintenance
   c. Users and General Occupants
   d. Special Functions
   e. Other

Organization and Service Requirements

1. Provide a description of the major objectives of the organization or sub-division.

2. Distinguish the facility requirements in terms of desired and required individual spaces, groups of spaces and overall space relationships. This should be according to previously stated agency, department, division and section organization responsibilities and the jurisdiction of authority by which they operate.

3. Identify the facility in terms of organizational requirements, fully describing major agencies, departments, divisions and sections, and their interrelationships, including general adjacency requirements.

Individual Space Descriptions

1. Identify and properly name all required spaces by individual or use designations.

2. Determine floor area and volume requirements according to contemporary architectural standards or needs of the activities to be accommodated within the space.

3. Determine occupant quantity for each space in terms of management, user and overall public requirements.

4. Determine primary, secondary and other related functions of each space, including any flexibility requirements.

5. Determine adjacencies and space relationships of each space according to overall organization, sub-divisions, user needs and general service requirements. Prioritize in order to determine most flexible usage. Provide diagrams and/or charts to illustrate relationships.

6. Identify physical environmental requirements in terms of space quality, character, shape, finishes, air control, light and power, acoustics, safety, technology or other unique conditions discovered in program research with the facility management and users. Provide diagrams and/or charts organized by individual rooms to illustrate requirements and conditions.

7. Provide a summary of all fixed equipment which is required to optimize maximum use of each space. Include specific items and descriptive information for such items and information/instruction devices, storage cabinets, work top and base cabinets, racks and benches, lockers, tables, bookcases, tool cabinets, wall cabinets, coat spaces or other similar equipment. Itemize, clearly stating quantities and other detailed fixed requirements.

8. Provide a description of all movable furnishings which will be required to optimize maximum service of each space. Include specific items such as chairs, desks, tables, waste receptacles, restrooms, files, task lights or other similar furniture. Itemize clearly stating quantities and other detailed requirements affected by the provision of the furnishings.

9. Provide a description of all mechanical equipment requirements for each space. Include specific requirements related to air quality and control, plumbing fixtures and outlets, humidity, natural gas, compressed air, floor drains, water service, sound control or other special mechanical requirements. Identify all potentially hazardous conditions which might require special finishes or safety precautions.

10. Provide a description of all special electrical equipment requirements for each space. Include specific requirements related to lighting, power, telecommunications, data communications, sound, fire alarms, appliances, office machines, maintenance equipment or other special electrical requirements. Identify all potentially hazardous conditions which might require special finishes or safety precautions.

11. Provide a description of all other special equipment requirements as might exist for each space. Include that which might be strictly limited to service areas, public spaces or exterior spaces.

12. Provide a summary of all individual space requirements according to the identified organizational service outline. Include appropriate allowances for circulation, mechanical rooms, electrical rooms, telecom and data rooms, service areas, toilet rooms and other unassignable areas. This summary shall be the basis of the project cost estimate.

Project Concept Development

1. Identify the project concept and mission in overall terms of major goals, accommodation of activities, special requirements and other general considerations affecting design of the project. This shall serve as a project vision statement which primarily identifies the architectural problem to be solved by a future design process and not the immediate solution.

2. The statement should explain what the facility should do within limits of performance expectations and relationships. It should consider basic concepts of both space and function and the interaction of human needs, physical limitations and external influences. Factors such as community, social, political and image requirements should be addressed clearly and as simply as possible.

3. High performance criteria should include a statement which outlines the various objectives being sought, a measure which outlines the desired outcome. Allow for a qualitative analysis and explanation in instances where quantitative measure can not be easily identified.

4. Concept development may include written material, diagrams, charts, data and general design percepts. The task is to accurately and completely identify the overall concepts of a total facility and its program, not to create ready-made plans, elevations and/or artist's drawings.

Preliminary Project Cost Estimate

1. Provide a project cost estimate based on the summary of individual space descriptions which shall include an appropriate grossing factor for all areas. A line item shall be included in the project cost estimate showing estimated escalation in 1 year increments to at least 5 years in the future.

   Also include the cost for site development, including demolition if necessary, utility development, fixed equipment, furnishings as directed, graphics, or other identified requirements not listed elsewhere. A design contingency, construction contingency, design fee and owner's management fee will be factors in the estimated construction cost and determined by the programmer in conjunction with the county's project manager.

2. The total project cost shall be identified and described in terms of net square foot, gross square foot, gross cubic foot and total project cost.

Preliminary Code Analysis

1. A preliminary code analysis shall be provided based on the information available at the end of the programming process and the final recommendations of the program. It shall list occupancy and group, probable construction type, basic fire rating requirements, proposed use of any fire-sprinkler systems, approximate building height including number of stories if known, total building area, approximate occupant load, required exiting widths, and number of plumbing fixtures required. Any additional code-specific items that are known at the time of programming, and will guide future development and design of the project should be noted in the preliminary code analysis. Include specific requirements for the local jurisdiction such as zoning or other local ordinances and requirements.

Mechanical, Electrical, Plumbing, Civil, Structural and Environmental Narratives

1. Narratives for building systems (mechanical, electrical, plumbing, civil, and structural) shall include general descriptions of probable system components including materials, approach, economics, and advantages for any probable system.

2. High Performance Standard. This narrative should indicate whether the project will use the County's High Performance Standard and should include strategies for achieving this standard. If the project is designated to achieve LEED® Gold certification provide a point chart and narrative for each credit that will be sought after. If the project is designated as High Performance, any known exceptions to the standard should be noted in the narrative. Note whether exceptions to the standard are proposed or if they have been approved by the County. If the project is not designated as High Performance, the narrative should still include applicable sustainable strategies that will be used for the project.

3. Environmental Issues. There may be environmental issues which must be addressed in the planning of a project and for this purpose the resources of Risk Management Office should be utilized. Of greatest concern are environmental regulations imposed at the local, state and federal levels pertaining to air and water quality mandating that consideration be given to atmospheric emissions; discharges to storm and sanitary systems, canals and navigable waterways; and the handling of solid and hazardous substances, including their disposal.

FFE Scope and Purchasing Responsibilities

1. Furnishings, fixtures, and equipment (FF&E) needs should be included in the building program. With the County project manager, identify basic FF&E needs, and clearly define the responsibilities of the County and the architect in specifying and procuring FF&E items. Identify any budget items associated with both specification and procurement of FF&E items and include in the preliminary project costs.

Implementation

1. The primary goal of this effort is to provide both a long-term viable program to guide ultimate development of the project. It shall provide clarity and order for manageable development within the limitations of current funding.

2. Provide the County with up to ten (10) bound copies and one digital copy of the approved program upon completion of this work. Provide digital copies in their

native file formats, (i.e.: Revit, AutoCAD, QuarkXpress, InDesign, Word, etc.) as well as final packaged documents (i.e.: pdf)

Field Trips

For some projects, a trip to other related facilities may be authorized by the County's Project Manager for the study of buildings of similar function. If a trip authorized, it will be taken before the building program is finalized and bound. Programmer shall document each facility visited with photographs and notes to be included in the final building program document. At the conclusion of the trip, the architect/engineer shall prepare a "trip report", including the photographs and notes taken, which will be made available to the County project manager and PDT.

Calculation of Building Floor Areas

In the preparation of plans in all phases of the project--schematic, preliminary and working drawings-- the architect is expected to make each room and facility conform reasonably well to the footages listed in the building program. Strict compliance with the total gross floor area of the building listed in the program is mandatory, however.

The AIA definition of architectural areas as listed below (AIA Document D101™ - 1995) shall be used in all floor area calculations.

Gross Floor Area of Buildings

"The Architectural (gross) area of a building is the sum of the areas of the several floors of the building, including basements, mezzanine and intermediate floored tiers and penthouses of headroom height measured from the exterior faces of exterior walls of from the centerline of walls separating buildings."

"The Architectural (gross) area does not include such features as pipe trenches, exterior terraces or steps, chimneys, roof overhangs, etc."

Net Assignable Floor Area of Buildings

The standard net assignable area is that portion of the area which is available for assignment or use by an occupant, including every type of space usable by the occupant.

The standard net assignable area should be measured from the predominant inside finish of permanent outer walls to the office side of corridors or permanent partitions. Where there are interior spaces surrounded by corridors, measurement shall be from the inside face of enclosing walls. Included should be space subdivisions for occupant use; i.e., offices, file rooms, office storage rooms, etc. Deduction should not be made for columns and projections necessary to the building or for partitions subdividing space.

General Room Requirements

Mechanical rooms should be located so as to isolate sound and vibrations from offices, classrooms, and other occupied spaces.

A custodial equipment and supply room with a 10’ clear height shall be located on each floor of 15,000 square feet or less. A suspended ceiling is not necessary in this room. On larger floors, there shall be one room for each 15,000 square feet of floor space. If the length of a building hallway exceeds 250 feet, then one of these equipment and supply rooms should be located near each end of the hallway. Each room shall have a floor drain and mop sink not smaller than 2’ x 3’ and mixer type facets mounted 2’ above the sink. This room needs at least one electrical outlet. Each closet which has a sink should also have check-valves and anti-siphon protection. Lights should include covers. Air should exhaust to the outside from these rooms. Shelving and hanging fixtures shall be specified by the architect for the storage of supplies and tools.

Custodial equipment and supply rooms must be separate from any other mechanical or electrical areas. There shall be no electrical panels, telephone junctions, fire alarm boxes, pipe chases or major plumbing junctions located inside these rooms. Otherwise, since a clear area of at least three feet needs to be maintained in front of these areas, the usable custodial space would be negated.

Each major building (approximately 40,000 square feet and up) shall have one custodial bulk storage room of approximately 200 square feet in addition to the custodial equipment and supply rooms noted above. In buildings which exceed 150,000 square feet, an additional space of approximately 100 square feet shall be provided for each additional 75,000 square feet above 150,000 square feet. This additional space may be part of the same room or in an additional room. The location of these rooms is not critical but must be near an elevator as the purpose of these rooms is for bulk storage of chemicals, equipment and paper supplies. In very large buildings, it is preferable to have two rooms, one located on or near the bottom floor and one on or near the top floor. These rooms may be adjacent to electrical or mechanical areas but not be a part of them nor have major junction boxes, fan areas or other similar systems as part of this space

Each building shall have a separate storage area for tables, chairs, easels and other items for building support commensurate with the amount of scheduled events planned for the building. The minimum space should be 8' x 10' and have an extra wide door with a magnetic hold open. This storage area needs to be located by the loading dock and the service elevator.

Each building designated to obtain LEED® Gold Certification shall include the following sustainable spaces and design elements at the discretion of the County Project Manager:

1. Space for collection & storage of recyclables including paper, corrugated cardboard, glass, plastics, and metals.

2. Space for bike racks/storage and shower/changing facilities.

3. Alternative Fuel refueling stations

4. An EQP2 – Specific Smoking Area

5. Daylight and Views for a minimum of 75% of the regularly occupied spaces of the building. See Division 26 for more information.

INITIAL SITE SURVEY AND REPORT

After receiving the County's building program requirements and other related instructions, the architect/engineer shall proceed with the following:

1. Visit the site with the County representative in order to become familiar with all governing site conditions (unless released from this requirements by written instructions).

2. Request from the County other requirements and information, such as existing drawings or previously completed reports, needed for the work. If available, the County project representative will provide such information to the consultant.

3. Request from the County an accurate site boundary and topographic survey including, but not limited to, property lines, fences, easements, contours, spot elevations, streets, drive cuts, curb and gutter, sidewalks, structures, trees and major vegetation, survey control and benchmark elevations. If the survey has been obtained previously by the County, the architect/engineer will not be required to resurvey, but will be expected to review the survey information provided and verify that it meets the design needs. Civil surveys provided by the County to an architectural/engineering consultant shall not be substituted for the civil or architectural site plan drawing for the project.

4. Advise whether soil bearing and water table studies should be conducted. It will be the County's responsibility to order and pay for the borings or test pits and subsequent mechanical, chemical or other tests. This data should be included with the site survey and report.

5. Request flow and pressure tests, which will be obtained and provided by the County.

6. Submit a written report to the County representative incorporating the data and findings enumerated above together with a declaration as to the suitability of the site. The architect/engineer shall also include a statement in this report as to his ability or inability to develop a building plan that will meet the project program requirements. Include any recommendation for further engineering studies, if any. After receipt of this report, the County will advise the architect of any additional or unusual engineering studies that may be performed as directed by the County representative.

7. Specialty Surveys – the County will obtain and provide specialty surveys, such as hazardous materials reports, seismology surveys, asbestos reports, traffic studies, and soil/climate analysis on an as-needed basis to the consultant.

When the initial site survey and report have been completed satisfactorily, the County representative will advise the architect/engineer to proceed with schematic drawings.

SCHEMATIC DESIGN

The architect/engineer (Design Team) shall prepare schematic drawings in accordance with the owner's building program requirements and the recommendations contained therein. At the beginning of the Schematic Design phase, the architect/engineer shall propose and submit a Design Process Schedule with the Schematic Design Phase shown in great detail (noting meeting or workshop dates, etc.) to be reviewed and accepted by the County project manager.

The Design Team is required to utilize an integrated design process, as described in the General section of this document, and develop several solutions to address design parameters and to arrive at the most functional schematic plan. High Performance design elements should be incorporated at the Schematic Design phase. Frequent consultations with the PDT during this important phase of work are essential.

Documentation of LEED requirements should be coordinated with the Salt Lake County project representative.

Design Approach

The Design Team is asked to utilize a design approach that acknowledges the primary role of providing public services to the citizens of Salt Lake County. An appropriate design response is desired to achieve an image of substance and integrity, and actual performance which is exemplary in energy performance, site impact minimization, and waste reduction management and life cycle costs.

Salt Lake County facilities are required to be open and readily accessible, commodious and safe, with well defined entries for both pedestrian walkways, easily maintained landscaped open spaces with responsibly lighted circulation and parking areas.

The resulting design should achieve a timeless aesthetic, with careful evaluation of trends or styles, simply landscaped, constructed of durable and waste-cycle conscious materials, and respectfully in scale and character with the neighborhood in which it is located. However, it should be of considerable more substance than the community norm without being overstated, reflecting the dignity of Salt Lake County Government.

Building Program Integration

The Design Team is required to read the scope or building program requirements carefully and bring to the County project manager's attention any conditions or requirements that they feel cannot be met.

Clarify the project program requirements through exploration and development of the most promising alternative design approaches; provide a reliable basis for each solution with attendant justification for the most desirable schemes; and, include appropriate site plans, space floor plans, elevation studies, conceptual building sections, sketches, diagrams, outline specifications, cost estimates and other graphic or written material as may be required to adequately represent the various concepts proposed by the effort.

Proposed deviations from the program requirements must have written approval of the County project manager before the work proceeds.

Building Codes and Related Recommendations

Plans and specifications for Salt Lake County buildings shall conform to all applicable building codes for this area. Design and construction for Salt Lake County facilities is not exempt from any particular applicable code. Such codes include, but are not limited to, the current version of the following:

Fire Marshall Regulations
International Building Code (IBC)
Utah State Health Code
City and County Health Department regulations
Life Safety Code
Seismic Code
International Energy Conservation Code (IECC)
National Plumbing Code
AWPA Manual of Standard Plans and Specifications
American National Standard ICC/ANSI A117.1
Americans with Disabilities Act (ADA) Standards for Accessible Design
NFPA
Building and Zoning Ordinances having jurisdiction at specific site location
Salt Lake County's Insurance Company Regulations

Provisions shall be made in the design of buildings and equipment to accommodate individuals with disabilities. Specific requirements are noted under the Accessibility section and throughout portions of this document.

Classifications of Building

All buildings to be constructed for Salt Lake county shall be classified in accordance with the International Building Code, latest edition adopted by jurisdictional authorities.

Seismic Considerations

All buildings to be constructed for Salt Lake County shall be designed in accordance with the Uniform building Code Seismic Requirements, latest edition. Essential County facilities including sheriff and fire facilities shall be designed to specific location seismic code requirements. Careful consideration should be given to the seismic design of all County facilities to increase the design criteria and requirements as project funding allows.

Energy Conservation

Building projects involving heating and/or cooling shall be designed to minimize energy consumption and shall have maximum operating efficiency. All projects shall be designed to meet the Baseline Performance Criteria integrated throughout this document. The County shall designate projects which shall meet High Performance Criteria, defined in the General section, with specific requirements

throughout this document. The Design Team is required to present all energy saving proposals and strategies in the schematic design phase.

Coordination

It is extremely important that the architect/engineer coordinate closely with the consulting engineers (including the commissioning agent) and that they coordinate with each other during the schematic phase of the projects and also through the preliminary and working drawings phase. The Design Team is required to utilize an integrated design process, as described in the General section of this document, by involving all disciplines at this phase in the design process.

Schematic Design Submittal

Schematic Design Narrative
A written narrative describing design concept and intent, functional aspects, and general descriptions of major building systems shall be part of this submittal. Major building systems may include, but are not limited to proposed structural system, mechanical and electrical systems, roof and site drainage strategy. For both Baseline and High Performance buildings, narrative shall describe the design's strategy to meet or exceed energy performance, site impact minimization, and waste reduction requirements. Indicate future expansion requirements as identified in building program.

Cover Sheet - Design Criteria
The following design criteria are to be included on the cover sheet of the schematic drawings:
1. Building Code (Year of IBC):
2. Construction type:
3. Occupancy:
4. Seismic Zones:
5. Square Footage- (Basement, First Floor, etc.)

Floor Plan Drawings
1/16" = 1'0" or 1/8 = 1'0" scale floor plan drawings should be in accordance with the building program requirements. The plan submitted shall be the resulting iteration of several studies and options considered by the PDT during the design process. This plan shall be reviewed and approved to move forward into the next phase by the PDT.

Floor Area Comparison
Associated with the schematic floor plan, include a floor area comparison showing square footage recommended for each facility in the project's building program compared to the schematic drawing square foot floor area. An example of how this comparison may be set up is provided under the County Documents section of these Standards. Square foot floor area shall be calculated by the AIA definition of architectural space.

Site Plan
A site plan, or plans, should show the general shape of the proposed building and location of adjacent buildings, streets, sidewalks, parking lots, utilities, etc. The plan submitted shall be the

resulting iteration of several studies and options considered by the PDT during the design process. The site plan shall include the following information where applicable:

1. A scale of 1' = 20'0", or larger
2. A north indicating arrow
3. Name of Project and address
4. Direction of prevailing winds
5. Outline of existing buildings
6. Existing land contours with elevations (rough)
7. Proposed land contours with elevations
8. Parking area, tally of parking capacity, and proposed parking layout with accessible parking stall locations.
9. Location and type of existing trees
10. Outline of existing open areas, roads, sidewalks, curbs and gutters
11. Location and pertinent data of existing wells, springs, ditches, canals, culverts, water mains, sanitary sewers, storm sewers, gas lines, electrical power lines, both buried and overhead, etc.
12. Location of proposed roads, sidewalks, curbs and gutters.
13. Location of proposed buildings or additions.

Schematic Elevations

Schematic elevations and sections should be sufficient to indicate scope of size, shape and volume, but not to provide details of architectural design appearance or structural system. If the County project manager requests, the Design Team shall also provide one or two optional elevations studies for consideration and approval by the PDT.

Presentation Drawings

When requested by the County project manager for publicity purposes, the Design Team shall provide presentation quality drawings, in the form of boards or colored drawings and electronic format. Type of drawings to be included will be based on needs of specific project, and shall be negotiated within A/E fee if the presentation drawing scope is determined at the time of fee proposal.

Specification Outline

Outline Specifications, in broad scope, should be prepared to indicate anticipated systems to be included, as well as general appearance and finishes.

Estimated Construction Cost

An estimate of probable construction cost based on area, volume or other unit cost should be carefully prepared. The estimate shall include costs for individual building areas, site work, furnishings to be included in the contract, general conditions, contractor mark-up, design contingency and escalation where applicable. In the event the estimated construction cost exceeds the County's construction budget, the A/E team shall provide recommendations and options to bring the project into budget as part of the base A/E Service Fixed Fee amount.

High Performance Design

A preliminary LEED® point chart, using the current rating system that will be in force when project is registered with the United States Green Building Council, with all anticipated points

marked should be included with the Schematic Design Submittal. For more information on the LEED® points refer to USGBC's website at www.usgbc.org.

Schematic Submittal, Review, and Approval

The number of copies of the Schematic submittal materials shall be determined by the County project manager and all persons directly concerned. The architect/engineer and sub-consultants will be invited to a review meeting at which time they will be given copies of comments and suggested changes to be made to the plans and specifications. The agreed upon changes must be completed and revised plans returned to the County's representative as soon as possible. Formal adoption of the Schematic Design will be indicated by County project manager signature, upon which time the project may move on to the Design Development phase.

The architect/engineer is responsible for reviewing plans and specifications with the appropriate governing building inspection agency to ensure that all applicable codes and ordinances are complied with. In this schematic drawing phase, the architect/engineer is required to visit with the governing agency personnel and review the proposed facilities. The architect/engineer will be responsible for producing specifications and plans that meet or exceed all applicable codes and regulations.

Payment for Schematic Design Phase

Payment of architect's/engineer's fees will be made after the architect/engineer receives the County's written approval of schematic drawings, in accordance with the architect/engineer's agreement. Request for this payment should be submitted on printed forms furnished by the County, an example of which is included at the end of this document.

DESIGN DEVELOPMENT

At the completion of the Schematic Design Phase, and before commencing the Design Development Phase, the Design Team shall meet with the project development team (PDT) who will invite the appropriate county personnel to jointly determine the best electrical, mechanical, and specialty systems for the proposed building. The Schematic Design submittal will be the basis for this review.

At the beginning of the Design Development phase, the architect/engineer shall propose and submit a Design Process Schedule which shows the Design Development and Construction Documents phases in detail, showing milestone meeting and progress dates, to be reviewed and accepted by the County project manager.

Design Development Guidelines

Further identify, define and describe all important aspects of the approved design; integrate and coordinate all major building systems as related to the soils elements, utilities, substructure, superstructure, facility envelope, walls and partitions, openings, materials, mechanical needs, electrical needs, fire suppression demands, building code requirements, High Performance design elements, or other special factors identified in the program; develop more definitive and quantifiable floor plans, elevation studies, building sections, details, material and fixture schedules, furnishings and equipment layouts and other documentation to fully describe the achievement of the project objectives and goals; and, provide a formal presentation of the recommended design solution including drawings, outline specifications, semi-detailed cost estimate and colored architectural rendering or model (of the County's choice) accurately depicting the project.

Develop the facility design keeping in mind the primary role of providing services to the citizens of Salt Lake County and of enhancing those services through the skillful incorporation of the following design factors:

1. Floor area and facility volume requirements by both individual and functional needs.

2. Optimum area arrangements and occupant loads for each space according to current County standards, Building Code demands and contemporary Architectural standards.

3. Primary, secondary, and alternate uses for each space in accordance with the identified priorities.

4. Space access, adjacencies and relationships according to overall organizational, facility user and service requirements, and in a manner consistent with ADA requirements.

5. Physical environment of each area in terms of space quality, character, shape, finishes, air control, daylighting, light and power, acoustics, safety and unique functional needs as identified by the program.

6. Fixed equipment and furnishings for each area, clearly indicating and controlling its effect on the area, its storage and service.

7. Mechanical, electrical and other special equipment for each and every area.

8. Unassignable areas of entries, lobbies, corridors, reception areas, toilet rooms, service areas, mechanical and electrical areas to satisfy all governmental institutional and service oriented requirements as may be required to make all other areas function properly.

Building codes and Related Recommendations

See Schematic Design Section for Codes and Recommendations. The architect/engineer is responsible for reviewing plans and specifications with the appropriate governing building inspection agency to ensure that all applicable codes and ordinances are complied with. In this drawing phase, the architect/engineer should review the design and proposed structural and utility systems with the governing agency personnel. The architect/engineer will be responsible for producing specifications and plans that meet or exceed all applicable codes and regulations.

Energy Conservation

The Design Team is required to develop all energy saving proposals and strategies in the design development phase, outlining suggested systems and preliminary exterior envelope performance.

Coordination

It is extremely important that the architect/engineer coordinate closely with the consulting engineers (including the commissioning agent) that they coordinate with each other during the preliminary drawing phase of this project and also through the working drawing phase.

Design Development Submittal

The Design Development submittal shall include floor plans, elevations, building sections, outline specifications, with an estimate of cost, a site plan, and an area comparison. Each sheet should be complete with title block, project name, scale, etc. Submittal should be accompanied by a letter of transmittal.

<u>Outline Specifications, Cut Sheets, & Design Development Narrative</u>
Outline Specifications, material cut-sheets, and written narratives describing design concept and intent, functional aspects, daylighting strategy, and primary aspects of each major building system shall be part of this submittal. Major building systems may include, but are not limited to proposed structural system, mechanical and electrical systems, roof and site drainage strategy. Provide cut sheets indicating actual equipment and major items proposed including furnishings, mechanical equipment, plumbing fixtures, electrical fixtures and other major items as may be requested. Narrative shall include information pertaining to possible expansion and other unique requirements as indicated in the project program.

For both Baseline and High Performance buildings, narrative shall describe particular aspects of the design strategy, products, or systems which meet or exceed energy performance, site impact minimization, and waste reduction requirements.

Cover Sheet - Design Criteria

The following design criteria are to be included on the cover sheet of the design development drawings:

1. Building Code (Year of IBC):
2. Construction type:
3. Occupancy:
4. Seismic Zones:
5. Square Footage- (Basement, First Floor, etc.)

Floor Plan Drawings

1/8 = 1'0" scale floor plan drawings, with possible enlarged partial plans of selected areas should show refinement from schematic design phase. The plan submitted shall incorporate input from the PDT during the design development process meetings. This plan shall be reviewed and approved to move forward into the next phase by the PDT.

Floor Area Comparison

Associated with the floor plan, include a floor area comparison showing updated square footage for each component of the project, noting differences from the schematic design phase, and the original program. An example of how this comparison may be set up is provided under the County Documents section of these Standards. Square foot floor area shall be calculated by the AIA definition of architectural space.

Site Plan

A site plan, or plans, should show footprint of the proposed building and location of adjacent buildings, streets, sidewalks, parking lots, utilities, etc. The plan submitted shall reflect the direction agreed upon by the PDT during the design process. The site plan shall include the following information where applicable:

1. A scale of 1' = 20'0", or larger
2. A north indicating arrow
3. Name of Project and address
4. Outline of existing buildings
5. Existing land contours with elevations
6. Proposed land contours with elevations
7. Parking area, tally of parking capacity, and proposed parking layout with accessible parking stall locations.
8. Location and type of existing trees
9. Outline of existing open areas, roads, sidewalks, curbs and gutters
10. Location and pertinent data of existing wells, springs, ditches, canals, culverts, water mains, sanitary sewers, storm sewers, gas lines, electrical power lines, both buried and overhead, etc.
11. Location of proposed roads, sidewalks, curbs and gutters.
12. Location of proposed buildings or additions.

Exterior Elevations and Building Sections
Design Development elevations and sections should be sufficient to indicate scope of size, shape and volume, as well as integration of architectural design appearance and structural system. Rough clearances planned for interstitial space for mechanical and other building systems should be indicated. Proposed exterior materials should be indicated as well.

High Performance Buildings
For High Performance Buildings, the Design team shall provide a preliminary daylighting study and preliminary whole building project energy simulation. The format of the studies to be determined on a case by case basis. A progress LEED® point chart and preliminary LEED® letter templates with narratives for each design submittal credit shall be submitted with the Design Development package.

Estimated Construction Cost
An estimate of probable construction cost moderately detailed, with quantified material and labor costs or other unit costs should be carefully prepared. The estimate shall include detailed and quantified costs for individual building rooms, site work items, furnishings to be included in the contract, general conditions, contractor mark-up, design contingency and escalation where applicable. In the event the estimated construction cost exceeds the County's construction budget, the A/E team shall provide recommendations and options to bring the project into budget as part of the base A/E Service Fixed Fee amount.

Prepare a list of all items indicated as work "not-in-contract" or "County furnished" and include a justification for each item. Carefully coordinate each item with the County representative and PDT.

Perspective Rendering
When requested by the County project manager for publicity purposes, the Design Team shall provide one each digital and printed perspective rendering of the building shall be furnished preferably in color. The specific method or medium of rendition is left to the choice of the architect, but should be suitable for easy viewing at a distance of 20 feet. The County may request a model of the project in place of a rendering or a rendering and a model. This work shall be negotiated within A/E fee if the presentation drawing scope is determined at the time of fee proposal.

Design Development Submittal Copies

Several copies of the design development submittal material shall be prepared, the number to be determined by the County project manager and all persons directly concerned.

Design Development Review Process

Design Development drawings and related materials will be carefully studied and reviewed by the County's representative, the PDT, Salt Lake County's Insurance Agency, and all persons directly concerned with the project. The architect/engineer will be given redlined drawings and specifications and a written critique. The County's Insurance Agency shall provide comment, and the architect/engineering

team shall incorporate. A meeting will be held where various questions can be discussed and resolved. The agreed upon changes must be completed and returned to the County's representative as soon as possible. Until written approval of the design development drawings has been received, the architect/engineer should not proceed with working drawings.

Payment for Design Development Phase

Design development or preliminary drawing stage payment fee is due after the architect receives the written approval of the Design Development submittal, in accordance with the architect's agreement. Request for this payment should be submitted on printed forms furnished by the County, an example of which is included at the end of this document.

CONSTRUCTION DOCUMENTS

After receiving written approval of design development drawings and outline specifications, the architect/engineer is authorized to proceed with the preparation of bid or contract documents consisting of working drawings and specifications.

Identify, organize and assemble an appropriate compilation of complimentary indexing, contract conditions, technical specifications, construction drawings, addenda and other miscellaneous documents to be utilized in conjunction with the County's standard bidding documents to fully describe the project and to accurately identify the full contractual obligation of each project participant throughout all project phases. Include summary of construction phasing and work under different contracts.

Coordination

Coordination is extremely important during the preparation of working drawings and specifications. The architect/engineer shall coordinate closely with the consulting engineers (including the commissioning agent) and the consulting engineers with each other to prevent interference of air ducts, electrical and plumbing lines, thermostats, marker & display boards, electrical outlets, audio controls, equipment, etc.

Building Codes and Related Recommendations

The architect/engineer is responsible for reviewing plans and specifications with the appropriate governing building inspection agency and other authorities having jurisdiction to ensure that all applicable codes and ordinances are complied with. In this drawing phase, the architect/engineer should review the design and proposed structural and utility systems with the governing agency personnel. The architect/engineer will be responsible for producing specifications and plans that meet or exceed all applicable codes and regulations prior to completion of 100% construction drawings.

Floor Area Comparison

A floor area comparison shall be included with the working drawing submittal showing footage recommended for each facility in the county's building program compared to the working drawing square foot floor area.

Structural Design Information

The gravity and lateral load resisting structural systems and their connections shall be clearly shown on the drawings. The allowable floor and roof loads shall be indicated on the drawings. The structural engineer shall submit complete calculations to the County. The calculations must be bound and include a cover sheet and table of contents.

Working Drawings

The consultant architect/engineer shall provide construction drawings to accurately define the character, configuration, limitations, size, quantity and overall intent of the design sufficient to guide a contractor in completing the intended project. These minimum drawings shall consist of:

1. Title sheet complete with project name, project number, and design criteria, index of drawings, design team members and project location map.

2. Site development drawings showing grade changes, retaining walls, drainage structures, utilities, parking, walks, landscaping, irrigation, etc.

3. Architectural plans, elevations, sections, schedules and details.

4. Structural engineering drawings, schedules and details showing footings, foundations, floor framing, roof framing etc. The design floor loads as noted in the program or as previously agreed upon shall be prominently recorded on the working drawings.

5. Mechanical plans, diagrams, schedules and details.

6. Plumbing plans, diagrams, schedules and details.

7. Electrical plans, diagrams, schedules and details.

8. Other special engineering or allied discipline design documents required to fully define the intent of extent of the project.

9. Each drawing sheet shall have project name, project number, architect's name, architect's/engineer's stamp, sheet number and date.

Specifications

Consistency with approved preliminary drawings and outline specifications is expected.

The Consultant Architect shall provide technical specifications for each and every material, architectural system, engineering system, piece of equipment, piece of furnishing, construction system or other item to be utilized in the construction. These shall clearly define the materials, systems, methods and quality standards by which all phases of the work are to be completed.

They shall be identified, listed and organized according to the AIA's Masterspec and/or the CSI's Masterformat unless approved otherwise by the County.

Performance standards for both materials and labor shall be carefully detailed and referenced to the most widely known associates of the American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), Factory Mutual (FM) and Underwriter's Laboratories (UL). Other professionally recognized standards shall be utilized as may be unique or appropriate to critical phases of the work.

The Consultant Architect shall endeavor to select and specify at least three (3) variables in each category of materials and/or systems utilized on the project. Proprietary products may only be specified when the Consultant Architect and County jointly agree that such a usage is required to insure the integrity of the design, compatibility with an existing system, availability within critical completion period or execution to other conditions unique within the project. Door Hardware shall be coordinated with current County requirements.

In all instances, a written justification shall be prepared by the Consultant Architect and acted on favorable by the County before inclusion in the specification. The "or equal' phrase SHALL NOT be used, as it is a constant source of contention.

Title page and signature approval page shall be prepared by the County and County representative.

General index of specification shall list all parts and divisions in the document.

Trade classifications shall be so written that each may be bid separately. Do not print two major trade classifications on any one sheet.

The term "base bid" shall be understood to include all work contained in the contract documents, excluding any substitutes. The contractor shall bid on only those materials, equipment and methods that are contained in the contract documents. Except for a few proprietary items, the contract documents are prepared to give the contractor a multiple choice of manufacturers. The contact will be awarded on the basis of lowest responsive base bid. Salt Lake County utilizes a multiple base bid schedule in lieu of alternates. Successive numbered base bid amounts are requested for differing scopes of work.

Standard County Boiler Plate Forms and printed instructions listed below are to be included in the specification documents. The County representative will assist the architect/engineer in securing completed boiler plate information to be included in the specifications. It shall remain unedited except as may be jointly approved by the County Attorney and County representative.

Notice to All Bidders
Invitation to Bid
Table of Contents

Instruction to Bidders
Form of Proposal
Minimum Standards for Responsiveness
Bidding Schedule
Bid Bond
Certificate of Non-Collusion
Certificate of Non-Discrimination
Agreement
Performance Bond
Labor and Material Payment Bond
General Conditions

In instances where Federal or other funding is being utilized on the project, special compliance conditions may exist which will require adding other documents to the specifications. These documents shall then be considered part of the County's normal "boiler plate".

Supplemental Information may be provided by the consultant architect/engineer in the form of an additional summary of the Work, or Special Conditions Sections as may be deemed necessary by the County to assure the successful description and completion of the project only.

Not-In-Contract List

The architect shall submit a list to the owner of all work that will not be included in the contract at the time of the working drawing review.

High Performance Design

All design submittal credits with completed LEED® letter templates should be submitted to USGBC for evaluation. A progress LEED® point chart with construction submittal credits, preliminary letter templates, and narratives should be completed.

Payment for Construction Document Phase

Construction document phase payment of the architect's fee will be made in accordance with provisions of the architect's agreement. Request for this payment should be submitted on printed forms furnished by the County. FF&E package progress payments shall be made in accordance with provisions of the architect's agreement. Final payment for the FF&E package(s) shall be made upon completion of bid package documents and review and recommendation of all bids.

Design Criteria

The following design criteria are to be included on the cover sheet of the working drawings:

1. Building Code (year of UBC)
2. Construction Type:
3. Occupancy:
4. Seismic Zone:
5. Square Footage- Basement
   First Floor:
   Etc.

Drawing Format

All Construction Drawings shall be uniform in size, format and of a permanent material acceptable to the County; all appropriately drafted with standard architectural scale, symbols, dimensions, orientation and fully legible notations; all being fully reproducible by direct print methods utilized by the County; either manually or computer-aided drafted (the latter preferred); and, all appropriately stamped with the Utah State "certified" licenses required by the building authority of the area in which the facility is to be constructed.

Special Format

Format of specification shall conform to the "Construction Specification Institute CSI Manual of Practice," most recent edition. To expedite supervision and inspection, it is recommended that different colors of paper be used for major divisions: blue for mechanical, yellow for electrical, etc.

Ownership of Documents

All construction documents, drawings, addenda and specifications are the property of the County and shall be completely and appropriately modified to the "As-built" condition at the conclusion of the project and prior to final delivery to the county. They shall incorporate all deviations from the bidding set as discovered by observations of inspectors and as recorded by various project participants, Contractors or Sub-Contractors performing work.

Alternatives

Provide direction to the County relative to the current advantages and disadvantages relative to project financing options, construction systems, methods and trends, project delivery options and alternative Construction Phase services.

Cost Estimate

Provided a complete and detailed Final Cost Estimate of the final design based on the completed Construction Documents prior to the bid-opening. In the event the estimated construction cost exceeds the County's construction budget, the A/E team shall provide recommendations and options to bring the project into budget as part of the base A/E Service Fixed Fee amount.

BIDDING

Information about Salt Lake County procurement is contained in the Standard Contract Requirements, examples under the County Documents section of this document.

Distribution of Plans and Specifications

The architect/engineer will supply the number of plans and specifications required by the contract for distribution by the architect/engineer as well as digital copies for use with the County's use of Bid Sync. The architect/engineer shall coordinate the printing of any additional sets of plans and specifications with the County's printing service vendor and billed to Salt Lake County. The architect/engineer shall coordinate the printing effort with the County project manager. An accurate list of all contractors, subcontractors, plan rooms and agencies in possession of plans and specifications shall be maintained. Furnish copies of the plan holder list to all inquiring parties.

Issuance of plans shall require a monetary deposit, as managed by the architect/engineer, and shall be limited to (2) sets for general contactors, (1) set for major subcontractors. Subcontractors shall be encouraged to use local plan room facilities to review documents and prepare bids. Comply with current Bid Sync requirements as directed by County Purchasing.

Pre-Bid Conference

The County Project Management Section Supervisor may elect to hold and conduct a pre-bid conference at the project site or other location. The architect/engineer shall attend the conference and explain special conditions and requirements. The architect/engineer shall answer questions, take notes and provide addenda answering questions raised during the conference.

Addenda

During the bidding period, any and all additional instructions, clarifications, interpretations or modifications shall be made by an addendum prepared by the architect/engineer and approved by the County project manager. The architect/engineer shall issue addendums to all parties on the plan holders list, including the County project manager and the County Contracts and Procurement office.

The addendum shall be available electronically and hand delivered, mailed or faxed as agreed upon by the architect/engineer and the county project manager.

Addendum which adds specifications and/or scope of work shall be issued by the architect up until 1 week of the advertised bid time and date. Addendum which provides clarification shall be issued up until 48 hours of the advertised bid opening time and date.

No one is authorized to make any clarifications, interpretations, modifications or give any instructions to the bidders during the bidding period except by addendum as described above. Salt Lake County Contracts and Procurement has the right to extend the bid date. Architect to advise County Project Management Section Supervisor if it is believed a bid date extension is in the best interest of the County.

Bid Recommendation

Evaluate submitted bids, schedule of values and list of subcontractors to provide appropriate recommendation for contract award.

CONSTRUCION SERVICES

Building permit

It is the architect's/engineer's responsibility to prepare plans and specifications that will qualify for all required building permits prior to the distribution of bid documents. It is the contractor's responsibility to make application for the building permit and either the County's or contractor's responsibility to pay for the building permit depending upon the method chosen by the County project manager.

Substitute Materials during Construction

Approval of materials not listed in the contract documents (including addenda) will be granted only under extenuating circumstances. The architect/engineer shall not authorize a change in materials independently, without the county representative's approval. Authorized changes must be described on a Change Order form.

High Performance Buildings & Commissioning

When a project has been designed to meet the County's High Performance Criteria, a Commissioning Agent will be separately contracted by the County to commission selected portions of the building. The Contractor and A/E Team will be expected to comply with submittals required with the LEED® process during and after construction, and required by Division 1 of the specifications.

Request for Information Form

Architects Supplement Instructions

A request for clarification or similar type form shall be used to transmit information from the architect/engineer to the contractor. Electronic format is expected and preferred. All forms should be numbered consecutively, beginning with number one on each project. This form is the basic means of communication. Architects/engineers are asked to refrain corresponding directly with the contractor by letter. All communications shall be copied to the County's representative. The architect/engineer shall maintain a log for request for clarification throughout the entire construction administration phase.

Proposal Request Form

A proposal request or similar type form shall be used to request prices for changes in the work. Electronic format is expected and preferred. All forms should be numbered consecutively, beginning with number one on each project. The architect/engineer shall maintain a log for proposal requests throughout the entire construction administration phase.

Construction Change Authorization Form

A construction change authorization form will be issued by the County, under special circumstances, to authorize immediate completion of changes in the work. The form will be prepared and completed by the County representative when time limits are such that the formal change order process will cause unreasonable delays or additional costs to the project. The form will include a fixed or estimated cost to be included as part of a change order at the earliest possible date. All forms should be numbered consecutively, beginning with number one on each project. Electronic format shall be utilized unless determined otherwise by the County Project Manager. The architect/engineer shall maintain a log for construction change authorizations throughout the entire construction administration phase.

Change Order Form

A change order form shall be used to authorize all changes that will increase or decrease the contract amount or contract time. Electronic Change Order forms and contractor's back-up shall be prepared by the contractor and reviewed by the architect/engineer and shall be submitted to the County project manager for preparation and issuance by the County. Hard copy format is also required for wet signature and record. Change Orders must be submitted with contractor's back-up cost documentation, including General Contractor cover letter and sub-contractor original invoices showing material and labor break-down. Each Change Order form must be numbered consecutively, beginning with number one on each project. After necessary approvals and signatures are obtained, all copies of the Change Order form should be returned to the owner, who will then make the necessary distribution, including to the contractor authorizing him to proceed with the change. Payment will not be made for change order items until the change order form has been fully executed by the County. The architect/engineer shall maintain a log for change orders throughout the entire construction administration phase.

Shop Drawings

Provide a review and approval of all product data, samples, color selections, material mock-ups, test results, guarantees, warranties, shop drawings, maintenance agreements, workmanship bonds, field measurement data, project photos, operation and maintenance manuals or other similar information required by the construction contract, documents or process. Electronic format and transfer shall be used in all possible circumstances. The review shall be sufficient to ascertain compliance with the design standards and specifications of the project. Provide a duplicate copy of all approved submittals to County. The CONTRACTOR shall maintain a log for shop drawings and submittals throughout the entire construction administration phase, which will be reviewed at each regularly scheduled construction period meeting.

Letter of Transmittal

It is required that plans, shop drawings, change orders, job instruction, etc., be sent with a cover letter of transmittal.

Architect's Agreement

The architect shall coordinate his services with the County project manager during the construction stage of the project. All Conditions of the architect's agreement should be complied with.

Construction Phase Payments

Requests for construction phase payments, including final payment, shall be submitted on printed forms available from the County. (See Appendix). Additional architect/engineering fees will not be considered for preparation of change order item documentation. A fee for this service has already been calculated in the architectural/engineering fee percentage for construction contingency as per the architectural services agreement.

Color and Material Approvals

Provide a materials color selection board identifying all proposed colors, textures and finishes for all materials exposed to view. Achieve consensus and approval of all material color selections in a timely manner so as not to delay the work of the contractor. Present final selection of all materials mounted on a display board and labeled by type of material and area used. Contractor to coordinate and facilitate sample procurement.

Pre-Construction Conference

Fully participate in a Pre-Construction Conference which will be organized and managed by the County project manager. Provide a representative who will be the official spokesperson for the Consulting Architect in all project meetings and all other architectural administration activities throughout the construction phase of the project. Review all Contract obligations by the Architect, the Contractor and the county during this project phase. Identify and provide a directory of all engineering consultants who will be assisting in those architectural responsibilities for the entire project period.

Progress Meetings

Fully participate in the regularly scheduled Construction meetings with the Contractor's representative and the County representative. Prepare a regular project agenda for each meeting. Direct, guide and record the resolution of all identified issues, both prepared and discovered, throughout the construction phase. Distribute timely summaries of all such meetings in the form of a project log, accurately registering and reporting all actions and resolutions of those meetings to the main project participants. The County project manager will similarly document an accounting of all such project meetings.

Review Special Testing Reports

It is the responsibility of the architect/engineer to review the special testing reports and provide recommendations to the County project manager.

Site Visits

At the time of fee proposal, Architect and County project manager agree on frequency and overall amount of construction administration site visits, which may differ from project to project. Provide both regular and selective visits to the construction site to observe, monitor and evaluate the work of the Contractor. These visits shall be sufficient to observe all the major construction activity, to measure the quality of both labor and material against the criteria of the contract documents and to evaluate the overall progress of the Contractor. Assist the Contractor and the County in the interpretation of those documents without assuming the responsibility for either the methods or delivery of the actual work. Make an official report of all on-site observations on a minimum weekly basis describing critical site factors, weather conditions, types of activities in progress, issues requiring action or resolution and instructions given in respect to identified issues. Note and report any and all conditions which may appear irregular, substandard or outside the standards required by the contract without assuming the liability for such.

Contractor Payments

Based on site observations, receive, review, evaluate, recommend and certify the Contractor's Applications for Payment complies with the County's contract terms and conditions. Make adjustments as required from a Schedule of Values and report on the progress in terms of percentage of the project complete with each application. At the completion of the project, issue appropriate Certificates of Substantial completion and other documents as may be required for Occupancy for the project facility.

Changes in the Work

Provide assistance to the County in identifying, quantifying, documenting and justifying all required design and construction Changes in the Work. Issue Requests for Proposals and Field Orders to the Contractor along with other appropriate documentation of all desired changes; evaluate the complete proposal or individual response utilizing standard estimating techniques; prepare a justification and analysis of each item; and, prepare a recommendation for acceptance of all Changes to the County.

Record Drawings

Regularly prepare or review the preparation of on-site record documents by the Contractor and Sub-Contractors to aid in the correct and complete documentation of the as-built project condition. At the conclusion of the project, obtain all of these documents from the Contractor and prepare the final record documents to be submitted to County as a condition of project close-out. Record documents shall be delivered to the County in a manipulatable electronic format. Exact format preference to be specified by the County project manager.

County Occupancy

Respond to various inquiries, issues and discovered conditions relating to occupancy, operation and maintenance of the completed facility during the specified guarantee and warranty periods of all space, materials, equipment and furnishings. Investigate, gather data, perform analysis and provice

recommendations for corrective action to resolve those identified elements of concern. Assist in securing a positive response from the contractor to the identified needs and goals of contracted performance standards.

BUILDING COMMISSIONING

What is Building Commissioning?

Commissioning (Cx) is a systematic process of verifying that building systems perform interactively according to the design intent and the owner's operational needs. This is achieved beginning in the design phase by documenting the design intent and continuing through construction, acceptance, and the warranty period with actual verification of performance, operation and maintenance (O&M) documentation verification and the training of operating personnel.

When is Building Commissioning Required?

Baseline Performance Standard:
Salt Lake County will perform their own commissioning on building projects designated as baseline.

High Performance Standard:
Building systems commissioning will be implemented by the County on a case by case basis for projects designated as high performance. Note that even when commissioning is required, it is at the County's discretion to determine what systems will be commissioned. Check with the County Project Manager for specific requirements. Refer to the Building Systems Commissioning Checklist in the County Documents Reference section for additional information.

Building Commissioning Guidelines

Refer to Section 019113 in the building design standards for specific building commissioning guidelines and requirements. It is the responsibility of the architect/engineer to coordinate closely with the Commissioning Agent through the design and construction process.

ACCESSIBILITY REQUIREMENTS

SUMMARY

A. This Section includes Salt Lake County's requirements for Accessibility in addition to all applicable codes standards, including but not limited to:

1. American National Standard ICC/ANSI A117.1
2. ADA Standards for Accessible Design – Most recent enforceable version (found on the Department of Justice website, www.ada.gov)
3. Standard Plans for Public Works Construction, Salt Lake County Department of Public Works, most recent version.

B. SL County Baseline and High Performance Criteria shall be the same for all accessibility standards.

1. Design Team's approach is encouraged to seek design solutions which integrate accessibility requirements in a seamless and aesthetically pleasing manner.

C. Particular requirements of this section are in addition to those required within specific Division sections of this document. If conflict does occur, the Design Team shall bring it to the attention of the County project representative.

D. The Design Team shall consider the use of a hearing loop or portable hearing loop system for all spaces subject to special accommodations under codes indicated above. The County Representative shall direct scope of this element to promote "Effective Communication" without compromising privacy concerns.

MILLWORK

The required accessible portion of any public information counter must be incorporated into the overall design so that it is visible from the building entryway.

DIVISION 8 - DOORS

A. For all projects, at least one public entry must have an automatic door opening system. Preferred location is at the primary public entry.

1. Salt Lake County shall have final approval of exact location of the door actuator pads and condition of proposed final installation.

B. For specific door closer and operator requirements, refer to Division 8 of this document.

C. Before building is turned over to the Owner for occupancy, all interior doors shall be balanced to operate with 5lbs of force, with a sweep period of 5 seconds minimum.

D. All doors shall have a clear opening width of 32" minimum.

DIVISION 9 – CARPET

A. Carpet shall be installed with the weave going in the predominate direction of pedestrian travel. (This avoids causing non-motorized wheelchairs, catering carts, etc. from having to propel down a continuous "side-hill" and being thrown toward the wall or oncoming traffic.)

DIVISION 10 - SIGNAGE

A. Comply with Salt Lake County Standards, and chapter 7 of the American National Standard ICC/ANSI A117.1 for signage requirements.

B. Exceed ICC/ANSI requirements for sign contrast. All signs, primary building exterior identification as well as interior room signage, must have a minimum 60% contrast between characters and background, or other open area.

C. Salt Lake County shall have final approval for sign illumination. Location, material, and type of illumination shall be selected to avoid glare. On site approval of sign illumination will be by the County. Adjustments to be made within general construction contract.

D. Size of characters for building directories shall be submitted for review and approval by the County.

DIVISION 10 – TOILET AND BATH ACCESSORIES

A. Locate automatic hand dryer or paper towel dispenser immediately adjacent to the lavatory with proper clear floor space area for approach. Location across the room, on wall opposite of lavatory(ies) shall not be accepted, unless exception is given by the County.

B. Toilet seat protector dispensers shall not be mounted above toilets on any wall. Locate at open side of stall, either above or below handrail.

C. Accessible toilet stall door handles shall not be flush or recessed type, and shall be mounted on both inside and outside door faces.

1. Refer to list of acceptable door handles in Division 8.

D. Where all lavatories are accessible, all lavatory pipes shall be protected from contact by people using wheelchairs. (This avoids the row of multiple lavatories but only one has installed pipe protection.)

E. In facilities that are prone to vandalism, a fixed shower head will be used in lieu of the required hand held shower wand. This exception is allowed by ANSI. Park Operations will provide specifications for the acceptable fixed shower head unit.

F. If showers are provided in facilities built for the Parks and Recreation Division, Park Operations will provide information for a concrete shower bench to be used in lieu of a folding shower bench.

DIVISION 12 – FURNISHINGS

A. ANSI Section 903 applies to park benches provided on a site.

B. ANSI Section 902 applies to dining tables provided on a site.

DIVISION 13 – SPECTATOR SEATING

A. Wheelchair seating spaces must be an integral part of the spectator bleacher footprint. These seating spaces are only required on the first row of bleacher units. Also, units with accessible ramps will be needed if elevated seating is provided. See ANSI Section 802 for further bleacher requirements or information.

DIVISION 14 – WHEELCHAIR LIFTS

A. The use of Wheelchair Lifts to provide vertical circulation in a facility must be approved by the involved Agency and the Design Team.

DIVISION 22 – PLUMBING FIXTURES

A. Flush valves shall not be located on the wall or partition side of the toilet fixture. Installation must be on the open side of the toilet fixture, adjacent to the open accessible floor area. Installations not complying with this requirement will not be accepted, and shall be corrected at the contractor's expense.

B. Accessible transfer-type showers must be reviewed in design stage by the County for correct grab bar placement and clear floor space requirements.

C. Depending on the size, function and use of the facility, Salt Lake County requires at least one family (unisex) restroom per facility. Exception can be granted by the Design Team.

D. Toilets are required to be mounted with the top of the toilet seat at 19 inches above the finished floor.

DIVISION 32 – ACCESSIBLE PARKING & CURB RAMPS

A. Van Accessible parking stall dimensions shall use the universal parking space dimension found in the ADAAG Parking Requirement. Parking stall preferred dimension 11'-0" wide, with access aisle of 5'-0" (60 inches) wide. See ANSI Section 502 for further requirements or information.

B. "Van Accessible" parking signs are required at the identified spaces, in addition to the standard accessible parking signs. Van accessible aisles shall be a minimum of 96 inches. Two parking spaces may share an access aisle.

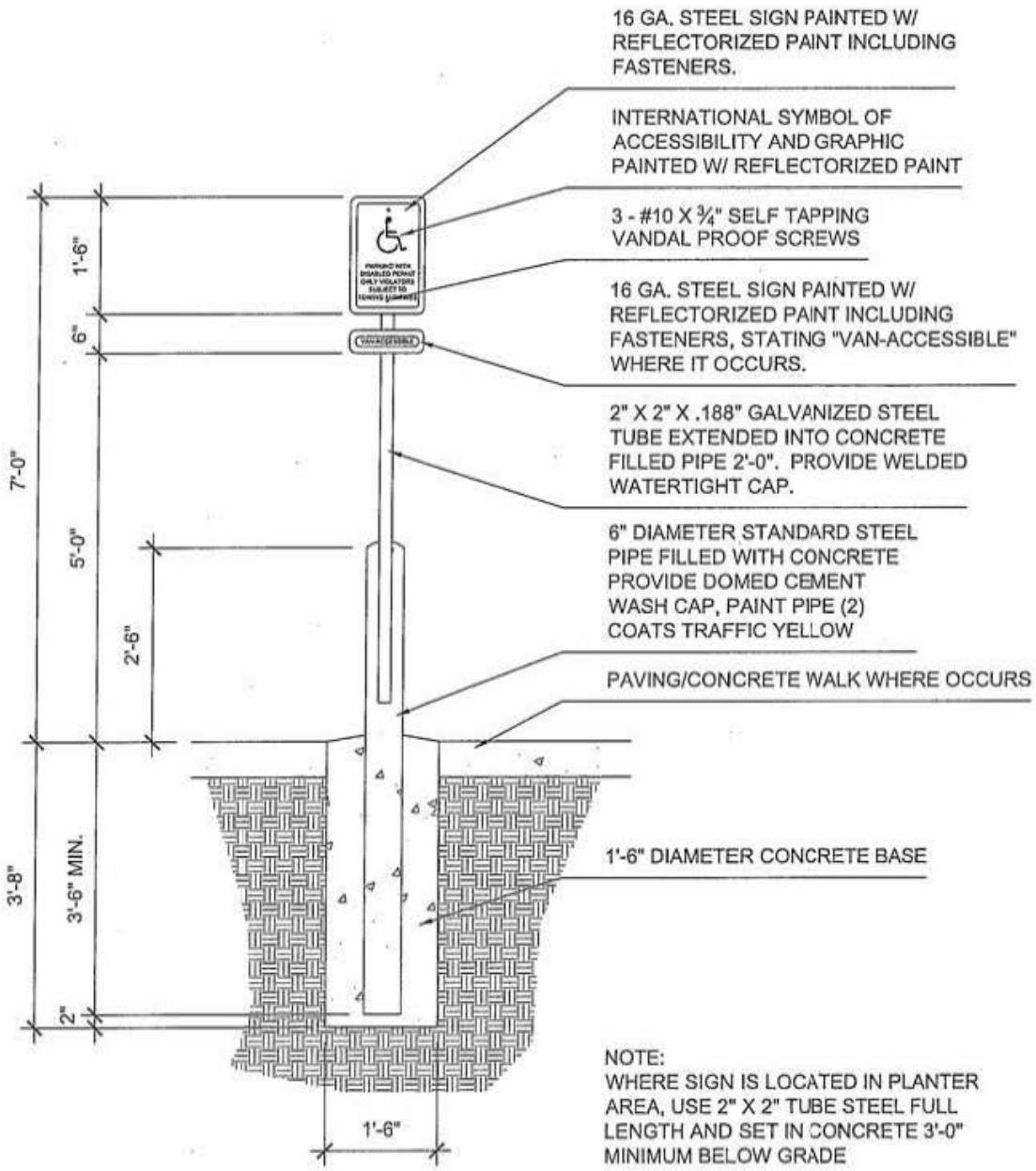
C. Where more than one public entrance will exist to a facility or activity area, the location of required accessible parking spaces shall be distributed to place accessible parking stalls close to each of the entries. Design Team to propose this distribution with Schematic Design submittal site plan for review by the County.

D. Curb ramp locations shall connect the path of travel from each access aisle to the walkway/sidewalk surface.

E. Curb ramp locations are also required at all drop-off locations. See ANSI Section 503 for further requirements or information.

F. Detectable warning surfaces will be installed on right of ways as indicated in current ANSI requirements. (This includes curb ramps installed on site as well as in the public right of way.) Currently detectable warning surfaces are not required on curb ramps at the head of an access aisle.

G. Truncated domes are the only allowable detectable warning surface permitted.



ACCESSIBLE PARKING SIGN

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C. Depending on the size, function and use of the facility, Salt Lake County requires at least one family (unisex) restroom per facility. Exception can be granted by the Design Team.

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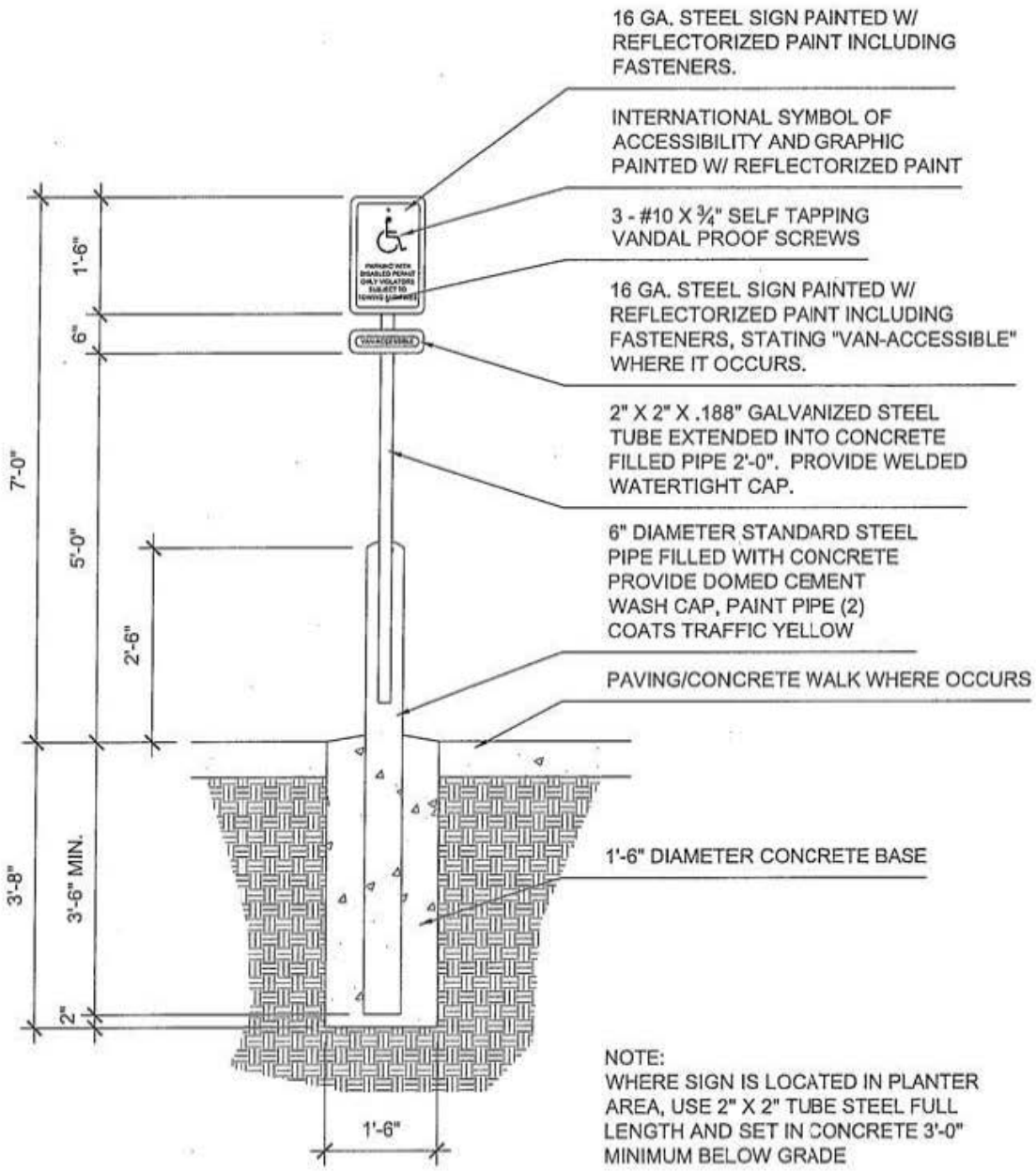
D. Curb ramp locations shall connect the path of travel from each access aisle to the walkway/sidewalk surface.

E. Curb ramp locations are also required at all drop-off locations. See ANSI Section 503 for further requirements or information.

F. Detectable warning surfaces will be installed on right of ways as indicated in current ANSI requirements. (This includes curb ramps installed on site as well as in the public right of way.) Currently detectable warning surfaces are not required on curb ramps at the head of an access aisle.

G. Truncated domes are the only allowable detectable warning surface permitted.



ACCESSIBLE PARKING SIGN

SUMMARY OF WORK – (SECTION 011000)

GENERAL

A. The following information shall be included, as contained herein, in the Summary of Work or Supplemental Conditions section of the architects/engineer's specifications. Each item should be carefully reviewed with the County's project representative for relevance to each specific project.

B. County Logo is required on all projects.

PERMITS AND FEES

A. County's responsibility:

1. The County will submit the construction documents for plan review. The County will pay the following costs to be paid directly to the governing agency and entity upon request from the contractor:

   a. Plan check fees (completed prior to bidding).

   b. Building Permits.

   c. Impact Fees (i.e. – hydrology)

   d. Conditions Use Permit Fee (i.e. – gas, sewer, water, power, phone)

   e. Utility unit labor and material costs for work not included with connection fees and normally performed by the utility company.

   f. Testing

B. Contractors responsibility:

1. The contractor will make arrangements to secure the building permit and will notify the County's project representative, in a timely manner, of the fee amount required to obtain the building permit. The contractor will research, coordinate and schedule all work required by the utility companies, special service districts and subcontractors to complete all work shown on the construction documents. The contractor will be responsible for all work not normally performed by the utility companies or special service districts (i.e. – trenching and backfilling) even if this work is not indicated in the construction documents. The contractor will be responsible for notifying the County project representative, in a timely manner of all costs to be paid by the County.

2. The contractor will be responsible for all bonding requirements and deposits that might be required by utility or government entities to perform the work.

SPECIAL INSPECTIONS AND TESTING

A. The County will engage an independent, qualified testing agency, acceptable to the County and, as defined in the construction documents. The contractor will be responsible for coordinating and scheduling all inspections and disseminating all required reports to the proper parties.

B. The testing agency representative shall meet with the architect/engineer, County project representative and contractor to establish the testing requirements and frequency of testing including, but not limited to, the testing and inspection specified in the contract documents. Other testing and inspections will be performed at the discretion of the County project representative.

C. All retesting for previously failed tests shall be paid for by the contractor.

CHANGES IN THE WORK

A. Any changes in the work of this contract due to discovered conditions or project scope modifications are subject to the following requirements:

1. A "Request for Proposal" shall be issued to the Contractor by the Architect clearly stating the exact conditions of the proposed change in the work or a "Request for Change" shall be issued to the Architect by the Contractor for review and acceptance.
2. The Contractor shall provide a written "Proposal" identifying the specific material and labor required to complete the change in the work. The Proposal shall completely itemize all material quantities, unit costs, labor estimates, hourly rates, and mark-up factors calculated in the overall cost. Material costs shall not exceed those listed at established market levels and labor costs shall not exceed those listed at Journeyman schedules as established for this region by current R.S.Means.

    a. Direct subcontractor and/or contractor mark-up for profit, overhead and administrative costs shall not exceed a combined total of 15% of the itemized costs for material supplied and labor directly performed by that individual firm. Additional contractor mark-up on subcontractor work is limited to 5% of the work of those other subcontractor amount. A maximum additional performance bond mark-up of 1%, or the actual bond cost rate as verified by the bonding company, will also be allowed as valid mark-up as part of the Contractor's submittals.

    b. No other mark-ups are allowed. (i.e. project management, supervision)

3. The Project Architect shall review and certify all Contractor's proposals and shall issue to the County a justification statement for all proposed changes.

4. Execution of formal change orders is a time consuming process which could delay action on critical work. Any work performed prior to the issuance of the official change order is at the contractor's risk. However, the County Project Representative will endeavor to minimize that risk through the expeditious processing of all change order items. Full, complete and detailed information on each item by the contractor will aide in that process.

5. Change Authorizations A construction change authorization form will be issued by the County under special circumstances, to authorize immediate completion of changes in the work. The form will be prepared and completed by the County representative when time limits are such that the formal change order will cause unreasonable delays or additional costs to the project. The form will include a fixed or estimated cost to be included as part of a change order at the earliest possible date. All forms should be numbered consecutively, beginning with number one of each project. Electronic format shall be utilized unless determined otherwise by the County Project Manager. The architect/engineer shall maintain a log for construction change authorizations throughout the entire construction phase.

PRIOR APPROVALS

A. Where possible, three or more acceptable brands of equipment, manufactured articles or methods of construction have been identified in the contract documents in order to establish a standard and allow for competition. The intent of this process is not to exclude the use of other brands, articles or methods which may be acceptable and deserving of consideration. However, only explicitly specified or prior approved items are acceptable to the County. To be considered for a prior approval the bidder must during the bidding period:

1. Submit fully detailed technical data, samples, installation methods, test reports and certification, references and all other supporting documentation as may be requested by the architect/engineer.
2. Prove to the architect/engineer and the County that items held up as equal or superior to specified items meet project specification design and intent. Obtaining prior approval does not relieve the contractor from meeting the project specifications or any portion thereof.

B. Specification Sections: For convenience or reference and to facilitate letting of subcontracts, the specifications are separated into respective divisions and sections. The forming of these separations shall not operate to make the architect/engineer or the County or any of its representatives an arbiter to establish subcontract limits between contractor and subcontractor or suppliers.

SCHEDULE OF VALUES / LIST OF SUBCONTRACTORS

A. After the bid opening and upon request of the County, the apparent low bidder, and if deemed advisable, the apparent second or third low bidders shall submit the schedule of values and the entire list of subcontractors, used in formulating their respective bids, to the County project representative and the architect/engineer within twenty-four hours.

1. If a bidder has any doubt regarding the correctness or acceptability of any subcontract proposal, the bidder may submit the names and amount of other competing subcontractors, making sure that the bidder clearly states which one was used in formulating his proposal.

B. No changes to the original Schedule of Values will be allowed except by change order. Changes to the original List of Subcontractors involving major subcontractors will not be allowed except with the approval of the County project representative.

BUILDERS RISK INSURANCE

A. Contractor shall secure and pay for an acceptable all-perils type Builder's Risk Insurance Policy for the full amount of the contract price including any change orders and shall include the interests of the contractor, subcontractors and suppliers. The policy should also include transit coverage insuring materials being moved to the job site. The policy should clearly state that Salt Lake County, the project manager and the architect are named insured.

1. The maximum allowable deductible shall be $1000.00 per occurrence.
2. Insurance carrier shall have an A.M. Best rating of A-: VIII.

CONTRACTOR SUPERVISION

A. The contractor shall designate and keep continuously on the project, during its progress and until the project is finally accepted, an experienced and competent superintendent and any necessary assistants, all satisfactory to the County's project representative. The superintendent shall not be changed except with the consent of the County's project representative unless the superintendent proves to be unsatisfactory to the contractor and ceases to be in his employ.

B. The superintendent shall represent the contractor in his absence and all notices, requests and instructions given to the superintendent shall be considered as having been given to the contractor.

C. The contractor shall give efficient supervision to the work, using his best skill and attention. The contractor shall carefully study and compare all drawings, specifications and other instructions giving prompt notice to the architect/engineer of any errors, inconsistency, or omission which have been discovered, but shall not be held responsible for their existence or discovery.

CONTRACTOR DAILY RECORD

A. The contractor, at each scheduled progress meeting, shall provide the county project manager with a copy of their daily work log. This refers to the daily report that documents the number of staff on site, materials delivered, sub-contractor activity, etc. This report will provide information to be compared against the approved work schedule.

LIQUIDATED DAMAGES

A. It is recognized and agreed by the contractor and County that it is of importance to the County to have this project completed within the time schedule contained in the contract documents. Should the contractor fail to complete the work within the time stated in the Agreement or within such additional time as may have been allowed by change order extension, there shall be deducted from any moneys due, or that may become due the contractor, the sum of $_____ per day (as defined in contract), for each and every calendar day beyond the agreed or extended completion day, that the work remains uncompleted. Such sum is fixed and agreed upon by the County and the contractor as liquidated damages due the County by reason of the inconvenience and added costs of administration, loss of use and/or revenue and supervision resulting from the contractor's default, and not as penalty.

1. Permitting the contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the County or any of his rights under the contract.

2. Said liquidated damage provision shall remain in effect and continue until substantial completion and acceptance of the project by the County. The contractor hereby authorizes the County to retain sufficient amounts of money due it and remaining in the hands of the county to pay the damages caused by any such default or defaults.

ALLOWANCES – (SECTION 012100)

GENERAL

A. General allowances are not allowed by the County with the exception of allowances established for special inspection and testing. Any allowances must receive the approval of the County project representative.

B. Allowances should be written such that amounts not used are to be credited back to the County at the completion of the project. Any overages will be compensated to the contractor by change order, that will also include a complete accounting of amounts used including detailed quantities and labor.

C. The contractor will be allowed a (5%) five-percent markup for testing and inspection allowance amounts submitted as part of the contractor's pay request. The contractor shall include invoice amounts from each respective testing agency used.

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL – (SECTION 017419)

SUMMARY

A. This Section includes Salt Lake County preferences for responsible construction waste management and disposal for High Performance Building design.

B. Design Teams are encouraged, and may propose to apply aspects of this section and other High Performance Standards to Baseline Performance projects with review and approval from the County project manager.

C. LEED®/ High Performance Submittal: LEED® letter template for related credits, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

HIGH PERFORMANCE GOALS AND REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of a minimum of **75** percent by weight of total waste generated by the Work.

B. Salvage/Recycle Goals and Requirements: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible.

SUBMITTALS

A. Waste Management Plan: At the beginning of the contract, submit a proposed waste management plan to be reviewed and accepted by the County Project Manager.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

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

QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Waste Management Conference: Conduct conference at Project site.

WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification and waste reduction work plan. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Forms: Prepare waste management plan on format required by the USGBC.

PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Grind asphalt to maximum 4-inch (100-mm) size.

B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4-inch (100-mm) size.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 4-inch (100-mm) size.
2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.

J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

L. Plumbing Fixtures: Separate by type and size.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Lighting Fixtures: Separate lamps by type and protect from breakage.

O. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

P. Conduit: Reduce conduit to straight lengths and store by type and size.

RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Transport waste materials off Owner's property and legally dispose of them.

CLOSEOUT PROCEDURES – (SECTION 01770)

PART 2 - GENERAL

2.1 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.

2.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals including CD-ROM submittal.
4. Warranties. (Include on CD-ROM).
5. Instruction of Owner's personnel. (Include on CD-ROM).
6. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of those Sections.

2.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Complete startup testing of systems.
8. Submit test records.
9. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
10. Complete final cleaning requirements, including touchup painting.
11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

2.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

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

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit four copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of areas in sequential order, starting with exterior areas first and proceeding to the interior.
2. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect
    d. Name of Contractor.
    e. Page number.

2.6 PROJECT RECORD DOCUMENTS

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

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings. (Include CD with PDF files of each sheet and cad drawings with each drawing digitally “bound” so all pertinent information displays when file is opened and each file drawn to meet the current version of the National CAD Standard.)

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings and Product Data, where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.

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

2.7 OPERATION AND MAINTENANCE MANUALS

A. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data as required below:

B. Binders shall be red buckram with easy-view metal for size 8-1/2 x 11-inch sheets, with capacity expandable from 2 inches to 3-1/2 inches as required for the project. Construction shall be rivet-through with library corners. No. 12 backbone and lining shall be the same material as the cover. The front cover and backbone shall be foil-stamped in white as follows:

OPERATING AND MAINTENANCE MANUAL

FOR THE

(INSERT PROJECT NAME)
(INSERT PROJECT COMPLETION YEAR)

VOLUME No. ( )

(INSERT ARCHITECT)

Binders shall be a manufactured by:

We R Memory Makers Attn: Melvin Hiller

631 North 400 West

Salt Lake City, Utah 84103

801-539-5000

C. Hardcopy Requirements

The following table of contents should be common to all o & M Manuals and is based on ASI388 2 and Industry Best Practice.

Introduction and Scope

This is a basic introduction about the project, the builder, and the scope of work documented in the manual

Assets Record Information

Describing items of equipment, assets, or elements of the work.

Maintenance Documents:

The maintenance schedules and tasks required to maintain a piece of equipment/assets and hence prevent breakdown and/or meet compliance and manufacturer requirements.

Operations

This section should be used to record relevant information on the Operations of the system and/or assets. It should also include safety instructions, special tools, cleaning and operating instructions and trouble-shooting to assist in solving problems to prevent expensive call outs.

Warranties and Certificates

Record specific warranty and certificate reference information. Important test results and performance criteria relating to commissioning and operations should also be included.

Spare Parts

Record any relevant information on the Spare Parts data for assets provided as part of the contract. It may also include information on spare parts suppliers.

Help and Contact

This section should be used to record information to allow the Client to call for expert assistance in relation to the assets included in the project. This would include the main contractors, sub-contractors and suppliers.

Drawings and References

This section allows you to attach/bind and or upload information like as-built plans, copies of specifications, complete product manuals and other documents relevant to the works and the O&M.

D. Operation & Maintenance Manual CD-ROM data

1. An intuitive CD-ROM instructional manual shall be provided to give the owners representative

the information they need to care, adjust, maintain and operate all of the equipment within the building, to include but not limited to, the heating, air conditioning, ventilating, plumbing automatic temperature control systems, kitchen equipment, stage and theatrical equipment, electrical equipment and building products requiring maintenance.

2. An orientation date shall be set up to instruct the owner's representative on the use of the operation and maintenance CD-ROM. A written report specifying times, dates, and names of personnel instructed shall be forwarded to the owner's representative.

3. CD-ROM preparation shall be under the direction of an individual or organization that has demonstrated expertise in the preparation of comprehensive and complete CD-ROM products. Qualifications shall be submitted for approval.

4. All CD-ROM's shall be authored with Adobe Acrobat. The authoring shall, but not be limited to include the following:

    a. All design drawings and documentation shall be included on the CD-ROM in a PDF format. These drawings shall be provided in an electronic format to the company contracted to create the CD-ROM and shall include the civil engineering, architectural, structural, electrical and mechanical sections.

    b. Icons shall be located on the PDF plans to link test and balance reports and mechanical operation and maintenance information to the design drawings.

    c. All information on the CD-ROM shall be printable on 8.5" x 11" plain paper with the design drawings and automatic temperature control drawings printable on 11" x 17" plain paper.

    d. Linked information such that the user can key word search for information.

    e. Provide a hyper-text alphabetical index of all equipment and building products as outlined in item 1 above.

    f. Use of multimedia formatting (text, pictures, graphics and sound etc.) will be used to make the information more accessible and understandable.

    g. All documentation shall be converted to an unchangeable Portable Document Format (PDF).

    h. The CD-ROM shall start automatically when inserted in the drive under the Windows 95 operation system. Any directions to continue will be observable on the screen.

    i. Operation and maintenance information to be supplied to the company contracted to do the CD-ROM by the contractor and suppliers providing the materials and equipment.

5. At the beginning or start-up of the CD-ROM there shall be a General Information Index screen to direct the user to the portion of the data desired. This index screen will consist of four (4) major groups. The groups will include:

    a. Contract Developers: This section is to include:

        1. Names of architects, engineers and contractors with address and telephone numbers.

b. Equipment List: This section to include:

1. A job specific alphabetical list of all items supplied to the project with names of the manufacturer, Item description including the plan number, model number and local supplier with current address and telephone number.

c. Design drawings

d. Manufacturer's Operation and Maintenance Manuals:

1. Architectural section: This section to include:

a. Building products, applied materials and finishes: Include product data with catalog number, size, composition, color and texture designations. Provide information for reordering custom manufactured products. Data shall include, but not limited to, information on finishes, builders hardware, etc.

b. Instruction for care and maintenance to include manufacturer=s recommendation for cleaning agents and methods, precaution against detrimental agents and methods and recommended schedule for cleaning and maintenance.

2. Mechanical/Plumbing section:

a. A general description of the mechanical system.

b. A step by step procedure to follow in putting each piece of mechanical equipment into operation.

c. Schematic control diagrams for each separate fans system, heating system, control panel, etc. Each diagram shall show locations of all control and operating components and devices.

d. Test and balance report

e. Valve tag schedule

f. All manufacturers operation and maintenance manual information

g. Maintenance instructions: This portion shall include:

1. A summary list of mechanical equipment requiring lubrication showing name of equipment and type and frequency of lubrication.

2. Special Maintenance Instructions to be summarized as follows:

a. Preventative Maintenance Procedures

b. Seasonal start-up and shut-down maintenance

c. Periodical inspection requirements

d. Water treatment procedures

3. Electrical section:

a. Building products, applied materials and equipment: Include product data with catalog number. Provide information for reordering custom manufactured products.

b. Instruction for care and maintenance to include all manufacturers' recommendations.

4. Warranty section: Include all product warranties on CD-ROM.

5. Training films and videos: Include all training films and videos on CD-ROM.

6. The minimum computer requirements to run the CD-ROM will be the following:

a. Pentium Processor 3.2 GHz

b. 256 Meg RAM

c. 48x CD-ROM drive

d. Sound Card

e. 64 bit 2 meg video card

f. Windows Version 7 or higher

g. Mouse

h. SVGA monitor

i. Monitor set to 800 x 600 resolution

7. Four (4) copies of the CD will be provided to the owner's representative.

DEMONSTRATION AND TRAINING – (SECTION 017900)

SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' name for each training module. Include learning objective and outline for each training module. Include learning objective and outline for each training module.

   1. At completion of training, submit two complete training manual(s) for Owner's use.

B. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses or architects and owners and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration: Submit two written copies within seven days of end of each training module.

   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project
      b. Name of Architect and Construction Manager.
      c. Name of Contractor.
   2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with label information. Include name of Project on each page.

INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

   1. Motorized doors, including overhead coiling doors and automatic entrance doors.
   2. Equipment, including projection screens, loading dock equipment, food-service equipment, and residential appliances.
   3. Fire-projection systems, including fire alarm and fire-extinguishing systems.

4. Intrusion detection systems.
5. Conveying systems, including elevators and wheelchair lifts.
6. Heat generation, including boilers, feed water equipment, pumps and water distribution piping.
7. Refrigeration systems, including chillers, cooling towers, condensers, pumps and distribution piping.
8. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
9. HVAC instrumentation and controls.
10. Electrical service and distribution, including transformers, switchboards, panel boards, uninterruptible power supplies and motor controls.
11. Packaged engine generators, including transfer switches.
12. Lighting equipment and controls.
13. Communication systems, including intercommunication, surveillance, clocks and programming, scoreboards, voice and data and television equipment.
14. Special Construction such as Swimming Pool Systems and Pool Amenities
15. Chemical Systems

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operation Requirements, and Criteria: Include the following:
   a. System, subsystem and equipment descriptions.
   b. Operating standards.
   c. Regulatory requirements.
   d. Equipment function.
   e. Operating characteristics.
   f. Limiting conditions.
   g. Performance curves.
2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operation manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.

b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control Sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operation instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspections Procedures
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following.
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

HIGH PERFORMANCE BUILDING DESIGN REQUIREMENTS – (SECTION 018113)

SUMMARY

A. This Section includes Salt Lake County requirements for High Performance building design.
   1. County project manager shall designate whether project is to meet High Performance Design Requirements, prior to request for proposals for design services from Design Teams.

2. County shall determine whether project will be submitted for USGBC LEED® certification, and level of certification to be attained, prior to request for proposals for design services from Design Teams.
3. Design Team shall incorporate requirements of this section into construction documents for all High Performance buildings.
4. LEED Scorecards (Version 3 for projects prior to 10/2016 only) are in Appendix EE.

B. Design Teams are encouraged, and may propose to apply aspects of this section and other High Performance Standards to Baseline Performance projects with review and approval from the County project manager.

DEFINITIONS

A. Refer to the definitions in the current version of the LEED® Reference Guide

SUBMITTALS

A. Provide items required by the County-issued checklist for each High Performance project. Submittals shall include certificates which guarantee material content.

MINIMUM PROGRAM REQUIREMENTS

A. Site and building planning and design shall result in a reasonable LEED® Project Boundary. For new construction projects that have only one structure on the site the Boundary shall be the Contract-Limit-Line. For projects that include multiple buildings or are located in a campus setting all buildings (both existing and new) shall be afforded their responsible share of parking, open space, etc., so as to afford each building the opportunity for LEED® Certification in the future.

STORAGE AND COLLECTION OF RECYCLABLES

A. Provisions for recycling waste associated with building operations shall be provided. This includes distributed collection points for occupants as well as an aggregated collection point for waste haulers. These provisions shall support the diversion of mixed paper, corrugated cardboard, glass, plastics, metals, **batteries, mercury-containing lamps and electronic waste** from the landfill.

ENVIRONMENTAL TOBACCO SMOKE

A. Comply with current LEED and County requirements.

LOW-EMITTING MATERIALS

A For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:

1. Aromatic Compounds: Paints and coatings shall not contain aromatic compounds.
2. Restricted Components: Paints and coatings shall not contain acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, or vinyl chloride.

B. Do not use composite wood or agrifiber products or adhesives that contain urea-formaldehyde resin.

REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

A. Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant.

B. Remove clean-agent fire-extinguishing agents that contain HCFCs or halons and replace with agent that does not contain HCFCs or halons.

MEASUREMENT AND VERIFICATION

A. Implement measurement and verification plan consistent with either the **Energy Conservation Measure Isolation** method, or the **Calibrated Simulation, Savings Estimation Method 2** in the EVO's "International Performance Measurement and Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction," and as further defined by the following:

B. If not already in place, install metering equipment to measure energy usage. Monitor, record, and trend log measurements.

C. Evaluate energy performance and efficiency by comparing actual to predicted performance.

D. Measurement and verification period shall cover at least one year of postconstruction occupancy.

CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT AND ASSESSMENT

A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
2. Replace all air filters immediately prior to occupancy.

B. Comply with one of the following requirements:

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. (4 300 000 L) of outdoor air per sq. ft. (sq. m) of floor area while maintaining an internal temperature of at least 60 deg F (16 deg C) and a relative humidity no higher than 60 percent.

2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. (1 070 000 L) of outdoor air per sq. ft. (sq. m) of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. (1.52 L/s per sq. m) of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. (4 300 000 L/sq. m) of outside air has been delivered to the space.

3. Air Testing: County project manager shall designate whether the project may consider this option prior to the commencement of construction.

REGIONAL PRIORITY

A. Site and building planning and design shall be responsive to Regional Priority credit opportunities, which vary by zip code, as established by the local Chapter of the United States Green Building Council.

GENERAL COMMISSIONING REQUIREMENTS – (SECTION 019113)

GENERAL

This section is to be included if it has been designated to meet Salt Lake **County High Performance building Criteria in the Owner's Project Requirements.**

Commissioning: Commissioning (Cx) is a systematic process of verifying that building systems perform interactively according to the design intent and the owner's operational needs. This is achieved beginning in the design phase by documenting the design intent and continuing through construction, acceptance, and the warranty period with actual verification of performance, operation and maintenance (O&M) documentation verification and the training of operating personnel.

RELATED DOCUMENTS

Documents referenced in paragraph below should be prepared during schematic design phase or earlier and updated as design progresses. They should be provided to Contractor when commissioning is used on Project.

Owner's Project Requirements and Basis of Design documentation are included by reference for information only.

SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:

These sections are to be added by the owner on the form provided in the appendix for "Project Commissioning Requirements." This form is to be included in the design team's programming documents.

1. Division 01 Section "Facilities Exterior Enclosure Commissioning" for commissioning process activities for building exterior enclosure, roof, and foundation systems, assemblies, equipment, and components.
2. Division 01 Section "Interiors Commissioning" for commissioning process activities for building interiors construction, stairways, and finish systems and assemblies.
3. Division 14 Section "Commissioning of Conveying Equipment" for commissioning process activities for conveying systems, assemblies, equipment, and components.
4. Division 21 Section "Commissioning of Fire Suppression" for commissioning process activities for fire-suppression systems, assemblies, equipment, and components.
5. Division 22 Section "Commissioning of Plumbing" for commissioning process activities for plumbing systems, assemblies, equipment, and components.

6. Division 23 Section "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.
7. Division 25 Section "Commissioning of Integrated Automation" for commissioning process activities for integrated automation systems, assemblies, equipment, and components.
8. Division 26 Section "Commissioning of Electrical Systems" for commissioning process activities for electrical systems, assemblies, equipment, and components.
9. Division 27 Section "Commissioning of Communications" for commissioning process activities for communications systems, assemblies, equipment, and components.
10. Division 28 Section "Commissioning of Electronic Safety and Security" for commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.

DEFINITIONS

A.
1. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) 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 Plan: A document that outlines the organization, schedule, allocation of resources, communication channels, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority. Owner's representative responsible for facilitating the commissioning process.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

CxA's RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Document The OPR and BoD in the Cx manual.

C. Perform Design Review for compliance with the OPR and BoD.

D. Perform Submittal Review for compliance with the OPR and BoD.

E. Provide commissioning plan.

F. Convene commissioning team meetings.

G. Provide Project-specific construction checklists and commissioning process test procedures.

H. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

I. Prepare and maintain the Issues Log.

J. Prepare and maintain completed construction checklist log.

K. Witness systems, assemblies, equipment, and component startup.

L. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

STORMWATER MANAGEMENT PLAN

A. Comply with all requirements indicated in the Salt Lake County 2014 Stormwater Management Plan and any updates or addenda to this document. See following agreement and complete.

October 8, 2014

Agreement and Understanding of Applicable

Responsibilities for Salt Lake County Stormwater Permit UTS000001.

In compliance with the Storm Water Management Plan (SWMP) 2014,

Section 1.6.1.3;

I have reviewed the SWMP portions that apply to the _____ Division.

I accept and understand the applicable responsibilities and tasks that are required by

the _____ Division to implement this plan.

_____ _____

Signed Division Director Date

EXISTING CONDITIONS

General (Structure Demolition & Selective Structure Demolition)

Salt Lake County requirements for all applicable Sections under this Division to be selected by the Design Team and reviewed by the County on a project by project basis. Section number system should be based on Masterspec® Masterformat 2004 version.

HIGH PERFORMANCE BUILDING DESIGN GUIDELINES

A. Requirements for Building Reuse:

1. Refer to current version LEED for requirements.

2. Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits. County Project Manager to determine with Design Team the percentage of existing walls, floors, & roof to be maintained.
3. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits. County Project Manager to determine with Design Team the percentage of interior non-structural elements to be maintained.
4. Maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be demolished; do not demolish such existing construction beyond indicated limits. County Project Manager to determine with Design Team the percentage of interior non-structural elements to be maintained.

B. Salvaged Items:

1. Incorporate salvaged materials into building design. Consider salvaged materials such as beams, posts, flooring, paneling, doors & frames, cabinetry & furniture, brick and decorative items. County Project Manager to determine with Design Team the percentage of salvaged materials to be used.

   a. Comply with the following:
      1) Clean salvaged items of dirt and demolition debris.
      2) Pack or crate items after cleaning. Identify contents of containers.
      3) Store items in a secure area until delivery to Owner.
      4) Transport items to storage area designated by County Project Manager or indicated on drawings.
      5) Protect items from damage during transport and storage.

DIVISION 3 CONCRETE

SUMMARY

A. This Section specifies cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.

B. See Division 03 Section "Cast-In-Place Concrete" for formwork; material, fabrication, and installation requirements for steel reinforcement; and field quality control.

SUBMITTALS

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

B. High Performance Submittals:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Design Mixtures: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.

4. Product Certificates: for products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

5. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

C. Design Mixtures: For each concrete mixture.

D. Formwork Shop Drawings.

E. Placement schedule.

F. Samples: For each of the following materials:

1. Form-facing panel.
2. Form ties.
3. Form liners.
4. Coarse- and fine-aggregate gradations.
5. Chamfers and rustications.

G. Material test reports and certificates.

QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M -09 requirements for production facilities and equipment.

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

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301- Current Version "Specification for Structural Concrete, Sections 1 through 5 and Section 6, "Architectural Concrete."
2. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."

C. Field Sample Panels: After approval of verification sample and before casting architectural concrete, produce field sample panels to demonstrate the approved range of selections made under sample submittals. Produce a minimum of 3 sets of full-scale panels, cast vertically, approximately 48 by 48 by 6 inches (1200 by 1200 by 150 mm) minimum, to demonstrate the expected range of finish, color, and texture variations.

D. Mockups: Before casting architectural concrete, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

E. Preinstallation Conference: Conduct conference at Project site.

FORM-FACING MATERIALS

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for formwork and other form-facing material requirements.

B. Form-Facing Panels for As-Cast Finishes: Steel, glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that will provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

C. Form Liners: Units of face design, texture, arrangement, and configuration to match design reference sample. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.

D. Rustication Strips: Metal, rigid plastic, or dressed wood with sides beveled and back kerfed; nonstaining; in longest practicable lengths.

E. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch (19 by 19 mm), minimum; nonstaining; in longest practicable lengths.

F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch (6 mm) thick.

G. Form Ties: Factory-fabricated, internally disconnecting removable ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

STEEL REINFORCEMENT AND ACCESSORIES

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."

1. Where legs of wire bar supports contact forms, use gray, all-plastic bar supports.

CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, Type I or I/II. Supplement with the following: Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, Class 5S, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse Aggregate Size: 3/4 inch (19 mm).
2. Gradation: Uniformly graded.

C. Normal-Weight Fine Aggregate: ASTM C 33 manufactured or natural sand, from same source for entire Project.

D. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

E. Air-Entraining Admixture: ASTM C 260.

F. 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. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

G. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black**,** nonfading, and resistant to lime and other alkalis.

CURING MATERIALS

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

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

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

1. For integrally colored concrete, curing compound shall be pigmented type approved by color pigment manufacturer.
2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.

B. Proportion concrete mixtures as follows:

1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.46.
3. Slump Limit: 4 inches (100 mm) or 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.0 percent at point of delivery 3/4-inch (19-mm) nominal maximum aggregate size.

C. Cementitious Materials: Use fly ash, pozzolan, as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 20 percent.

D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

CONCRETE MIXING

A. Ready-Mixed Architectural Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.

1. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

FORMWORK

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for formwork, embedded items, and shoring and re-shoring.

B. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm)

C. Fabricate forms to result in cast-in-place architectural concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Chamfer exterior corners and edges of cast-in-place architectural concrete.

E. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

F. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

G. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

REINFORCEMENT AND INSERTS

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.

B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

   1. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.

B. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of 28-day design compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place architectural concrete surfaces.

JOINTS

D. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.

E. Contraction Joints: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

CONCRETE PLACEMENT

A. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

B. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.

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

D. Hot-Weather Placement: Comply with ACI 301.

FINISHES

A. Architectural Concrete Finish: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

C. Maintain uniformity of special finishes over construction joints, unless otherwise indicated.

D. Form Liner Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture.

E. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi (6.9 to 10.3 MPa), apply scrubbed finish. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed. Rinse scrubbed surfaces with clean water. Maintain continuity of finish on each surface or area of Work. Remove only enough concrete mortar from surfaces to match design reference sample or mockup.

F. High-Pressure Water-Jet Finish: Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of 4500 psi (31 MPa). Coordinate with formwork removal to ensure that surfaces to be high-pressure water-jet finished are treated at same age for uniform results.

G. Abrasive-Blast Finish: Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi (13.8 MPa). Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results. Expose aggregate as follows:

1. Brush: Remove cement matrix to dull surface sheen and expose face of fine aggregate; with no significant reveal.
2. Light: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; with maximum reveal of 1/16 inch (1.5 mm).
3. Medium: Generally expose coarse aggregate; with slight reveal, a maximum of 1/4 inch (6 mm).
4. Heavy: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter; with reveal range of 1/4 to 1/2 inch (6 to 13 mm).

H. Bushhammer Finish: Allow concrete to cure at least 14 days before starting bushhammer surface finish operations.

1. Surface Continuity: Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances of cut as shown on Drawings or to match design reference sample or mockup.
2. Surface Cut: Maintain required depth of cut and general aggregate exposure.

CONCRETE CURING

A. Begin curing cast-in-place architectural concrete immediately after removing forms from concrete. Cure according to ACI 308.1, by one or a combination of curing compound methods that will not mottle, discolor, or stain concrete:

FIELD QUALITY CONTROL

A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for field quality-control requirements.

REPAIRS AND PROTECTION

A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

   1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.

B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.

C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

DIVISION 4 UNIT MASONRY

SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Decorative concrete masonry units.
3. Pre-faced concrete masonry units.
4. Concrete brick.
5. Face brick.
6. Building (common) brick.
7. Hollow brick.
8. Glazed Structural-clay facing tile.
9. Adhered Stone Masonry
10. Cast Stone Masonry

B. See Division 05 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.

C. See Division 07 Section "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints for metal flashing.

D. Allowances: The following are included under the allowances indicated as specified in Division 01 Section "Allowances."

1. Face brick under the Face Brick Allowances.
2. Preconstruction and field quality-control testing under Testing and Inspecting Allowance.

SUBMITTALS

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

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Samples for each type and color of exposed masonry units and] colored mortars.

D. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.

1. For masonry units include material test reports substantiating compliance with requirements.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

F. HIGH PERFORMANCE DESIGN

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

4. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

QUALITY ASSURANCE

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner.

1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
3. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

C. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches (1200 mm) <Insert size> long by 48 inches (1200 mm) high.

PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

MANUFACTURERS

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

COLORS, TEXTURES, AND PATTERNS

A. Exposed Masonry Units: Match sample.

CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength **for exposed units**.

1. Available Products: Addiment Incorporated; Block Plus W-10.
   Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
   Master Builders, Inc.; Rheopel.

C. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
2. Weight Classification: Lightweight.
3. Pattern and Texture for Decorative Units: Standard pattern, ground finish.
   Standard pattern, split-face finish. Standard pattern, split-ribbed finish. Scored vertically, standard finish. Triple scored vertically, standard finish.

4. Pre-faced Concrete Masonry Units: Lightweight concrete units, with smooth resinous facing complying with ASTM C 744.

   Size: Manufactured with pre-faced surfaces having 1/16-inch- (1.5-mm-) wide returns of facing to create 1/4-inch- (6.5-mm-) wide mortar joints.

D. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3500 psi (24.1 MPa).
2. Weight Classification: Lightweight.

CONCRETE AND MASONRY LINTELS

A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.

B. Concrete Lintels: Precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.

C. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade SW, Type FBX.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4400 psi (30.3 MPa).
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
5. Size (Actual Dimensions): 3-1/2 inches (89 mm) or 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 8 inches (203 mm) long.

C. Building (Common) Brick: ASTM C 62, Grade SW.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4400 psi (30.3 MPa).
2. Size: Match size of face brick.

D. Hollow Brick: ASTM C 652, Grade SW, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area, Type HBX.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4400 psi (30.3 MPa).
2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
3. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
4. Size (Actual Dimensions): 7-1/2 inches (190 mm) wide by 3-1/2 inches (89 mm) high by 11-1/2 inches (292 mm) long or] 7-5/8 inches (194 mm) wide by 3-5/8 inches (92 mm) high by 11-5/8 inches (295 mm) long.

STRUCTURAL-CLAY FACING TILE

A. General:

1. Provide multicored units designed for use in reinforced, grouted masonry.
2. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated that cannot be produced by sawing standard units.

B. Glazed Structural-Clay Facing Tile: ASTM C 126, Grade S (Select).

1. Sizes: 8W Series with actual face dimensions of 7-3/4 inches (197 mm) high by 15-3/4 inches (400 mm) long by widths indicated.
2. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.

MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II or I/II, except Type III may be used for cold-weather construction.

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

C. Masonry Cement: ASTM C 91.

1. Available Products: Capital Materials Corporation; Flamingo Color Masonry Cement. Essroc, Italcementi Group; Brixment or Velvet. Lafarge North America Inc.; Trinity Super White Masonry Type S. Lehigh Cement Company; Lehigh Masonry Cement. National Cement Company, Inc.; Coosa Masonry Cement.

D. Mortar Pigments: Iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Available Products: Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments. Davis Colors; True Tone Mortar Colors. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.

E. Colored Cement Product: Packaged blend made from portland cement and lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
2. Available Products: Colored Portland Cement-Lime Mix: Capital Materials Corporation; Riverton Portland Cement Lime Custom Color. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime. Lafarge North America Inc.; Eaglebond. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

F. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products: Addiment Incorporated; Mortar Kick. Euclid Chemical Company (The); Accelguard 80. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset. Sonneborn, Div. of ChemRex; Trimix-NCA.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

1. Available Products: Addiment Incorporated; Mortar Tite.
Dry-Block Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture. Master Builders, Inc.; Color Cure Mortar Admix or MasterPel 240MA Rheopel; Blocktite Mortar Admixure, by Euclid Chemical

K. Water: Potable.

REINFORCEMENT

L. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420). 60% Recycled Content

M. Masonry Joint Reinforcement: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.

2. Wire Size for Cross Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
3. Wire Size for Veneer Ties: W2.8 or 0.188-inch (4.8-mm) diameter.
4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
5. Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
   Multiwythe Masonry: Select acceptable types from first three subparagraphs below. More than one type may be needed; Part 3 "Composite Masonry" and "Cavity Walls" articles specify types required for various applications. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width. Tab type, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Retain option in first subparagraph below in Seismic Design Categories E and F (UBC Seismic Zones 3 and 4) and in other locations if continuous horizontal wire is used to reinforce veneer wythe. Adjustable (two-piece) type, with one side rod at each face shell of backing wythe and with ties that extend into facing wythe. Ties engage eyes or slots in reinforcement and extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous wire in the facing wythe.

6. Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm) diameter, hot-dip galvanized, carbon-steel continuous wire.

TIES AND ANCHORS

A. Materials:

   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
   2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
   3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

   1. Wire: Fabricate from 3/16-inch- (4.8-mm) diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

   1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
   2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from [0.188-inch- (4.8-mm) diameter, hot-dip galvanized steel wire.

3. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.

E. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M

G. Adjustable Masonry-Veneer Anchors General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows: Structural Performance Characteristics: Capable of withstanding a ***100-lbf (445-N)*** load in both tension and compression without deforming or developing play in excess of ***0.05 inch (1.3 mm)***.

H. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting wire tie. Fabricate sheet metal anchor sections from 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.

I. Available Products:

1. Dayton Superior Corporation, Dur-O-Wal Division; D/A 21 or D/A 210 with D/A 700-708. Heckmann Building Products Inc.; 315-D with 316. Hohmann & Barnard, Inc.; DW-10. Wire-Bond; 1004, Type III or RJ-711.

2. Seismic Masonry-Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.

3. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, and slotted holes for inserting connector section.
Connector Section: Rib-stiffened, sheet metal bent plate; sheet metal clip; or wire tie and rigid extruded vinyl clip designed to engage continuous wire. Size connector to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.

4. Fabricate sheet metal anchor sections and other sheet metal parts from 0.097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.

5. Fabricate wire connector sections from 0.188-inch- (4.8-mm) diameter, hot-dip galvanized, carbon-steel wire.

Available Products: Dayton Superior Corporation, Dur-O-Wal Division; D/A 213S. Hohmann & Barnard, Inc.; DW-10-X-Seismiclip. Wire-Bond; RJ-711 with Wire-Bond clip.

EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing**,** where flashing is exposed or partly exposed and where indicated, complying with Division 07 Section "Sheet Metal Flashing and Trim."

1. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
2. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
3. Metal Expansion-Joint Strips: Fabricate from stainless steel copper to shapes indicated.

B. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. (2-kg/sq. m) copper sheet bonded with asphalt between 2 layers of glass-fiber cloth.

2. Available Products: Advanced Building Products Inc.; Copper Fabric Flashing. AFCO Products Inc.; Copper Fabric. Hohmann & Barnard, Inc.; H & B C-Fab Flashing. Phoenix Building Products; Type FCC-Fabric Covered Copper. Polytite Manufacturing Corp.; Copper Fabric Flashing. Sandell Manufacturing Co., Inc.; Copper Fabric Flashing. York Manufacturing, Inc.; York Copper Fabric Flashing.

3. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less 0.040 inch (1.0 mm).

4. Available Products: Advanced Building Products Inc.; Peel-N-Seal. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier-44. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing. Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing. Hohmann & Barnard, Inc.; Textroflash. Polyguard Products, Inc.; Polyguard 300. Polytite Manufacturing Corp.; Poly-Barrier Self-Adhering Wall Flashing. Williams Products, Inc.; Everlastic MF-40.

5. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.025 inch (0.6 mm) thick, with a 0.015-inch- (0.4-mm-) thick coating of rubberized-asphalt adhesive.

6. Available Products: Hyload, Inc.; Hyload Cloaked Flashing System.

7. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.

8. Available Products: Carlisle Coatings & Waterproofing; Pre-Kleened EPDM Thru-Wall Flashing. Firestone Building Products; FlashGuard. Heckmann Building Products Inc.; No. 81 EPDM Thru-Wall Flashing.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer.

MISCELLANEOUS MASONRY ACCESSORIES

A. Revise first two paragraphs below if a specific product is required.

B. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene.

C. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. Weep/Vent Products: Use one of the following, unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

3. Available Products: Advanced Building Products Inc.; Mortar Maze weep vent. Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents. Heckmann Building Products Inc.; No. 85 Cell Vent. Hohmann & Barnard, Inc.; Quadro-Vent. Wire-Bond; Cell Vent.

4. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

5. Available Products: Mortar Net USA, Ltd.; Mortar Net Weep Vents.

F. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

G. Provide one of the following configurations:
   1. Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep.
   2. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
   3. Sheets or strips full depth of cavity and installed to full height of cavity.

   4. Available Products: Advanced Building Products Inc.; Mortar Break. Archovations, Inc.; CavClear Masonry Mat. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop. Mortar Net USA, Ltd.; Mortar Net.

INSULATION

A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

B. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.

   1. Available Products: Concrete Block Insulating Systems; Korfil. Shelter Enterprises Inc.; Omni Core.

C. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.

D. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).

MASONRY CLEANERS

A. Verify acceptability of cleaner for cleaning masonry with pigmented mortar joints and for kinds of masonry units specified.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

   1. Available Manufacturers: Diedrich Technologies, Inc. EaCo Chem, Inc. ProSoCo, Inc.

MORTAR AND GROUT MIXES

A. General: Do not use admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

D. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

MORTAR BEDDING AND JOINTING

A. Delete first paragraph and subparagraphs below if no hollow concrete masonry units are required. Mortar bedding of cross webs should be added if required.

B. Lay hollow brick and concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

C. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

D. Lay structural-clay tile as follows:

1. Lay vertical-cell units with full head joints, unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.

2. Lay horizontal-cell units with full bed joints, unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position.
3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6- to 10-mm-) thick joints.
4. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
2. Masonry Joint Reinforcement: Installed in horizontal mortar joints. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes or tab-type reinforcement. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at exterior walls, except cavity walls, and interior walls and partitions.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
3. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

CAVITY WALLS

A. Delete this Article if cavity walls are not used.

B. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
2. Masonry Joint Reinforcement: Installed in horizontal mortar joints. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes or tab-type reinforcement. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.

E. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing."

F. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit insulation between wall ties and other confining obstructions, with edges butted tightly. Press units firmly against inside wythe of masonry.

MASONRY-CELL INSULATION

A. Delete paragraph below if granular insulation is not used.

B. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story in height, but not more than 20 feet (6 m).

C. Install molded-polystyrene insulation units into masonry unit cells before laying units.

MASONRY JOINT REINFORCEMENT

A. General: Install in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

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

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

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

ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing, concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners.
2. Embed tie sections, connector sections and continuous wire in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. (0.25 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products or open head joints] to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

REINFORCED UNIT MASONRY INSTALLATION

A. Usually retain first paragraph and subparagraphs below only if reinforced masonry beams, slabs, soffits, and similarly formed elements are required.

B. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

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

C. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

D. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

1.2 FIELD QUALITY

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

1. Payment for these services will be made by Owner.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.

E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

H. Prism Test: For each type of construction provided, according to ASTM C 1314 at seven days and 28 days.

PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm) with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours and protect parging until cured.

CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel in location agreed to by owner; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-4A applicable to type of stain on exposed surfaces.

STRUCTURAL STEEL FRAMING (051200)

SUMMARY

A. This Section includes structural steel and grout.

PERFORMANCE REQUIREMENTS

B. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand LRFD loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9.

SUBMITTALS

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

B. High Performance Submittal:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Certificates: for products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

C. Shop Drawings: Show fabrication of structural-steel components.

D. Welding certificates.

E. Mill test reports.

F. Source quality-control test reports.

QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

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

C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges 303-10 or current addition" and AISC 360-10 or current addition.

D. Preinstallation Conference: Conduct conference at Project site.

STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

B. W-Shapes: ASTM A 992/A 992M.

C. Channels, Angles, M, and S-Shapes: ASTM A 36/A 36M.

D. Plate and Bar: ASTM A 36/A 36M.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

G. Welding Electrodes: Comply with AWS requirements.

BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

   1. Finish: Plain.
   2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8,) compressible-washer type. Finish: Plain

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

   1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36

1. Configuration: Straight.
2. Finish: Plain

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Finish: Plain.

F. Threaded Rods: ASTM A 193/A 193M.

1. Finish: Plain

PRIMER

A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI #79 and compatible with topcoat.

GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. 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.

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 AISC 303" and AISC's “Load and Resistance Factor Design Specification for Structural Steel Buildings AISC 360"

B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

   1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

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 be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. 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 2, "Hand Tool Cleaning."
   2. 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 dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

SOURCE QUALITY CONTROL

D. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of Part 3, Article "Field Quality Control."

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

F. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding.

ERECTION

A. Examination: Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

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

B. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges AISC 303current edition " and “Load and Resistance Factor Design Specification for Structural Steel Buildings AISC 360 current edition."

C. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   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 base or bearing plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and base or bearing 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.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

   1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and “Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option: Liquid Penetrant Inspection: ASTM E 165. 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. Ultrasonic Inspection: ASTM E 164. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

STEEL JOIST FRAMING (052100)

SUMMARY

A. This Section includes the following:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. Long-span steel joists.
5. Joist girders.
6. Joist accessories.

SUBMITTALS

B. Product Data: For each type of joist, accessory, and product indicated.

C. High Performance Submittal:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

D. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

E. Welding certificates.

F. Manufacturer certificates.

G. Mill Certificates: For bolts.

H. Field quality-control test and inspection reports.

I. Research/Evaluation reports.

QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by the Steel Joist Institute (SJI) to manufacture joists complying with SJI standard specifications and load tables.

B. SJI Specifications: Comply with SJI's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, SJI's "Specifications") that are applicable to types of joists indicated.

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

DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

1. Recycled Content: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.

B. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

C. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Plain.

D. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type as follows and end and top-chord arrangements indicated.

1. Joist Type: LH-series steel joists and DLH-series steel joists.

JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members and with end and top-chord arrangements as indicated.

JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories. Apply 1 coat of shop primer.

INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with Research Council on Structural Connections' "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

STEEL DECKING (053100)

SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.
3. Noncomposite form deck.

SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. High Performance Submittal:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

D. Product certificates.

E. Welding certificates.

F. Field quality-control test and inspection reports.

G. Research/Evaluation Reports: For steel deck.

QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

C. 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."

D. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than **25** percent.

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.

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.

ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer. Color: Manufacturer's standard Gray.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer. Color: Manufacturer's standard.

4. Deck Profile: As indicated.
5. Profile Depth: As indicated..

6. Design Uncoated-Steel Thickness: As indicated.

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. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard gray or white baked-on, rust-inhibitive primer.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
4. Profile Depth: As indicated.
5. Design Uncoated-Steel Thickness: As indicated.

NONCOMPOSITE FORM DECK

A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum.
2. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer. Color: Manufacturer's standard.

3. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230)] G60 (Z180) zinc coating.
4. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer. Color: Manufacturer's standard.

5. Profile Depth: 9/16 inch (14 mm) minimum.
6. Design Uncoated-Steel Thickness: 0.0179 inch (0.45 mm).
7. Span Condition: Simple span.

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.

G. Galvanizing Repair Paint: ASTM A 780 with a minimum of 94 percent zinc dust by weight.

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).

1.2 Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

B. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

C. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

D. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

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.

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 top surface of prime-painted deck immediately after installation, and apply repair paint.

METAL FABRICATIONS (055000)

SUMMARY

A. This Section includes the following:

1. Miscellaneous steel framing and supports.
2. Prefabricated building columns.
3. Shelf angles.
4. Loose bearing and leveling plates.
5. Steel weld plates and angles.
6. Structural-steel door frames.
7. Miscellaneous steel trim.
8. Metal ladders and safety cages.
9. Metal bollards.
10. Pipe guards.
11. Bicycle racks.
12. Metal floor plate and supports.
13. Abrasive metal nosings, treads and thresholds.
14. Loose steel lintels.

B. See Division 05 Section "Metal Stairs" for metal-framed stairs.

C. See Division 05 Section "Pipe and Tube Railings" for metal pipe and tube railings.

D. See Division 05 Section "Metal Gratings" for metal gratings.

E. See Division 05 Section "Decorative Metal" for ornamental metal items.

F. See Division 05 Section "Decorative Metal Railings" for ornamental metal railings.

SUBMITTALS

A. Product Data: For the following:

1. Prefabricated building columns.
2. Metal nosings and treads.
3. Grout.

B. High Performance Submittal:

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material

manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

C. Shop Drawings: Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

D. Templates: For anchors and bolts.

E. Samples: For each type and finish of extruded nosing and tread.

MANUFACTURERS

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
3. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
4. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
5. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
6. Abrasive-Surface Floor Plate: Steel plate[with abrasive granules rolled into surface or with abrasive material metallically bonded to steel by a proprietary process. Available Products: IKG Industries, a Harsco company; Mebac. W. S. Molnar Company; SlipNOT.

7. Steel Tubing: ASTM A 500, cold-formed steel tubing.
8. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
9. Slotted Channel Framing: Cold-formed metal channels complying with MFMA-3, 1-5/8 by 1-5/8 inches (41 by 41 mm). Channels made from galvanized steel complying with ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.
10. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

C. Nonferrous Metals:

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6.
2. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.
3. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

FASTENERS

A. General: Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Cast-in-Place Anchors in Concrete: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.

B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Available Products: Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19. Carboline Company; Carbozinc 621. ICI Devoe Coatings; Catha-Coat 313. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content (94% minimum) paint for regalvanizing welds in steel.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

E. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

FABRICATION

A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
5. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches (600 mm) o.c.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate steel girders for wood frame construction from continuous steel shapes. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches (600 mm) o.c.
2. Fabricate steel pipe columns for supporting wood frame construction with steel baseplates and top plates welded to pipe with fillet welds the same size as pipe wall thickness.

C. Prefabricated Building Columns: Assemblies of load-bearing structural-steel members protected by insulating concrete fireproofing encased in an outer non-load-bearing steel shell and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing according to ASTM E 119.

1. Fire-Resistance Rating: As indicated.

D. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

1. Lintels in Exterior Walls: Galvanize Prime with zinc-rich primer.

E. Shelf Angles: Fabricate shelf angles of sizes indicated and for attachment to framing. Fabricate with horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c.

1. Shelf Angles in Exterior Walls: Galvanize.
2. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

F. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.

G. Structural-Steel Door Frames: Fabricate from structural shapes and bars fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel channel stops secured with countersunk machine screws. Reinforce frames and drill and tap as necessary to accept finish hardware. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

1. Exterior Frames: Galvanize.

H. Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Exterior Miscellaneous Steel Trim: Galvanize.

I. Metal Ladders and Safety Cages: Comply with ANSI A14.3, unless otherwise indicated.

1. Elevator Pit Ladders: Comply with ASME A17.1.
2. Space siderails 16 inches (406 mm) 18 inches (457 mm) apart, unless otherwise indicated.
3. Steel Ladder Construction: Flat bar siderails, with 3/4-inch- (19-mm-) diameter steel bar rungs fitted in centerline of siderails, plug-welded, and ground smooth on outer rail faces. Provide nonslip surfaces on top of each rung.
4. Aluminum Ladder Construction: Extruded channel or tube siderails, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick; with extruded tube rungs, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, fitted into centerline of siderails and fastened by welding or with stainless-steel fasteners or brackets and aluminum rivets. Provide rungs with ribbed tread surfaces.
5. Fabricate ladder safety cages to comply with ANSI A14.3. Fabricate from same metal as ladders to which safety cages are attached and assemble by welding or riveting.
6. Exterior Steel Ladders and Safety Cages: Galvanize.

J. Metal Bollards: Fabricate from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness rectangular steel tubing.

1. Cap bollards with 1/4-inch- (6-mm-) thick steel plate.
2. Fabricate bollards with 3/8-inch- (10-mm-) thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch (19-mm) anchor bolts.
3. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- (6-mm-) thick steel plate welded to bottom of sleeve.

K. Pipe Guards: Fabricate from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-

mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.

L. Bicycle Racks: Fabricate from Schedule 40 steel pipe, fully welded together.

1. Fabricate with NPS 3 (DN 80) top rails and end posts, NPS 1-1/2 (DN 40) bottom rails, and NPS 3/4 (DN 20) vertical separators at approximately 8 inches (200 mm) o.c.
2. Make top rails 36 inches (900 mm) above pavement/floor and bottom rails 4 inches (100 mm) above pavement/floor.
3. Fabricate end posts with 1/4-inch- (6.4-mm-) thick steel baseplates for bolting to concrete slab. Drill end post baseplates at all 4 corners for 1/2-inch (12.7-mm) anchor bolts.
4. Finish: Galvanize.

M. Metal Floor Plate:

1. Fabricate from rolled-steel floor plate of thickness indicated below: Thickness: 1/4 inch (6.4 mm).

2. Provide steel angle supports as indicated.
3. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

N. Abrasive Metal Nosings, Treads and Thresholds.

1. Cast-Metal Units: Cast gray iron, Class 20 with an integral abrasive finish.

2. Available Manufacturers: American Safety Tread Co., Inc. Balco Inc. Barry Pattern & Foundry Co., Inc. Granite State Casting Co. Safe-T-Metal Co. Wooster Products Inc.

3. Extruded Units: Aluminum, with abrasive filler in an epoxy-resin binder.

4. Available Manufacturers: ACL Industries, Inc. American Safety Tread Co., Inc. Amstep Products. Armstrong Products, Inc. Balco Inc. Granite State Casting Co. Wooster Products Inc.
5. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion. Provide solid-abrasive-type units without ribs.

6. Provide anchors for embedding units in concrete, either integral or applied to units.
7. Drill for mechanical anchors and countersink. Locate not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c.

FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

B. Steel and Iron Finishes:

1. Hot-dip galvanize items as indicated to comply with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed metal fabrications:
3. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

5. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting," for shop painting.

INSTALLATION

A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.

C. Bollards:

1. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch (19-mm) bolts at each bollard.
2. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout.
3. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
4. Fill bollards solidly with concrete, mounding top surface to shed water.

D. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

WOODS, PLASTICS AND COMPOSITES

ROUGH CARPENTRY (061000)

SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking, cants, and nailers.
5. Wood furring and grounds.
6. Wood sleepers.
7. Plywood backing panels.

SUBMITTALS

B. Product Data: For each type of process and factory-fabricated product.

1. Include data for **wood-preservative and fire-retardant** treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. High Performance Submittals:

1. Product Data: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

2. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

4. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

D. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

E. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.

2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Power-driven fasteners.
5. Powder-actuated fasteners.
6. Expansion anchors.
7. Metal framing anchors.

WOOD PRODUCTS, GENERAL

F. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, **mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency**.
3. Provide dressed lumber, S4S, unless otherwise indicated.

G. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, 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.

WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction~~.~~ **and containing no arsenic or chromium**.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat **all rough carpentry items indicated on Drawings, and the following:**

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, **furring, stripping,** and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

FIRE-RETARDANT-TREATED MATERIALS.

A. General: Comply with performance requirements in **AWPA C20 (lumber and AWPA C27 (plywood)**.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
3. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

C. Application: Treat **items indicated on Drawings, and the following:**

1. Framing for raised platforms.
2. Concealed blocking.
3. Framing for non-load-bearing partitions.
4. Framing for non-load-bearing exterior walls.
5. Roof construction.
6. Plywood backing panels.

DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: **19 percent**.

B. Non-Load-Bearing Interior Partitions: **Standard, Stud, or No. 3** grade of any species.

C. Framing Other Than Non-Load-Bearing Interior Partitions: **No. 2** grade and **any of** the following species:

1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (north); NLGA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

D. Framing Other Than Non-Load-Bearing Interior Partitions: Any species and grade with a modulus of elasticity of at least [**1,500,000 psi (10 350 MPa)** and an extreme fiber stress in bending of at least **1000 psi (6.9 MPa)** for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.

E. Exposed **Exterior** and **Interior**] Framing **Indicated to Receive a Stained or Natural Finish**: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type.
2. Species and Grade: Hem-fir (north), **No. 1** grade; NLGA.
3. Species and Grade: Southern pine, **No. 1** grade; SPIB.
4. Species and Grade: Douglas fir-larch; **No. 1** grade; WCLIB, or WWPA.
5. Species and Grade: Mixed southern pine, **No. 1**grade; SPIB.
6. Species and Grade: Spruce-pine-fir, **No. 1** grade; NLGA.
7. Species and Grade: Douglas fir-south; **No. 1** grade; WWPA.
8. Species and Grade: Hem-fir; **No. 1** grade; WCLIB, or WWPA.
9. Species and Grade: Douglas fir-larch (north); **No. 1** grade; NLGA.
10. Species and Grade: Spruce-pine-fir (south), **No. 1** grade; NeLMA, WCLIB, or WWPA.
11. Species and Grade: Eastern hemlock-balsam fir or Eastern hemlock-tamarack; **No. 1** grade; NeLMA.
12. Species and Grade: Redwood, **No. 1** grade; RIS.
13. Species and Grade: Western cedars, **No. 1** grade; WCLIB, or WWPA.

ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559 **and containing no urea formaldehyde**.

1. Extreme Fiber Stress in Bending, Edgewise: **2600 psi (17.9 MPa)** for 12-inch nominal-(286-mm actual-) depth members.
2. Modulus of Elasticity, Edgewise: **2,000,000 psi (13 700 MPa)**.

B. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.

1. Provide I-joists manufactured without urea formaldehyde.
2. Web Material: **Either oriented strand board or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1**.
3. Structural Properties: Provide units with depths and design values not less than those indicated.
4. Provide units complying with APA PRI-400, factory marked with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.

C. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.

1. Material: **All-veneer product or product made from any combination solid lumber, wood strands, and veneers**. **Provide rim boards made without urea formaldehyde.**
2. Thickness: **1-1/8 inches (28 mm).**
3. Provide performance-rated product complying with APA PRR-401, **rim board** grade, factory marked with APA trademark indicating thickness, grade, and compliance with APA standard.

MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide **Standard, Stud, or No. 3** grade lumber with 19 percent maximum moisture content of any species.

C. For concealed boards, provide lumber with **19** percent maximum moisture content and **any of** the following species and grades:

1. Mixed southern pine, No. **2** grade; SPIB.
2. Eastern softwoods, No. **2** Common grade; NeLMA.
3. Northern species, No. **2** Common grade; NLGA.
4. Western woods, **No. 2 Common** grade; WCLIB or WWPA.

PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, **fire-retardant treated,** in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners **with hot-dip zinc coating complying with ASTM A 153/A 153M**.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

METAL FRAMING ANCHORS

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:

C. Basis-of-Design Products: Subject to compliance with requirements, provide **products indicated on Drawings** or comparable products by one of the following:

1. Alpine Engineered Products, Inc.
2. Cleveland Steel Specialty Co.
3. Harlen Metal Products, Inc.
4. KC Metals Products, Inc.
5. Simpson Strong-Tie Co., Inc.
6. Southeastern Metals Manufacturing Co., Inc.
7. USP Structural Connectors.

D. 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.

E. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate **furring,** nailers, blocking, **grounds,** and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

HEAVY TIMBER CONSTRUCTION (061232)

SUMMARY

A. Section includes framing using timbers and round wood poles.

DEFINITIONS

B. Timbers: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.

C. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NeLMA - Northeastern Lumber Manufacturers Association.
2. NHLA - National Hardwood Lumber Association.
3. NLGA - National Lumber Grades Authority.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB - West Coast Lumber Inspection Bureau.
6. WWPA - Western Wood Products Association.

SUBMITTALS

A. Certificates of Inspection: Issued by lumber grading agency for exposed timber not marked with grade stamp.

QUALITY ASSURANCE

A. Timber Standard: Comply with AITC 108, "Standard for Heavy Timber Construction."

TIMBER

A. General: Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable.

1. Factory mark each item of timber with grade stamp of grading agency.
2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that will not be exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.

B. Timber Species and Grade: Any species and grade that, for moisture content provided, complies with required structural properties.

1. Allowable Stress Ratings for 12-Inch Nominal (286-mm Actual) Depth: [Fb 1500 psi (10.3 MPa) and E 1,500,000 psi (10 340 MPa).

C. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.

D. Dressing: Provide dressed timber (S4S) or timber that is rough sawn (Rgh) as indicated on drawings.

E. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

F. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

ROUND WOOD POLES

A. Round Wood Poles: Clean-peeled wood poles complying with ASTM D 3200; with at least 80 percent of inner bark removed and with knots and limbs cut flush with the surface.

TIMBER CONNECTORS

A. General: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
2. Round steel bars complying with ASTM A 575, Grade M 1020.
3. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.

B. Provide bolts, 3/4 inch (19 mm) unless otherwise indicated, complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); provide nuts complying with ASTM A 563 (ASTM A 563M); and, where indicated, provide flat washers.

C. Provide shear plates, 2-5/8 inches (66.7 mm) in diameter, complying with ASTM D 5933.

D. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil (0.05-mm) dry film thickness.

E. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

FABRICATION

A. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

B. Coat crosscuts with end sealer.

C. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

INSTALLATION

A. General: Erect heavy timber construction true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

B. Fit members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.

1. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
2. Coat crosscuts with end sealer.

C. Install timber connectors as indicated.

1. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

D. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber construction if repairs are not approved by Architect.

SHEATHING (061600)
(further editing needed to distinguish Baseline and High Performance standards)

SUMMARY

A. This Section includes the following:

1. Wall sheathing.
2. Roof sheathing.
3. Composite nail base insulated roof sheathing.
4. Subflooring.
5. Underlayment.
6. Building paper.
7. Building wrap.
8. Sheathing joint-and-penetration treatment.
9. Flexible flashing at openings in sheathing.

SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

B. High Performance Submittals:

1. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

2. Product Data: For composite-wood products, documentation indicating that product contains no urea formaldehyde.

3. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Research/Evaluation Reports: For the following:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.
4. Building wrap.

QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1, unless otherwise indicated.

B. Oriented Strand Board: DOC PS 2.

PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA C9.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood, unless otherwise indicated.

FIRE-RETARDANT-TREATED PLYWOOD

A. General: Comply with performance requirements in AWPA C27.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
3. Use Interior Type A, unless otherwise indicated.

B. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat all plywood, unless otherwise indicated..

WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Exposure 1 sheathing.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.

C. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core.

1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

D. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

E. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.

1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

F. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV, with tongue-and-groove or shiplap long edges as standard with manufacturer.

1. Thickness: As indicated.

G. Foil-Faced, Polyisocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I, Class 2, aluminum-foil-faced, glass-fiber-reinforced, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.

1. Thickness: As indicated.

ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior Exposure 1 sheathing.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing.

COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.

B. Vented, Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 1, with oriented strand board adhered to spacers on one face.

1. Polyisocyanurate-Foam Thickness: As indicated.
2. Oriented-Strand-Board Nominal Thickness: As indicated.

SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Underlayment single-floor panels.

B. Oriented-Stand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.

C. Plywood Subflooring: Exterior, Exposure 1 single-floor panels or sheathing.

D. Oriented-Strand-Board Subflooring: Exposure 1 single-floor panels or sheathing.

E. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.

F. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch (15.9-mm) nominal thickness, for ceramic tile set in epoxy adhesive.

G. Plywood Underlayment for Carpet: DOC PS 1, Exposure 1, Underlayment..

H. Particleboard Underlayment: ANSI A208.1, Grade M-2, Exterior Glue, complying with dimensional tolerances and thickness swell requirements of Grade PBU.

I. Hardboard Underlayment: AHA A135.4, Class 4 (Service), Surface S1S; with back side sanded.

FASTENERS

A. General: Provide fasteners of size and type indicated.

1. For wall and roof sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

WEATHER-RESISTANT SHEATHING PAPER

A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

B. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
Products: Subject to compliance with requirements, provide one of the following: Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap. Ludlow Coated Products; Air Stop Housewrap, Barricade Building Wrap EnergyWrap Housewrap, R-Wrap Protective House Wrap. Pactiv, Inc.; GreenGuard Classic Wrap, RainDrop, Ultra Wrap, Value Wrap. Raven Industries Inc.; Rufco-Wrap. Reemay, Inc.; Typar HouseWrap.

2. Water-Vapor Permeance: Not less than 63g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).

C. Building-Wrap Tape: Tape recommended by building-wrap manufacturer.

SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced Gypsum Sheathing Board: Elastomeric silicone joint sealant recommended by sheathing manufacturer.

B. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, and recommended by tape and sheathing manufacturers.

C. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, of type recommended by sheathing and tape manufacturers.

D. Sheathing Tape for Foam-Plastic Sheathing: Tape recommended by sheathing manufacturer.

MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use indicated by manufacturers of both adhesives and panels.

   1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm).

INSTALLATION, GENERAL

A. Securely attach to substrate by fastening as indicated, complying with the following:

   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
   3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
   4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
   5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
   6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
   7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."

B. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.

C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."

   1. Comply with "Code Plus" installation provisions in guide referenced in paragraph above.

B. Fastening Methods: Fasten panels as indicated below:

   1. Combination Subfloor-Underlayment: Glue and nail to wood framing. Screw to cold-formed metal framing.

   2. Subflooring: Glue and nail to wood framing. Screw to cold-formed metal framing.

Wall and Roof Sheathing: Nail or staple to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels. Screw to cold-formed metal framing.

3. Underlayment: Nail or staple to subflooring.

GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
4. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials.

FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

PARTICLEBOARD UNDERLAYMENT INSTALLATION

A. Comply with the National Particleboard Association's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.

1. Fastening Method: Glue and nail underlayment to subflooring.

HARDBOARD UNDERLAYMENT INSTALLATION

A. Comply with AHA's "Application Instructions for Basic Hardboard Products" and with hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.

1. Fastening Method: Nail or staple underlayment to subflooring.

WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.

2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed tape in sealant. Apply sealant to exposed fasteners. Seal other penetrations and openings.
3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
2. Lap flashing over weather-resistant building paper at bottom and sides of openings.
3. Lap weather-resistant building paper over flashing at heads of openings.
4. After flashing has been applied, roll surfaces with a hard rubber or metal roller.

PROTECTION

A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

SHOP-FABRICATED WOOD TRUSSES (061753)

SUMMARY

A. This Section includes the following:

1. Wood roof trusses.
2. Wood floor trusses.
3. Wood girder trusses.
4. Wood truss bracing.
5. Metal truss accessories.

PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.

SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
5. Show splice details and bearing details.
6. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification Data: For metal-plate manufacturer, professional engineer, fabricator and Installer.

D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Metal-plate connectors.
2. Metal truss accessories.

QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

   1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Comply with applicable requirements and recommendations of the following publications:

   1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
   2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
   3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

DIMENSION LUMBER

A. Lumber: DOC PS 20. Provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

   1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section Miscellaneous Rough Carpentry.

METAL PRODUCTS

A. Connector Plates: Fabricate connector plates to comply with TPI 1 from hot-dip galvanized steel sheet complying with ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

B. Fasteners: Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

1. Nails, Brads, and Staples: ASTM F 1667.
2. Power-Driven Fasteners: NES NER-272.
3. Wood Screws: ASME B18.6.1.
4. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
5. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

C. Metal Truss Accessories: Provide truss accessories made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following: Cleveland Steel Specialty Co. Harlen Metal Products, Inc. KC Metals Products, Inc. Simpson Strong-Tie Co., Inc. Southeastern Metals Manufacturing Co., Inc. USP Structural Connectors.

4. 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.

FABRICATION

A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.

F. Securely connect each truss ply required for forming built-up girder trusses.

G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Division 06 Section Miscellaneous Rough Carpentry.
2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

H. Install wood trusses within installation tolerances in TPI 1.

I. Do not cut or remove truss members.

J. Replace wood trusses that are damaged or do not meet requirements.

GLUE – LAMINATED CONSTRUCTION (061800)
(further editing needed to distinguish Baseline and High Performance standards)

SUMMARY

A. Section includes framing using structural glued-laminated timber.

SUBMITTALS

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

B. High Performance Submittals:

1. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

2. Product Data for laminating adhesive used for structural glued-laminated timber, indicating that product contains no urea formaldehyde.

3. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.

QUALITY ASSURANCE

A. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that will not be exposed in the completed Work.

B. Quality Standard: Comply with AITC A190.1.

DELIVERY, STORAGE, AND HANDLING

A. General: Comply with provisions in AITC 111.

B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

STRUCTURAL GLUED-LAMINATED TIMBER

A. General: Provide structural glued-laminated timber that complies with AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.

1. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
2. Provide structural glued-laminated timber made with wet-use adhesive complying with ASTM D 2559. Use adhesive that contains no urea-formaldehyde resins.

B. Species and Grades for Structural Glued-Laminated Timber: **Any species** that complies with **structural properties** indicated.

C. Species and Grades for **Beams and Purlins**:

1. Species and Beam Stress Classification: **Any species, 24F-1.7E.**
2. Lay-up: **Either balanced or unbalanced**.

D. Species and Grades for Arches:

1. Species and Beam Stress Classification: **Any species, 24F-1.7E**.
2. Lay-up: **Either balanced or unbalanced**.

E. Species and Grades for **Column and Truss Members**:

1. Species and Combination Symbol: **Douglas fir-larch, 1**

F. Appearance Grade: **Architectural**, complying with AITC 110.

G. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

H. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

TIMBER CONNECTORS

A. General: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
2. Round steel bars complying with ASTM A 575, Grade M 1020.
3. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.

FABRICATION

A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.

C. End-Cut Sealing: Immediately after end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.

D. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

INSTALLATION

A. General: Erect structural glued-laminated timber true and plumb, and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

   1. Lift with padded slings and protect corners with wood blocking.

B. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing.

   1. Predrill for fasteners using timber connectors as templates.
   2. Dress exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
   3. Coat cross cuts with end sealer.

C. Cutting: Avoid cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

D. Repair damaged surfaces after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

E. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose including protection from weather, sunlight, soiling, and damage from work of other trades.

DIVISION 7 THERMAL AND MOISTURE PROTECTION

GENERAL (070000)

A. For all roof designs use of FM approved roof assemblies. County requires submittal of a RoofNav Contractor Package or an APPLICATION FOR ACCEPTANCE OF ROOFING SYSTEM (FM form EMV 2688 with detailed installation plans and materials and submittals to FM Global for review prior to installation. Design and install roofs in accordance with the FM Global on-line RoofNave application at www.roofnav.com and FM Global Property Loss Prevention Data Sheets 1-54 (Roof Loads for new Construction), 1-28 DESIGN WIND LOADS, 1-29 ROOF DECK SECUREMENT AND ABOVE-DECK ROOF COMPONENETS, 1-49 PERIMETER FLASHING and 1-31 METAL ROOF SYSTEMS as applicable. The RoofNav data base application at www.roofnav.com can be used to access and apply the above references to roof designs.

HIGH PERFORMANCE DESIGN

A. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 for a low-sloped roof and 29 for a steep-sloped roof, when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

B. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List".

C. Energy Performance: Provide roofing system with initial solar reflectance not less than **0.70** and emissivity not less than **0.75** when tested according to CRRC-1.

D. Install a vegetated roof for at least 50% of the roof area.

SUBMITTALS

A. HIGH PERFORMANCE DESIGN

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

4. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

5. Product Test Reports for roof, indicating that materials comply with solar reflectance index requirement.

SHEET WATERPROOFING (071300)

A. For basements and occupied levels below grade provide sheet waterproofing products which have been produced and installed to establish and maintain watertight continuous seals.

B. Types of sheet waterproofing specified may include the following:

1. Neoprene sheet waterproof membranes.
2. Butyl sheet waterproof membranes.
3. EPDM sheet waterproof membranes.
4. PVC sheet waterproof membranes.
5. Polyethylene sheet waterproof membranes.
6. Bituminous sheet waterproofing, premolded.
7. Rubberized asphalt sheet waterproofing.
8. Copper fabric sheet waterproofing.

Warranty

A. Provide written warranty, agreeing to replace/repair defective materials and workmanship. Warranty includes responsibility for removal and replacement of other work which conceals sheet waterproofing. Warranty period shall be minimum 3 years after date of substantial completion.

Testing

A. In-place Testing: Before completed membranes on horizontal surfaces are covered by protection course or other work, test for leaks with 2” depth of water maintained for 24 hours. Repair any leaks revealed by examination of substructure and repeat test until no leakage is observed.

EXTERIOR INSULATION AND FINISH SYSTEMS (072400)

A. It is required that the manufacturer supply a current compliance report from the National Evaluation Service (US), BOCA Evaluation Services, ICBO Evaluation Services, SBCCI Public Safety Testing and Evaluation Services or an equivalent report (outside the US) which shows the durability, fire performance, system structural performance and component performance. Fire performance should be demonstrated by a large-scale fire test (example: UBC 26-4 [formerly UBC 17-6], FM Approvals Corner Test, CAN/ULC-S134, UBC 26-3, UBC 26-9).

In the absence of an independent evaluation service, individual test reports conducted by recognized, independent testing agencies, should be submitted for review.

B. The substrate should be acceptable to the system manufacturer and should be noncombustible (i.e. brick, masonry, concrete) or minimum 1.2 in. (12mm) water-resistant core gypsum sheathing. Plywood, oriented-strand board (OSB) or other combustible sheathing materials should not be used as a substrate for EIFS unless the EIFS has been specifically tested (large-scale tests indicated in 2.3) or Approved with them and the system manufacturer finds them acceptable for the adhesives/mechanical fasteners to be used.

C. When the insulation is adhered to gypsum board, only glass mat-faced gypsum board should be used. Paper-faced gypsum board (ordinary and water-resistant core) should not be used.

D. Systems where the insulation board is secured directly to metal or wood studs (i.e., without a sheathing substrate over the exterior of the studs) should not be used.

E. The total heat content of insulation in EIFS systems should not exceed 6,000 Btu/ft2 (68 MJ/m2) in any portion of the wall. The insulation thickness should not exceed the maximum thickness tested and listed in the compliance report (see A).

F. Install only as much insulation as can be covered with a layer of base coat in a single working day, or prior to expected start of inclement weather. Seal unfinished edges at the end of each day to minimize potential moisture damage.

G. System shall be resistant to water penetration from exterior into system and assemblies behind it or through them into interior of building which results in deterioration of thermal-insulating effectiveness or other degradation of system and assemblies behind system including substrates, supporting wall construction, and interior finish.

H. System shall be designated and installed to be free from bond failure within system components for between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.

I. Reinforcing Fabric shall be used and shall be of heavy-duty and installation for all areas subject to impact and damage. Reinforcing shall be of the following minimum design. Balanced, alkali-resistant open weave glass fiber fabric treated for compatibility with other system materials; made from continuous multi-ended strands with tensile strength of not less than 120 lbs. and 140 lbs. in warp and fill directions, respectively, per ASTM D 1682 and complying with ASTM D 578.

J. Expansion joints shall be designed and installed at minimum intervals recommended by EIMA or the manufacturer.

ASPHALT SHINGLES (073113)

A. Asphalt shingles shall only be used on a limited basis and only with the approval of the County project representative. Shingles used shall be Class 'A' of minimum thirty year wear rating. Architectural, three-dimensional laminated style shingles are preferable.

B. Because of fire hazards wood shakes shall only be used on a limited basis where there is an existing facility with existing wood shakes and only with the approval of the County project representative.

BUILT-UP ASPHALT ROOFING SYSTEM (075113)

A. Built-up asphalt roofing is only to be used on a limited basis where there is an existing facility with existing built-up roofing and there is a need to tie into the existing roof. Asphalt roofing may only be specified with the approval of the County project representative.

FLEXIBLE SHEET ROOFING SYSTEM (075300 & 075400)

Roofing System

A. All roofing, insulation, flashings and accessories shall be applied in strict accordance with the approved roofing materials manufacture's latest printed specifications for a 20-year bonded type roof.

B. Use full coverage 20-year bond roofing specification with reinforcing for the type of deck upon which the roofing is to be applied.

C. Specifications for roofing installation shall be formulated by the architect after consultation with the County project representative. Specifications shall include the following:

1. General contractor and roofing sub-contractor jointly agree, for a period of two (2) years after the date of substantial completion, in inspect and make immediate emergency temporary repairs as required to stop leaks or correct defects in the roofing system work, including attachments to

metal flashings forming an integral part of the roofing, within three working days of notice received from the owner by telephone, telegram or letter; and further agree to make permanent repairs to restore the affected items to the standards of construction required by these specifications within a reasonable time and as weather conditions permit; and further agree to make such temporary and permanent repairs without reference to or consideration of the cause or nature of such leaks or defects in the waterproofing work. In case of defective roofing system work, damage caused by leaks or by their repair shall also be repaired. Work required within the period shall be completed without cost to the owner, except that repair work required because of Acts of God, abuse, alterations or failure of the substrate or supporting structure (other than that caused by defects in the roofing work), will be paid for by the owner, promptly after completion of the required repair work in each instance. However, this agreement and the enforcement of its provisions shall not deprive the owner of any action, right or remedy otherwise available to him.

D. Acceptable roofing systems include the following:

1. Polyvinyl Chloride (PVC.)
2. Ethylene Propylene Diene Monomer (EPDM.)
3. Elastomeric Membrane
4. Thermoplastic Membrane
5. Thermoplastic Polyolefin (TPO)

Roofing system selection shall be coordinated with County project manager.

E. All roofing membrane systems to be installed in strict accordance with the manufacturer's printed instructions.

ROOF DECKS (coordinate with Division 5 & Division 6)

A. All roofs shall be designated so that there is a minimum slope of 2½ % to a roof drain or minimum of ¼" slope per foot. The roof shall not have any flat spots or ponding of water on the surface of the roof. Supplemental slopes shall be provided by crickets utilizing tapered insulation.

B. Cant strips, if any, on flat roof decks shall be at least 4" high (preferably 6") and shall slope toward a drain not less than 3" per foot (25%).

C. Roof insulation shall comply with current recommendations of ASHRAE Utah State and Federal Regulations.

ROOF PENETRATIONS AND FLASHINGS (076000 & 077000)

A. Two or more objects shall not extend through the roofing closer than 18" unless both objects are flashed with integral flashings. No objects shall extend through the roof closer than 18" from cant strips of firewalls, etc.

B. The Architect should clearly designate who is to furnish each type of flashing, counter flashing, roof jack, etc; whether they are lead, steel, copper, galvanized iron, etc.

SHEET METAL FASCIAE AND COPINGS (076200)

A. Sheet metal fasciae and copings shall be minimum 24 gauge metal and heavier where subjected to impact. Sheet metal shall be prefinished with manufacturer's standard baked-on or flouropolymer coating.

B. Other exposed sheet metal fabrications such as window sills and trim shall be minimum 22 gauge metal and heavier where subjected to impact. Sheet metal shall be prefinished with manufacturer's standard baked-on flouropolymer coating.

ROOF HATCHES (077200)

A. Roof hatches will be needed for the following two circumstances:

1. For mechanical equipment on roofs needing servicing; and
2. For roof heights above 16 feet with or without mechanical equipment.

B. Roof hatches should be 30" square minimum size. Where major mechanical systems placed on the roof are involved, hatches should measure 34" x 72" and should be accessed by a ship's ladder-type stairway.

C. If the roof of a building has several levels, ladders on the roof will be needed extending between levels or a roof hatch for each level will be necessary.

DIVISION 8 OPENINGS

BUILDING ENTRANCES (SECTIONS 081000 & 084000)

A. All major building entrances shall have two sets of doors with at least seven feet between the inner and the outer doors as required by ADA.

B. Glass panels in doors or at the side of the doors must have a horizontal bar or other high contrast visual marking the same height as the panic device to prevent people from walking through.

C. All public entrances provided in accordance with Paragraph F206.4.1 (Public Entrances) of the ABAAS shall have at least one entrance door complying with Section 404.3 (automatic and Power-Assisted Doors and Gates) of the ABAAS. Where a public entrance has a vestibule with exterior and interior entrance doors, at least one exterior door and at least one interior door shall comply with Section 404.3.

D. Before project is turned over to the Owner for occupancy, all interior doors shall be balanced to operate with 5lbs of force, and a sweep period of 5 seconds minimum.

Exterior Doors and Frames

A. Exterior doors on all public entrances shall be three feet wide or wider.

Interior Doors and Frames

A. Interior doors may be wood or metal of institutional quality. Styles and rails shall be reinforced to adequately support hinges, locks and closers. All interior doors must comply with National Fire Protection Association regulations.

B. Interior door frames shall be metal. Wood door frames are not acceptable.

DAYLIGHTING (NO SECTION REFERENCE)

A. Provide direct line-of-sight vision glazing for building occupants in a minimum of 75% of all regularly occupied spaces, unless directed otherwise for security or functional purposes by the County Project Manager.

HIGH PERFORMANCE DESIGN

A. Provide direct line-of-sight vision glazing for building occupants in 90% of all regularly occupied spaces, unless directed otherwise for security or functional purposes by the County Project Manager.

SUBMITTALS

A. HIGH PERFORMANCE DESIGN

1. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

2. Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

4. Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: adhesives, sealants, paints, & coatings.

5. Product Data for adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

6. Design Team to Submit Daylight area and percentage calculations.

B. Submit Daylight area and percentage calculations by utilizing USGBC method of calculations for applicable LEED® Credit.

SKYLIGHTS (SECTION 086200)

A. Specifications for skylight installation shall be formulated by the architect after consultation with the County project representative. Fiberglass, translucent, sandwich-panel type skylight systems are preferable to plastic dome skylights. Skylight must be of sandwich panel construction type, with mechanically pre-assembled components finished as a unit. Acceptable manufacturers are to be reviewed approved by Salt Lake County.

B. All skylight systems must be listed by a recognized building code authority (such as The International Conference of Building Officials) which requires quality control inspections by an approved agency.

C. Indicate NRCA requirements for assembly to be submitted by Contractor.

KEYING AND LOCKSETS (SECTION 087100)

A. Key schedule shall be prepared by the contractor and approved by the owner prior to keying. Keying shall be according to the specification provided. Complete keying shall be turned over to owners' representative.

B. Locksets and all keying cylinders shall be comply with the following performance specifications:

1. Twin 6000 with 51 keyway, double side bar
2. Grade 1, UL Listed quality
3. Allow multiple brands of lock types and keys into 1 system.
4. Allow owner key control.
5. Pick resistant and will not allow key butting.
6. All entries to have ASSA cylinders.

C. Contractor shall use construction cylinders for all construction period keying. Permanent keying cylinders shall be installed just prior to completion.

DOOR CLOSERS (SECTION 087100)

A. Where door closers are required for functional or safety reasons, they shall be from an acceptable manufacturer's heavy-duty, overhead, surface-mounted type.

B. Closer must be made of cast iron, providing superior burst and yield strength, and must be tested to over 10 million cycles, demonstrating durability, elimination of internal leaks, and minimum porosity, additionally minimizing expansion and contraction.

C. Closers shall have forged steel arms, providing maximum strength, including tensile and side loading.

D. Closers must have a minimum 1 ½" piston bore diameter to minimize abusive pressure spikes and achieve less psi of hydraulic pressure.

E. Closers must have a double heat-treated pinion 11/16" with large teeth, and use full compliment bearings.

F. All-weather hydraulic fluid must be provided in closers where temperature differential spans -30 degrees Fahrenheit to 120 degrees Fahrenheit, thus eliminating seasonal adjustments.

G. Powder-coated finish to be provided, passing a 100 hour salt spray test 4-times the standard.

H. High use doors shall have closers with a 20 year warranty. Moderate use doors shall have closers with a 10 year warranty.

I. Attaching screws shall bolt through doors; wood screws pull out and are, therefore, not acceptable.

J. Floor-mounted closers are not acceptable.

K. Pressure relief valves in closers are not acceptable.

L. Door closers shall not have hold-open devices, unless otherwise considered by the County Project Manager.

M. Closers shall be located on the inside of doors.

DOOR OPERATORS (SECTION 087100)

A. Where door operators are required for accessibility entrances, provide a door operator that has metal rollers. Nylon rollers are not acceptable. Switches shall be mounted on walls, columns or special posts at 36" above adjacent floor or exterior walkway surface with sufficient clearance for wheelchair footrests and without requiring the user to lean forward.

B. Automatic ADA operators shall include performance features described for door closers, as well as a digital control suite, complete on-board diagnostics and power supply to actuators or strikes, back-up default memory, quick plug and play sensor integration, and a "no destruct" feature (motor clutch).

DOOR STOPS AND HANDLES (SECTION 087100)

A. All exterior and interior doors that do not swing open to at least 108 shall have door stops installed, preferably on a wall.

B. Handles, pulls, latches, locks, and other operating devices on accessible doors shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate.

C. Lever-operated mechanisms, push-type mechanisms, and U-shaped handles are acceptable designs. When sliding doors are fully open, operating hardware shall be exposed and usable from both sides. Hardware required for accessible door passage shall be mounted no higher than 48 in (1220 mm) above finished floor.

DOOR CHECKS (SECTION 087100)

A. Door checks (hold-open devices) are preferred for ease of general building accessibility to primary circulation areas. Locations shall be determined and inclusion in project shall require specific review and approval of the building code official.

GLASS AND GLAZING (SECTION 088000)

A. High Performance Standard
   Select high performance glazing to maximize envelope energy performance to exceed that required by ASHRAE 90.1.

B. Select high performance glazing to maximize envelope energy performance to meet that required by ASHRAE 90.1.

C. Sealed double-glazed windows with appropriate surfaces are required.

D. Aluminum frames and sash are to be used in all windows. Wood or steel are not acceptable without specific approval. Fiberglass High performance frames are an option.

E. All tinted glass is to be heat strengthened or tempered.

F. All mating edges shall be gasketed to prevent air or dust infiltration.

G. Windows on buildings must have a designated and built-in system for cleaning inside and out if windows do not pivot.

H. All Assemblies shall list NRCA listings and requirements.

DIVISION 9 FINISHES

RECYCLED CONTENT

A. Use of recycled materials is strongly encouraged for all projects.

HIGH PERFORMANCE DESIGN

A. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post industrial content constitutes at least **10%** of the total value of the materials in the project. The value of the recycled content portion of a material shall be determined by dividing the weight of the recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item. Submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

B. Use materials that are extracted, processed and manufactured regionally. Submit Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Use low VOC emitting materials. Submit Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: carpet systems, adhesives, sealants, paints, & coatings.

D. Use adhesives and composite wood products that contain no urea formaldehyde.

E. Use rapidly renewable materials and products (made from plants that are typically harvested within a ten-year cycle or shorter) for 2.5% of the total value of all building materials and products.

F. Incorporate salvaged materials into building design. Consider salvaged materials such as cabinetry, furniture, finishes, and decorative items. County Project Manager to determine with Design Team the percentage of salvaged materials to be used.

GYPSUM BOARD (SECTION 092900)

Metal Framing

A. Metal studs for wall framing (non-load bearing) shall be minimum 25 gauge. 20 gauge shall be used for tall walls, tiled walls and other walls as required.

Interior Wall Surfaces and Painting

A. Brick, block, or gypsum drywall is recommended for interior walls in corridors, classrooms and offices. Plaster is to be avoided insofar as possible. Latex paint shall be used on interior surfaces unless conditions warrant otherwise.

B. Gypsum board interior walls shall be protected with chair rails and corner guards.

C. Gypsum board shall be finished according to the following specifications:

1. Tape and finish all joints as specified below for final finish material to be applied to gypsum board. When sanding, do not raise nap of gypsum board face paper.

2. First Coat:
   a. Apply tape over center of joint in complete, uniform bed of taping compound.
   b. Completely fill gouges, dents, and fastener dimples.
   c. Allow to dry and sand lightly if necessary to eliminate high spots or excessive compound.

3. Second Coat:
   a. Apply coat of finishing compound over embedded tape extending 3-1/2 inches on both sides of joint center.
   b. Re-coat gouges, dents, and fastener dimples.

   c. Allow to dry and sand lightly to eliminate high spots or excessive compound.

4. Third Coat:
   a. Apply same as second coat except extend application 6 inches on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.

5. Fourth Coat:
   a. Apply same as second coat except extend application 9 inches on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.

6. Skim Coat:
   a. Apply thin layer of finishing compound to entire surface of panel and immediately shear excess compound, leaving this film. Eliminate laps and tool marks with fine sandpaper or damp sponge.

D. Finish Levels

1. Unfinished Gypsum Board surfaces:
   a. GA-214-90 Level Two: "All joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over all joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable."

2. Pointed Gypsum Board surfaces in Storage Areas:
   a. GA-214-90 Level Three: "All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free of tool marks and ridges."

3. Gypsum Board Surfaces to Receive Wall Coverings or Texturing:
   a. GA-214-90 Level Four: "All joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free of tool marks and ridges."

4. Pointed Gypsum Board Surfaces, Except in Storage Areas:
   a. GA-214-90 Level Five: "All joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges."

CERAMIC TILE (SECTION 093000)

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

ACOUSTICAL PANEL CEILINGS (SECTION 095113)

A Hinged-type preferred in high ceiling spaces – 10'-0" above floor or higher.

B. Acoustical lay-in type, unless directed otherwise by County Project Manager, in spaces with typical ceiling heights.

CARPET (SECTIONS 096813 AND 096816)

A. <u>High Performance Standard</u>

1. The use of carpet containing recycled content is strongly encouraged to meet the "Recycled Content" portion of High Performance Standard noted above.

B. Utilize state contracts for carpet as frequently as possible.

C. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination. Warranty Period: 10 years from date of Substantial Completion.

D. Carpet VOC Limits: VOC limits below are based on CRI's Green Label Indoor Air Quality Testing Program. Provide carpet that complies with the following limits for VOC content when tested according to ASTM D 5116:

1. Total VOCs: 0.5 mg/sq. m x h.
2. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
3. Formaldehyde: 0.05 mg/sq. m x h.
4. Styrene: 0.4 mg/sq. m x h.

E. Carpet Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

F. Carpet Adhesive VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:

1. Total VOCs: 10.00 mg/sq. m x h.
2. Formaldehyde: 0.05 mg/sq. m x h.
3. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

PAINTS AND FINISHING (SECTIONS 099100 & 099300)

A. Specify low VOC paints and finishes

1. Flat Paints and Coatings: VOC not more than 50 g/L
2. Non-Flat Paints and Coatings: VOC not more than 150 g/L.
3. Anti-Corrosive Coatings: VOC not more than 250 g/L.
4. Varnishes and Sanding Sealers: VOC not more than 350 g/L.
5. Stains: VOC not more than 250 g/L.
6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds.
7. Restricted Components: Paints and coatings shall not contain acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, or vinyl chloride.

B. Wood Floor Finishes

1. Urethane finish preferred for Parks and Recreation applications
2. Hydroline base plus street shoe finish for other applications

C. Brick/Masonry Sealer

1. Sacrificial-type brick sealer is preferred for all areas where graffiti and other vandalism is possible.
2. Use of Sealer to be discussed and approved by County Project Manager.

DIVISION 10 SPECIALTIES

HIGH PERFORMANCE DESIGN

A. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post industrial content constitutes at least **5%** of the total value of the materials in the project. The value of the recycled content portion of a material shall be determined by dividing the weight of the recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item. Submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

B. Use materials that are extracted, processed and manufactured regionally. Submit Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Use low VOC emitting materials. Submit Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: carpet systems, adhesives, sealants, paints, & coatings.

TOILET COMPARTMENTS (SECTION 102113)

A. Acceptable materials for toilet compartments include stainless steel, plastic laminate, phenolic core, solid polymer and granite/marble/stone. Baked enamel finishes are not desirable. Ceiling-Hung is the preferred anchoring system for toilet compartments.

FIRE-PROTECTION SPECIALTIES (SECTION 104400)

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period. Warranty Period: Six years from date of Substantial Completion. Failures include, but are not limited to, the following:

1. Failure of hydrostatic test according to NFPA 10.

2. Faulty operation of valves or release levers.

B. Specify fire suppression systems that do not contain CFCs, HCFCs, or Halons.

C. County Project Manager to provide system type preference on a location and use basis, including but not limited to the following types:
Stored-Pressure Water Type, Stored-Pressure Antifreeze Type, Stored-Pressure Water-Mist Type, Wet-Chemical Type, Regular Dry-Chemical Type in Steel Container, Multipurpose Dry-Chemical Type in Steel Container, Purple-K Dry-Chemical Type in Aluminum Container, Carbon Dioxide Type, Dry-Powder Type, Clean-Agent Type in Steel Container.

ACCORDION AND PANEL FOLDING PARTITIONS (SECTION 102226)

A. County Project Manager to guide product type preferences on a location and use basis.

TOILET AND BATH ACCESSORIES (SECTION 102800)

A. Consult with the designated County project manager for specific requirement for the following toilet and bath accessories:

1. Toilet Tissue (Roll) Dispenser – ASI brand #0030
2. Paper Towel (Roll) Touchless (motion-detection activated) Dispenser – ASI brand #0210
3. Waste Receptacle
4. Combination Towel Dispenser/Waste Receptacle
5. Liquid-Soap Dispenser – ASI brand #0345
6. Other Dispenser (Foam Soap, Powder, Hand Sanitizer)
7. Grab Bar
8. Sanitary Napkin Vendor – ASI brand #0864
9. Sanitary Napkin Disposal Unit – ASI brand # 0852
10. Seat-Cover Dispenser
11. Mirrors
12. Warm-Air Dryer
13. Diaper-Changing Station
14. Diaper-Pack Vendor

B. Park Operations will provide specifications for the acceptable fixed shower head unit.

C. If showers are provided in facilities built for the Parks and Recreation Division, Park Operations will provide information for a concrete shower bench to be used in lieu of a folding shower bench.

SIGNAGE (SECTION 101400)

A. All building signage shall comply with current codes and the ADA. An exterior monument sign shall be provided at each facility and shall have the building name, building address, and a county or agency logo. Comply with current Logo and name requirements.

B. Refer to the Accessibility section of these standards for requirements that may exceed the ADA minimums

DEMOUNTABLE PARTITIONS (SECTION 102219)

A. Utilize state contracts for demountable partitions as frequently as possible.

DETENTION TOILET ACCESSORIES (SECTION 102813)

A. Use detention or vandal-resistant fixtures and accessories in areas prone to vandalism.

POSTAL SPECIALTIES (SECTION 105500)

A. Salt Lake County to provide special requirements for library book drops, and other preferences on a location and use basis.

DIVISION 11 EQUIPMENT

General

Salt Lake County requirements for all applicable Sections under this Division be selected by the Design Team and reviewed by the County on a project by project basis. Section number system should be based on Masterspec® Masterformat 2004 version.

High Performance Design

A. All facilities designated by County Project Manager as High Performance should strive to maximize energy efficiency. The ultimate goal in all of our facilities is to achieve the highest rate of energy efficiency possible. At minimum, High Performance facilities should achieve 75 points under the Energy Star program.

DIVISION 12 FURNISHINGS

HIGH PERFORMANCE DESIGN

A. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post industrial content constitutes at least **10%** (recycled content percentage at the discretion of County Project Manager) of the total value of the materials in the project. The value of the recycled content portion of a material shall be determined by dividing the weight of the recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item. Submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

B. Use materials that are extracted, processed and manufactured regionally. Submit Product Certificates: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Use low VOC emitting materials. Submit Product Data, including printed statement of VOC content, for products and materials required to be low-emitting. Products that apply may include, but are not limited to: carpet systems, adhesives, sealants, paints, & coatings.

D, Avoid using products containing PVC.

WINDOW SHADES – (SECTION 122000)

SUMMARY

A. This Section includes Salt Lake County preferences for:

1. Roller shades.
2. Horizontal louver blinds.
3. All other window shade types to have prior review and approval by Salt Lake County for incorporation into each project on a case by case basis.

B. SL County Baseline and High Performance Criteria shall be the same for all window shades.

1. Design Team to specify best combination of product durability and high recycled content. Recommend minimum percentage of recycled content material based on high end of current industry standards.
2. Design Team shall select window shades in coordination with best daylighting strategies practice.

PRODUCTS

A. For all window locations with glazing higher than 7'-0" above floor finish, a motorized operating system is required.

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QUALITY ASSURANCE

A. Product installation mock-up is required for each type of window shade.

ENTRANCE FLOOR MATS AND FRAMES – (SECTION 124813)

SUMMARY

A. This Section includes Salt Lake County preferences for:

1. Roll-up mats in recessed frames.
2. Entrance mats in recessed frames.

B. SL County Baseline and High Performance Criteria shall be the same for entrance mats.

1. Design Team to specify best combination of product durability and high recycled content. Recommend minimum percentage of recycled content material based on high end of current industry standards.

2. Design entrances directly connected to the outdoors and that serve as regular entry points for the building to employ permanent entryway pollutant gathering systems. The Owner may elect to engage in a continual contracted service for roll-out mats to be maintained on a weekly basis.

SUBMITTALS

The Documents shall require the contractor to submit the following:

A. Product Data: For each type of floor mat and frame.

B. Shop Drawings: Show the following:

1. Items penetrating floor mats and frames.
2. Verification that substrate is level and ready to accept product.
3. Divisions between mat sections.
4. Perimeter floor moldings.
5. Custom Graphics: Scale drawing indicating colors.

C. Samples: For each floor mat and Frame member.

D. Maintenance data, and product warranty.

QUALITY ASSURANCE

A. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).", Sections 302 and 303 in ICC A117.1.

PRODUCTS

ROLL-UP MATS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or an equal product by one of the following:

1. American Floor Products Company, Inc.
2. Arden Architectural Specialties, Inc.
3. Balco, Inc.
4. Cactus Mat Mfg. Co.
5. K. N. Crowder Manufacturing, Inc.
6. C/S Group.
7. Durable Corporation
8. J. L. industries, Inc.
9. Kadee Industries, Inc.
10. Matco International
11. Musson, R. C. Rubber Co.
12. Pawling Corporation; Architectural Products Division.
13. Reese Enterprises, Inc.

B. Roll-up, Vinyl-Rail Hinged Mats

C. Roll-up, Aluminum-Rail Hinged Mats

D. Surface-Mounted Frames:

1. Tapered Frames: Tapered frame members, not less than 1-1/2 inches (38 mm) wide, attached to mat at all 4 edges, with welded mitered corners.

E. Recessed Frames:

1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.

ENTRANCE MATS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or an equal product by one of the following:

1. American Floor Products Company, Inc.
2. ARDEN Architectural Specialties, Inc.
3. Balco, Inc.
4. Cactus Mat Mfg. Co.
5. Consolidated Plastics Company, Inc.
6. C/S Group.
7. Durable Corporation.
8. Flexco
9. Matco International
10. Mats, Inc.
11. Musson, R. C. Rubber Co.
12. pawling Corporation; Architectural Products Division.
13. Sbemco International Inc.
14. Tennessee Mat Company, Inc.
15. Tepromark International, Inc.
16. U.S. Mat and Rubber Corporation

B. Resilient Link Mats: Reversible link mats with galvanized spring or stainless steel wire link rods, vulcanized edge-nosing trim, steel-reinforced end trim, and links consisting of rectangular units or continuous strips in a heel-proof, solid-weave pattern with no openings between links.

C. Recycled Content Rubber or Vinyl Mats

D. Cocoa Mats: Constructed from cocoa fiber yarn permanently bonded to PVC backing for dimensional stability and resistance to shedding.

E. Rubber-Tire Mats are not preferred

F. Carpet-Type Mats are not preferred

G. Surface-Mounted Frames will not be considered

H. Recessed Frames:

1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52

FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide unit for each mat installation; no not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devises.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat surfaces of aluminum frames that will contact cementitous material with manufacturer's standard protective coating.

INSTALLATION

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

B. Coordinate with substrate for level installation.

PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

ENTRANCE FLOOR GRILLES – (SECTION 124816)

SUMMARY

A. This Section includes Salt Lake County preferences for entrance floor grilles.

1. Provide recessed and drained type only.

B. SL County Baseline and High Performance Criteria shall be the same for entrance floor grilles.

1. Design Team to specify best combination of product durability and high recycled content. Recommend minimum percentage of recycled content material based on high end of current industry standards.

PRODUCTS

A. Provide manufacturer's standard 0.060-inch- (1.52-mm-) thick, metallic-coated steel, aluminum or stainless-steel sheet drain pan with NPS 2 (DN 50) drain outlet for each floor grille unit. Coat bottom of pan with protective coating recommended by manufacturer.

INSTALLATION

A. Install recessed foot grilles and frames to comply with manufacturer's written instructions at locations indicated and with top of foot grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set foot-grille tops at height for most effective cleaning action. **Coordinate top of foot-grille surfaces with doors that swing across grilles to provide clearance under door.**

SITE FURNISHINGS – (SECTION 129300)

A. ANSI Section 903 applies to park benches provided on a site.

B. ANSI Section 902 applies to dining tables provided on a site.

DIVISION 13 SPECIAL CONSTRUCTION

General

Salt Lake County requirements for all applicable Sections under this Division be selected by the Design Team and reviewed by the County on a project by project basis. Section number system should be based on Masterspec® Masterformat 2004 version.

HIGH PERFORMANCE DESIGN

A. Use adhesives and composite wood products that contain no urea formaldehyde.

B. For roof panels, comply with Solar Reflectance Index requirement.

C. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post industrial content constitutes at least **10%** of the total value of the materials in the project. The value of the recycled content portion of a material shall be determined by dividing the weight of the recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item. Submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

DIVISION 14 CONVEYING EQUIPMENT
ELECTRIC TRACTION ELEVATORS – (SECTIONS 142100 & 142113)

SUMMARY

A. This Section includes Salt Lake County preferences for:

1. Electric traction passenger elevators.
2. Electric traction freight elevators.

B. SL County Baseline and High Performance Criteria shall be the same for all elevators.

1. Design Team to specify best combination of product durability and high recycled content for elevator interior finishes. Recommend minimum percentage of recycled content material based on high end of current industry standards. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content must be submitted. Include statement indicating costs for each product having recycled content.

2. Use products and materials that are known to be low-emitting. Submit product data, including printed statement of VOC content. Products that apply may include, but are not limited to: carpet systems, adhesives, sealants, paints, & coatings.

3. Use materials that are extracted, processed and manufactured regionally. Submit Product Certificates for products and materials required to comply with requirements for regional materials indicating location and distance from project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

4. Biodegradable Hydraulic Fluid

   a. Hydraulic Fluid: Nontoxic, readily biodegradable**,** fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.

   b. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.

5. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1, of sufficient size to provide not less than 1-inch clearance from cylinder and extending above pit floor. Provide means to monitor casing effectiveness to comply with ASME A17.1.

C. Related Sections include the following.

1. Division 03 Section “Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.

2. Division 04 Section "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.

3. Division 05 Section "Structural Steel Framing" for the following:

    a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
    b. Machine beams.
    c. Divider beams.
    d. Hoist beams.
    e. Structural-steel shapes for subsills and hoistway door frames that are part of steel frame.

4. Division Section "Metal Fabrications" for the following:

    a. Attachment plates and angle brackets for supporting guide-rail brackets
    b. Machine beams.
    c. Weld plates for anchoring elevator machine to machine room floor slab.
    d. Divider beams.
    e. Hoist beams.
    f. Structural-steel shapes for subsills and hoistway door frames.
    g. Pit ladders.
    h. Cants in hoistways made from steel sheet.

5. Division 05 "Pipe and Tube Railings" for railings between adjacent elevator pits.
6. Division 09 painting Sections for field painting hoistway entrance doors and frames.
7. Division 10 Section "Wire Mesh Partitions" for guards between adjacent elevator pits.
8. Division 26 Sections for electrical service for elevators to and including fused disconnect switches at machine room door and standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.

PRODUCTS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Indicate loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For exposed finishes.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Operation and maintenance data.

F. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

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QUALITY ASSURANCE

A. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7.

B. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." 407 in ICC A117.1.

WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Maintenance service contract shall agree to a 24 hour response time for all service calls and request by County.

1. Perform maintenance, including emergency callback service, during normal working hours.

2. Include 24-hour-per-day-7-day-per-week emergency callback service.

a. Response Time: Two hours or less.

MANUFACTUER'S PRODUCTS

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. Fujitec America, Inc.
2. KONE Inc.
3. Otis Elevator Co.
4. Schindler Elevator Corp.
5. ThyssenKrupp Elevator.
6. Minnesota Elevator.

SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems, including standard components published by manufacturer as included in standard pre-engineered elevator systems and as required for complete system. Coordinate with Division 5 so that hoist beam is provided in General Contract.

OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system for each elevator or for each group of elevators as required to provide type of operation system indicated.

B. Group Automatic Operation with Demand-Based Dispatching: Provide reprogrammable group automatic system that assigns cars to hall calls based on a dispatching program designed to minimize passenger waiting time. System automatically adjusts to changes in demand for different traffic conditions including heavy incoming, heavy two-way, heavy outgoing, and light off-hours as variations of normal two-way traffic.

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

2. Products: Subject to compliance with requirements, provide one of the following:

a. Fujitec America, Inc.; Millenium
b. KONE Inc.;KCM 831
c. Otis Elevator Co.; Elevonic.
d. Schindler Elevator Corp.; Miconic TX.
e. ThyssenKrupp Elevator; Traflomatic
f. Minnesota Elevator

C. Security Feature: Security feature shall not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Coordinate card-reader operation as required by Owner.

a. Security access system equipment is specified in Division 28 Section "Access Control."
b. Security access system equipment is not in the Contract.

FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Stainless-Steel Bars: ASTM A 276, Type 304.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

F. Aluminum Extrusions: Except for ceiling panels, will <u>not</u> be considered.

G. Plastic Laminate: Except for ceiling panels, will <u>not</u> be considered.

H. Wood: Except for ceiling panels, will <u>not</u> be considered.

I. Solid Surface: Except for ceiling panels, will <u>not</u> be considered.

CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable or steel-framed car enclosures with no removable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.

2. Enameled-Steel Wall Panels: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.

3. Stainless-Steel Wall Panels: Flush, hollow-metal construction.

4. Stainless-Steel Doors: Flush, hollow-metal construction.

5. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.

6. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.

7. Provide minimum of 15 foot candles at elevator floor surface.

HOISTWAY ENTRANCES

A. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Enameled-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
3. Stainless-Steel Doors and Transoms: Flush, hollow-metal construction.
4. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

PROTECTION

A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for each elevator used for construction purposes

1. Provide protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
2. Do not load elevators beyond their rated weight capacity.
3. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

SIGNAL EQUIPMENT

A. General Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.

B. Car Control Stations: Provide manufacturer's standard car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

1. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
2. Mount controls at heights complying with [the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ICC A117.1.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide speaker in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Section "Fire Detection and Alarm."

E. Car Position Indicator: Provide illuminated**,** digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.

G. Hall Lanterns: Units with illuminated arrows.

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units mounted in both jambs of entrance frame for each elevator.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate adjust, and maintain elevator(s). Include to Division 01 Section "Demonstration and Training."

HYDRAULIC ELEVATORS – (SECTIONS 142400 & 142413)

SUMMARY

A. This Section includes Salt Lake County preferences for:

1. Hydraulic passenger elevators.
2. Hydraulic freight elevators.

B. SL County Baseline and High Performance Criteria shall be the same for all elevators.

1. Design Team to specify best combination of product durability and high recycled content for elevator interior finishes. Recommend minimum percentage of recycled content material based on high end of current industry standards.

QUALITY ASSURANCE

A. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." 407 in ICC A117.1.

MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

MANUFACTURERS PRODUCTS

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. Fujitec America, Inc.
2. KONE Inc.
3. Otis Elevator Co.
4. Schindler Elevator Corp.
5. ThyssenKrupp Elevator.
6. Minnesota Elevator.

OPERATION SYSTEMS

A. Security Feature: Security feature shall not affect emergency firefighters' service:

1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Coordinate card-read operation as required by Owner.

a. Security access system equipment is specified in Division 28 Section "Access Control."
b. Security access system equipment is not in the Contract.

FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Stainless-Steel Bars: ASTM A 276, Type 304.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

F. Aluminum Extrusions: Except for ceiling panels, will <u>not</u> be considered.

G. Plastic Laminate: Except for ceiling panels, will <u>not</u> be considered.

H. Wood: Except for ceiling panels, will <u>not</u> be considered.

I. Solid Surface: Except for ceiling panels, will <u>not</u> be considered.

CAR ENCLOSURES

A. General: Provide stainless steel car enclosures to receive removable or steel-framed car enclosures with no removable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.

2. Stainless-Steel Wall Panels: Flush, hollow-metal construction.

3. Stainless-Steel Doors: Flush, hollow-metal construction.

4. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.

5. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.

6. Provide minimum of 15 foot candles at elevator floor surface.

HOISTWAY ENTRANCES

A. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Stainless-Steel Doors and Transoms: Flush, hollow-metal construction.
3. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

SIGNAL EQUIPMENT

A. General Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.

B. Car Control Stations: Provide manufacturer's standard car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

1. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
2. Mount controls at heights complying with [the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ICC A117.1.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide speaker in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Section "Fire Detection and Alarm."

E. Car Position Indicator: Provide illuminated**,** digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.

G. Hall Lanterns: Units with illuminated arrows.

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units mounted in both jambs of entrance frame for each elevator.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction.

PROTECTION

A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for each elevator used for construction purposes

1. Provide protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
2. Do not load elevators beyond their rated weight capacity.
3. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate adjust, and maintain elevator(s). Include Division 01 Section "Demonstration and Training."

LIMITED-USE/LIMITED-APPLICATION ELEVATORS – (SECTION 142600)

SUMMARY

A. This Section includes Salt Lake County preferences for Limited-Use/Limited Application Elevators

B. SL County Baseline and High Performance Criteria shall be the same for all elevators.

1. Design Team to specify best combination of product durability and high recycled content for elevator interior finishes. Recommend minimum percentage of recycled content material based on high end of current industry standards.
2. Reference: In High Performance projects, refer to Division 1 requirements for Construction Waste Management and Disposal.

DEFINITIONS

A. Definitions in ASME A17.1 apply to Work of this Section.

B. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

PERFORMANCE REQUIREMENTS

A. Rated Load: 1400 lb (635 kg).

B. Rated Speed: 25 to 30 fpm (0.13 to 0.15 m/s).

SUBMITTALS

A. In addition to other submittals required, submit a pre-installation examination report. Indicating dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.

QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer’s authorized representative who is trained and approved for installation of units required for this Project.

B. Accessibility Requirements: Comply with Sections 407.4.1 through 407.4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ICC A117.1.

COORDINATION

A. Coordinate locations and dimensions of other work relating to elevator including pit ladder, sump, and floor drain in pit; entrance subsills; and electrical service, electrical outlets, lights, and switches in pit and machine room.

WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide five years full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Perform maintenance, including emergency callback service, during normal working hours.

2. Include 24-hour-per-day, 7-day-per-week emergency callback service.

a. Response Time: Two hours or less.

B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

MANUFACTURERS PRODUCTS

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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings, manufacturer’s name; product name or designation or a comparable product by one of the following.

1. Access Industries; a ThyssenKrupp Elevator Company.
2. American Crescent Elevator Mfg., Corp.

3. Concord Elevator, Inc.
4. Federal Elevator Ltd.
5. Liftavator, Inc.
6. National Wheel-O-Vator Co., Inc. (The).
7. Schumacher Elevator Company

ELEVATOR CAR ENCLOSURES AND HOISTWAY ENTRANCES

A. Refer to standard requirements for section 142100.

OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system for single automatic operation and selective collective automatic operation.

B. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put into service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.

C. Battery-Powered Lowering: Provide system that, when power fails, lowers car to the lowest floor, opens car and hoistway door, and shuts down. System includes rechargeable battery and automatic recharging system.

SIGNAL EQUIPMENT

A. General Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.

B. Car Control Stations: Provide manufacturer's standard car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

1. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
2. Mount controls at heights complying with [the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ICC A117.1.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is

contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide speaker in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 Section "Fire Detection and Alarm."

E. Car Position Indicator: Provide illuminated**,** digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.

1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.

G. Hall Lanterns: Units with illuminated arrows.

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units mounted in both jambs of entrance frame for each elevator.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction.

INSTALLATION

A. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

FIELD QULAITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by ASME A17.1 and by authorities having jurisdiction.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator. Refer to Division 01 Section "Demonstration and Training."

B. Check operation of elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

C. Check operation of elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

WHEELCHAIR LIFTS – (SECTION 144200)

A. The use of Wheelchair Lifts to provide vertical circulation in a facility must be approved by the involved Agency and the Design Team.

COMMON WORK RESULTS FOR FIRE SUPPRESSION – (SECTION 210500)

SUMMARY

A. It is the intent of this outline is to delineate areas where the County has specific requirements or preferences, rather than supplying a complete specification. The Consulting Engineer's specifications shall be modified to accommodate these provisions.

B. The type of fire suppression system shall be recommended by the consulting engineer and reviewed by the county project manager.

HIGH PERFORMANCE DESIGN

A. Do not install fire suppression systems that contain ozone-depleting substances (CFCs, HCFCs or Halons)

WARRANTY

A. All equipment and the complete system shall be guaranteed for a period of one year from the date of Substantial Completion. The contractor shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during that period.

B. All devices incorporated in these systems shall be adjusted in a manner that each shall develop it's maximum efficiency in the operation of the system.

STANDARDS

A. Current Edition of International Fire Code.

B. Current Edition of NFPA

C. Local Codes and Ordinances

D. Current Edition of International Building Code

SUBMITTALS

A. Welding certificates.

B. Product Data:
   1. Manufacturer's catalog data for each manufactured item.
      a. Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.

b. Include name, address, and phone number of each supplier.

2. Other submittal requirements by Division 21 Sections.

QUALITY ASSURANCE

A. The design shall conform to applicable FM Global property loss prevention data sheets.

1. Other quality assurance requirements of Division 21 sections.

OPERATION AND MAINTENANCE DATA

A. Summary:

1. This Section includes administrative and procedure requirements for preparing operation and maintenance manuals, including the following:

a. Operation manuals for systems, subsystems, and equipment.

b. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.

B. Submittals:

1. Manual: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

a. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

DOMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain. Refer to Division 1 Section "Demonstration and Training."

WET-PIPE SPRINKLER SYSTEMS – (SECTION 211313)

SUMMARY

A. This section outlines wet-pipe fire suppression systems. There will be instances where other types of fire suppression systems are applicable and specific requirements should be coordinated with the county project manager.

HIGH PERFORMANCE DESIGN

A. Do not install fire suppression systems that contain ozone-depleting substances (CFCs, HCFCs or Halons).

SUBMITTALS

A. Shop Drawings:

1. Size sprinkler system by one of the following methods:
   a. Hydraulic calculation design method based on water supply evaluation performed by building site and FM Global Property Loss Prevention Data Sheets.
   b. On Submittals, refer to sprinkler heads by sprinkler identification or model number published in appropriate agency listing or approval. Trade names and other abbreviated designations are not acceptable
2. Submit training agenda and material for review by Cx authority and/or engineer for approval.
3. Submit trainer's qualifications for approval by owner's representative.

QUALITY ASSURANCE

A. Qualifications:

1. Designer:
   a. Licensed fire protection engineer or fire protection system designer certified by NICET to level three minimum and engaged in design of fire protection systems. Engineer designer shall:
      1) Be responsible for overseeing preparation of shop drawings, hydraulic calculations where applicable, and system installation.
      2) Make complete inspection of installation.
      3) Provide corrected record drawings to owner with letter of acceptance.
      4) Certify that installation is in accordance with Contract Documents.

B. Design
1. Conform to applicable FM Global Property Loss Prevention Data Sheets.

OWNERS INSURANCE

A. Factory mutual (FM) approved is required on all projects. Contractor shall provide owner's project manager with copies of submittals for FM review.

B. Contractor shall make adjustments as necessary to meet FM insurance requirements.

OWNERS INSTRUCTIONS

A. Instruction Sessions:

1. Instruct owner's personnel in operation and maintenance of system utilizing Operation and Maintenance Manual when so doing. Minimum instruction period shall be four hours.
2. Instruction sessions shall occur after Substantial Completion inspection when system is properly working and before final payment is made.

PRODUCTS

GENERAL:

A. Use FM approved equipment and materials where applicable.

PIPING MATERIALS:

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with cast-iron threaded fittings, grooved-end fittings.

B. Standard-Pressure, Wet-Pipe Sprinkler System.

1. Schedule 40 black steel pipe.
   a. Fittings shall be threaded or groove-end.
2. Schedule 40 galvanized-steel pipe:
   a. Fittings shall be galvanized[plain-end pipe]or cut-grooved end.
3. Type L or Type M, copper tube and copper pressure-seal fittings.
4. NPS 2, Type L or Type M, copper tube with roll-grooved ends and copper fittings.

SPRINKLER MATERIALS

A. Sprinkler Types:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers applicable to project.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Deluge-Sprinkler Systems: Upright and pendent, open sprinklers.

ALARM DEVICES

A. Water-motor-operated alarm.

B. Electrically operated alarm bell.

COMMON WORK RESULTS FOR PLUMBING – (SECTION 220500)

SUMMARY

A. It is the intent of this outline is to delineate areas where the County has specific requirements or preferences, rather than supplying a complete specification. The Consulting Engineer's specifications shall be modified to accommodate these provisions.

B. Contractor shall be responsible for supplying all utilities, components, commodities and accessories required for a fully functioning system, including, but not limited to; utility connections and fees for same, fuel oil, bottled gases, cleaners, and water treatment.

WARRANTY

A. Guarantee Plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with contract documents.

B. Insure that all pipes, conduit, and connections shall be free from foreign matter, pockets and all other obstructions for the free passage of water, liquid and vent.

C. All equipment and the complete system shall be guaranteed for a period of one year from the date of Substantial Completion. The contractor shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during that period.

D. All devices incorporated in these systems shall be adjusted in a manner that each shall develop it's maximum efficiency in the operation of the system.

STANDARDS

A. Current edition of International Plumbing Code.

B. Current edition of International Mechanical Code.

C. Current edition of International Building Code.

D. Current edition of International Fuel Gas Code.

E. Current edition of the International Fire Code.

F. Current edition of NFPA.

G. Current edition of the International Energy Code.

H. Local codes and ordinances.

I. ASPE Handbooks.

J. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.

ENERGY EFFICIENCY

A. Baseline Construction: The building as a whole including envelope construction, HVAC, plumbing, lighting, etc. shall meet the current edition of ASHRAE STANDARD 90.1.
   1. The local authority having code jurisdiction may also require compliance with the current edition of the International Energy Code.

B. High Efficiency Construction: The building as a whole, including envelope construction, HVAC, plumbing, lighting, etc. shall exceed the current edition of ASHRAE STANDARD 90.1 by a minimum of 14% and as determined by County Project Manager as determined by the energy cost budget method of calculation.
   1. The Owner's project manager shall identify each project criteria as "baseline" or "high efficiency" construction.

C. Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.
   1. The design building shall demonstrate a water usage a minimum of 20% below EPA 1992 fixture performance requirements.

SUBMITTALS

A. Welding Certificates.

B. Product Data:
   1. Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underline.
   2. Include name, address, and phone number of each supplier.

C. Shop Drawings:
   1. Schematic control diagrams for each separate system.
   2. Other shop drawings required by Division 22 trade Sections.

OPERATION AND MAINTENANCE DATA

A. Provide operation and maintenance manuals, including the following:
   1. Operation manuals for systems, subsystems, and equipment.
   2. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.

B. Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

C. If requested, contractor shall submit sections of manual on specific equipment 2 weeks prior to start up for review by engineer, Cx agent and/or owner's representative.

PRODUCTS

JOINING MATERIALS

A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch maximum thickness unless thickness or specific material is indicated.

B. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12.

F. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.
   3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   4. PVC to ABS Piping Transition ASTM D 3138.

DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrours materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure and temperature.

C. Dielectrc Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 degF.

ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

B. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

EXECUTION

PIPING SYSTEMS

A. Install piping at indicated slopes and in such manner to allow valve servicing.

B. Install piping free of sags or bends.

PIPING CONNECTIONS

A. Install unions at each valve and at final connection to each piece of equipment and plumbing fixture having 2” diameter and smaller connections.

B. Install flange connections at each piece of equipment larger than 2” diameter.

C. Use dielectric connections for dissimilar metals.

PIPE CHASES:

A. Whenever possible, design plumbing systems in chases accessible thru main doors at least 18” wide.

B. Coordinate installation of one light fixture for maintenance work.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

METERS AND GAGES FOR PLUMBING PIPING – (SECTION 220519)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

A. Thermometers:

   1. Metal-Case, Liquid-in-Glass Type: Aluminum or Brass case, organic-liquid filled.
   2. Bimetallic-Actuated Dial Type: Dry or Liquid-filled type, stainless-steel case.

B. Thermowells shall be installed to hold thermometers.

C. Pressure Gages:

   1. Direct-Mounting Dial Type: Liquid-filled type, drawn-steel or cast-aluminum case

   2. Fittings: Needle valves.

D. Test Plugs: Corrosion-resistant brass or stainless-steel body with core inserts.

   1. Test kit containing pressure gage, low- and high-range thermometers, and carrying case.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

GENERAL-DUTY VALVES FOR PLUMBING PIPING – (SECTION 220523)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

LOW-PRESSURE, COMPRESSED-AIR VALVES

A. Pipe NPS 2 and Smaller:

   1. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
   2. Bronze Lift Check Valves: Class 125, bronze or nonmetallic disc.
   3. Bronze Swing Check Valves: Class 150, [bronze or nonmetallic disc.
   4. Bronze Gate Valves: Class 150.

B. Pipe NPS 2-1/2 and Larger:

   1. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze, ductile-iron, or stainless-steel disc.
   2. Iron, Grooved-End Butterfly Valves: 175 or 300 CWP.
   3. Iron Swing Check Valves: Class 250, nonmetallic-to-metal seats.
   4. Iron, Grooved-End Swing Check Valves: 300 CWP.
   5. Iron Gate Valves: Class 250.

DOMESTIC, HOT- AND COLD-WATER VALVES

A. Pipe NPS 2 and Smaller:

   1. Ball Valves: 400 psi, Teflon seat, stainless steel ball, full ported packed valve stern.
      a. Manufacturers:
         1) Apollo, Nibco or Wolverine.
   2. Bronze Swing Check Valves: Class 125:
      a. Manufacturer:
         1) Stockham B-309

B. Pipe NPS 2-1/2 and Larger:

   1. Iron Ball Valves: Class 150.

2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM or NBR seat, stainless-steel disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Iron Swing Check Valves: Class 250, nonmetallic-to-metal seats.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.
6. Iron Gate Valves: Class 250.
7. Iron Globe Valves: Class 250.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

SANITARY WASTE AND VENT PIPING – (SECTION 221316)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

PIPE

A. Cast-Iron Pipe and Fittings:

   1. Hub-and-spigot Service class with Ty-Seal joints.
   2. Hubless with neoprene gaskets and stainless-steel.

B. Steel Pipe and Fittings: Standard Weight and Schedule 40, galvanized, with cast-iron threaded fittings.

C. Copper Tubing and Fittings (Equipment Drains):

   1. DWV tube with solder-joint fittings.
   2. Hard copper tube with copper unions.

D. ABS Pipe and Fittings: Cellular-core pipe with socket fittings may be allowed at discretion of County's project manager.

E. PVC Pipe and Fittings: Cellular-core, sewer and drain series pipe with socket fittings may be allowed at discretion of County's project manager.

EXECUTION

ABOVE GROUND SYSTEMS

A. Cast iron hubless.

B. Hub and spigot.

C. Galvanized vents only.

BELOW GROUND SYSTEMS

A. Hub and spigot

B. ABS (if approved).

C. PVC (if approaved).

EQUIPMENT DRAINS:

A. Installation Notes: Slope all drains at 1/4" per foot or more. Provide complete condensate drain systems for all rooftop units, furnaces, etc., for all equipment which has a need for such service.

B. Terminate such drain systems near floor drains, floor sinks, or other authorized point of discharge.

TESTS

A. Tests shall be conducted in the presence of the Owner's representative. A written report (letter from) of all tests shall be submitted to the Owner's representative.

B. Waste, Drain and Vent Systems (Non-Pressurized): Sanitary soil and vent, both normal and acid-resistant shall be tested by plugging all outlets and filing the lines with water to the highest roof opening. All joints within the building shall be inspected for visible leaks. The building sewer shall be water tight at all points.

C. Include test report on project systems manual.

DEFECTIVE WORK:

A. If inspection or test shows defects or leaks such defective work or material shall be replaced or corrected and inspection and tests repeated. All repairs to piping shall be made with new materials. No caulking or screwed joints or holes will be acceptable.

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT – (SECTION 220529)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PERFORMANCE REQUIREMENTS

A. When a "Contractor Performance Specification" is utilized, the contractor shall include the following:
   1. Design supports for multiple pipes and equipment.
   2. Design seismic-restraint hangers and supports and obtain approval from authorities having jurisdiction.
   3. Shop Drawings: Signed and sealed by a qualified professional engineer.

PRODUCTS

A. Steel pipe hangers and supports.

B. Trapeze pipe hangers.

C. Fiberglass pipe hangers.

D. Metal framing systems.

E. Fiberglass strut systems.

F. Thermal-hanger shield inserts.

G. Pipe Stands.

H. Pipe positioning systems.

I. Equipment supports.

VIBRATION & SEISMIC CONTROLS FOR PLUMBING PIPING & EQUIPMENT – (SECTION 220548)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PERFORMANCE REQUIREMENTS

A. When a Contractor Performance Specification" is utilized, the contractor shall include the following:
   1. Seismic-Restraint Loading:
      a. Identify the Class as Defined in the IBC: [A] [B] [C] [D] [E] [F].
      b. Identify signed Seismic Use Group or Building Category as Defined in the IBC: [I] [II] [III].
         1) Component Importance Factor: 1.5
         2) Component Response Modification Factor: 3.5.
         3) Component Amplification Factor: 2.5
      c. Identify design Spectral Response Acceleration at Short Periods (0.2 Second):
      d. Identify Design Spectral Response Acceleration at 1-Second Period:

PRODUCTS

B. Vibration Isolators:

   1. Isolator Pads: Neoprene, Rubber or Hermetically sealed compressed fiberglass.
   2. Mounts: Double-deflection type.
   3. Restrained Mounts: All directional mountings with seismic restraint; cast-ductile-iron housing.
   4. Spring Isolators: Freestanding, laterally stable, open-spring type.
   5. Restrained Spring Isolators: Freestanding, steel, open-spring type with seismic restraint.
   6. Housed Spring Mounts: Ductile-iron or steel housing, with integral, vertically adjustable seismic snubbers.
   7. Elastomeric Hangers: Double-deflection type.
   8. Spring Hangers: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression.
   9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression and with vertical-limit stop.
   10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor.

11. Resilient pipe guides.

C. Vibration Isolation Equipment Bases:

1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

D. Seismic-Restraint Devices:

1. Snubbers: Welded structural-steel shapes and replaceable resilient isolation washers and bushings.
2. Channel Support System: MFMA-3 slotted steel channels.
3. Restraint Cables: Stainless-steel cables.
4. Anchor Bolts: Mechanical type, seismic rated.
5. Resilient Isolation Washers and Bushings: Molded neoprene.

SANITARY WASTE PIPING SPECIALTIES – (SECTION 221319)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

B. Quality Standard for Plastic Piping: NSF 14.

PRODUCTS

CLEANOUTS:

A. Cleanout Plugs shall be of the same size as pipe, except that cleanout plugs larger then 4" will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep quarter bend or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings.

B. Floor cleanouts shall be caulked into the hub of the fitting and finished flush with the floor.

C. Where cleanouts are shown in connection with threaded pipe and are accessible, they shall be cast iron drainage T-pattern, 90-degree branch fittings with square head brass screw plugs of the same size as the pipe, up to and including 4".

D. All outside soil, waste and drain lines shall have two-way cleanouts at all changes of direction.
   1. Approved Manufacturers:
      a. Zurn, Josam, Wade or Smith

FLOOR DRAINS:

A. Provide floor drains of cast brass or bronze as manufactured by Zurn or J.R. Smith.

EXECUTION

ORIENTATION:

A. All floor drains shall be installed with grates square to the building lines.

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT – (SECTION 220553)

PART 1 - SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

A. Equipment Labels: Stamped or Engraved Metal or Plastic.

B. Warning Signs and Labels: 1/8 inch thick with fasteners.

C. Pipe Labels: Self-adhesive.

D. Valve Tags: Brass, 0.032-inch minimum thickness.

E. Warning Tags: 3 by 5-1/4 inches minimum; brass grommet and wire fasteners.

PLUMBING INSULATION – (SECTION 220700)

PART 1 - SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors according to ASTM E 84.

FACILITY STORM DRAINAGE PIPING – (SECTION 221413)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittal
   6. Operation and Maintenance Data

PRODUCTS

PIPE

A. Cast-Iron Pipe and Fittings:

   1. Hub-and-spigot Service class with Ty-Seal joints.
   2. Hubless with neoprene gaskets and stainless-steel.

B. Steel Pipe and Fittings: Standard Weight and Schedule 40, galvanized, with cast-iron threaded fittings.

C. Copper Tubing and Fittings (Equipment Drains):

   1. DWV tube with solder-joint fittings.
   2. Hard copper tube with copper unions.

D. ABS Pipe and Fittings: Cellular-core pipe with socket fittings may be allowed at discretion of County's project manager.

E. PVC Pipe and Fittings: Cellular-core, sewer and drain series pipe with socket fittings may be allowed at discretion of County's project manager.

EXECUTION

ABOVE GROUND SYSTEMS

A. Cast iron hubless.

B. Hub and spigot.

C. Galvanized vents only.

BELOW GROUND SYSTEMS

A. Hub and spigot

B. ABS (if approved).

C. PVC (if approved)

TESTS

A. Tests shall be conducted in the presence of the Owner's representative. A written report (letter form) of all tests shall be submitted to the Owner's representative.

B. Drain Systems (Non-Pressurized): Roof drainage piping, shall be plugging all outlets and filling the lines with water to the highest roof opening. All joints within the building shall be inspected for visible leaks. The system shall be water tight at all points.

C. Include test report in project systems manual.

DEFECTIVE WORK:

A. If inspection or test shows defects or leaks such defective work or material shall be replaced or corrected and inspection and tests repeated. All repairs to piping shall be made with new materials. No caulking or screwed joints or holes will be acceptable.

DOMESTIC WATER PIPING – (SECTION 221116)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

UNDER-BUILDING-SLAB, DOMESTIC WATER PIPING

A. Pipe NPS 2 and Smaller:

   1. Soft copper tube, type K; wrought-copper solder-joint fittings; and brazed joints.

ABOVEGROUND DOMESTIC WATER PIPING

A. Pipe:
   1. Hard copper tube, ASTM B 88, Type L; copper solder-joint fittings; and 95-5 soldered joints.

MANUFACTURED UNITS

A. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.

EXECUTION

BELOW GRADE INSTALLATION

A. Completely protect pipe with 1/2" thick "Armaflex" continuous. Set wrapped pipe in 6" sand or pea gravel all around.

B. Isolation of Water Piping Distribution: Install water piping complete with isolation valves located such that separate buildings and logical portions of one building may be shut-off for servicing without disrupting the entire water distribution system. Where the main water shut-off valve is located within a building and not near the exterior install a shut-off valve at the point where the line initially enters the building.

Sterilization of Water Piping:

A. The entire domestic water systems shall be thoroughly sterilized with a solution containing not less than 250 parts per million of available chlorine. The chlorinating materials shall be introduced into the system in a manner approved by the Owner's representative. The sterilization solution shall be allowed to remain in the system for a period of 24 hours, during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution is not greater than 0.2 parts per million. Water system will not be accepted until a negative bacteriological test is made on water taken from the system, and dosing will be repeated as necessary until such negative test is accomplished.

Tests:

A. Shall be conducted in the presence of the Owner's representative. A written report (letter form) of all tests shall be submitted to the Owner's representative.

B. Domestic water systems shall be water tested to a pressure drop not to exceed 5 psi in a six-hour period, with no visible leaks.

C. If inspection or test shows defective or leaks such defective work or material shall be replaced or corrected and inspection and tests repeated. All repairs to piping shall be made with new materials. No caulking or screwed joints or holes with be acceptable.

D. Test results shall be included in the project systems manual.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

DOMESTIC WATER PIPING SPECIALTIES – (SECTION 221119)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

A. Vacuum Breakers and Backflow Preventers:

B. Balancing Valves:

   1. Copper-Alloy Calibrated Balancing Valves.

C. Temperature-Actuated Water Mixing Valves:

   1. Above devices shall be designed and installed as required by local codes.

D. Hose Bibbs:

   1. Chrome Plated for Indoor Applications.
   2. Provide with vacuum breaker.

E. Wall Hydrants:

   1. Nonfreeze Wall Hydrants:
      a. Provide with vacuum breaker.

F. Drain Valves:
   1. Stop-and-waste type.

G. Water System Shock Absorbers:
   1. Each hot and cold water connection to a fixture or faucet shall be equipped with a full size vertical air cushion not less than 12" long. In addition to the air cushions, provide stainless steel bellows type shock absorbers for hot and cold water at each fixture group.
   2. Approved Manufacturers:
      a. Zurn "Shocktrol" or Smith, Josam, Wade, size to number of fixtures.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

STORM DRAINAGE PIPING SPECIALTIES – (SECTION 221423)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

CLEANOUTS:

A. Cleanout Plugs shall be of the same size as pipe, except that cleanout plugs larger then 4" will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep quarter bend or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings.

B. Floor cleanouts shall be caulked into the hub of the fitting and finished flush with the floor.

C. Where cleanouts are shown in connection with threaded pipe and are accessible, they shall be cast iron drainage T-pattern, 90-degree branch fittings with square head brass screw plugs of the same size as the pipe, up to and including 4".

D. All outside soil, waste and drain lines shall have two-way cleanouts at all changes of direction.
   1. Approved Manufacturers:
      a. Zurn,
      b. Josam,
      c. Wade
      d. Smith

ROOF DRAINS:

A. Roof Drains and Downspouts:
   1. Metallic construction.

GENERAL-SERVICE COMPRESSED-AIR PIPING – (SECTION 221513)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Piping and related specialties for systems operating at 200 psig or less.

QUALITY ASSURANCE

A. Quality Standard for High-Pressure Compressed-Air Piping: ASME B31.1.

B. Quality Standard for Low-Pressure Compressed-Air Piping: ASME B31.9.

C. Quality Standard for Brazing: ASME Boiler and Pressure Vessel Code: Section IX or AWS B2.2.

D. Quality Standard for Welding: ASME Boiler and Pressure Vessel Code: Section IX.

PRODUCTS

PIPING APPLICATIONS

A. Piping between Air Compressors and Receivers:

   1. Steel pipe with threaded joints or copper tube with brazed joints.

B. Low-Pressure Distribution Piping:

   1. Steel pipe with threaded joints or copper tube with brazed joints.

C. Drain Piping: Copper tube with brazed or soldered joints.

EXECUTION

A. Scope all piping to drain locations.

B. Dielectric Fittings to be installed at dissimilar metals.

C. Flexible Pipe Connectors to be installed at vibrating equipment.

FUEL-FIRED DOMESTIC WATER HEATERS – (SECTION 223400)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

WARRANTY

A. Materials and Workmanship:

   1. Gas Water Heaters: Five years.
   2. Expansion Tanks: One year.

PRODUCTS

HOUSEHOLD, ATMOSPHERIC, DIRECT-VENT or POWER-VENT, STORAGE, GAS WATER HEATERS: ANSI Z21.10.1/CSA 4.1.

A. Storage Tank Construction: Steel.

B. Pressure Rating: 150 psig.

C. Interior Finish: Comply with NSF 61.

D. Burner: For natural-gas fuel.

E. Automatic Ignition: Electric.

F. Temperature Control: Adjustable thermostat.

COMMERCIAL, ATMOSPHERIC, POWER-BURNER OR POWER-VENT, STORAGE, GAS WATER HEATERS: ANSI Z21.10.3/CSA 4.3.

A. Storage Tank Construction: ASME code steel with 150-psig working-pressure rating.

B. Interior Finish: Comply with NSF 61.

C. Lining: Sheet copper complying with NSF 61.

D. Burner: For natural-gas fuel.

E. Automatic Ignition: Electric.

F. Temperature Control: Adjustable thermostat.

G. Safety Controls: Automatic, high-temperature-limit and low-water cutoff.

H. Special Requirements: NSF 5 construction.

COMMERCIAL, HIGH-EFFICIENCY, GAS WATER HEATERS: ANSI Z21.10.3/CSA 4.3.

A. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency.

B. Storage Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

C. Interior Finish: Comply with NSF 61.

D. Lining: Cement or Glass complying with NSF 61.

E. Burner or Heat Exchanger: For natural-gas fuel.

F. Temperature Control: Adjustable thermostat.

G. Safety Controls: Automatic, high-temperature-limit and low-water cutoff.

EXPANSION TANKS:

A. Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm.

B. Interior Finish: Comply with NSF 61.

C. Air-charging valve.

SOURCE QUALITY CONTROL:

A. Water Heater Storage Tanks, Specified to Be ASME-Code Construction: Tested and inspected according to ASME Boiler and Pressure Vessel Code.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

PLUMBING FIXTURES – (SECTION 224000)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 220500" for minimum requirements in the following areas:
   1. General
   2. Warrantee
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Regulatory Requirement: Public Law 102-486.

B. Quality Standard: NSF 61 for fixture materials in contact with potable water.

C. Quality Standard for Electrical Components, Devices, and Accessories: NFPA 70, Article 100.

D. Plumbing Fixture Standards: Comply with applicable portions of National Standard Plumbing Code pertaining to materials and installation of plumbing fixtures.

E. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.

F. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.

G. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.

H. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for Making Building and Facilities Accessible To and Usable by Physically Handicapped People."

PRODUCTS

GENERAL:

A. Unless otherwise specified, comply with applicable Federal Specification WW-P-541/-Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes.

B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, de-coloration, or other surface imperfections on finished units are not acceptable.

C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
   1. Stainless Steel Sheet: ASTM A 167, Type 302/304, hardest workable temper.
   2. Finish: No 4, bright, directional polish on exposed surfaces.
   3. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.

PLUMBING FITTINGS, TRIM AND ACCESSORIES:

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial qualify faucets, valves, or dispensing devices. Include manual shut-off valves and connection stem pipes to permit outlet servicing without shut-down of water supply piping system.

B. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.

C. P-Traps: Include removable P-traps where drains are indicated for direct connection to drainage system.

D. Carriers: Provide cast-iron supports for fixtures of either graphite gray iron, ductile iron, or malleable iron as indicated.

E. Fixture Bold Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

F. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated cast-brass escutcheons with set screw.

G. Aerators: Provide aerators of types approved by Health Departments having jurisdiction.

FIXTURES:

A. Acceptable Manufacturers:
   1. American Standard

2. Crane Co.
3. Eljer Plumbingware Div.
4. Kohler Co.

FLUSH VALVES

A. Acceptable Manufacturers: Flush Valves.
   1. Sloan Valve Co.
   2. Zurn Industries, Inc.; Hydromechanics Div.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

COMMON WORK RESULTS FOR HVAC – (SECTION 230500)

GENERAL

A. It is the intent of this outline is to delineate areas where the County has specific requirements or preferences, rather than supplying a complete specification. The Consulting Engineer's specifications shall be modified to accommodate these provisions.

B. Contractor shall be responsible for supplying all components, commodities and accessories required for a fully functioning system.

C. Division 01 Section "Sustainable Design Requirements," for submittals and procedures relating to the LEED® Rating System including, but not limited to:
   a. Environmental Quality credits 3.1 "Construction IAQ Management Plan – During Construction" and 3.2 "Construction IAQ Management Plan – Before Occupancy."
   b. Energy and Atmosphere credit 1 "Optimize Energy Performance."
   c. Energy and Atmosphere credit 5 "Measurement and Verification."

D. Division 01 Sections "General Commissioning Requirements" for submittals and procedures relating to building systems commissioning.

E. Division 01 Section "High Performance Building Design Requirements" – (SECTION 018113).

WARANTY

A. Guarantee HVAC systems to be free from noise in operation that may develop from failure to construct system in accordance with contract documents.

B. Insure that all pipes, conduit, and connections shall be free from foreign matter, pockets and all other obstructions for the free passage fluid.

C. All equipment and the complete system shall be guaranteed for a period of one year from the date of Substantial Completion. The contractor shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during that period.

D. All devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system.

STANDARDS

A. Current edition of International Mechanical Code.

B. Current edition of International Plumbing Code.

C. Current edition of International Building Code.

D. Current edition of International Fuel Gas Code.

E. Current edition of the International Fire Code.

F. Current edition of NFPA.

G. Current edition of the International Energy Code.

H. Local codes and ordinances.

I. ASPE Handbooks.

J. Current edition of ASHRAE Standard 90.1.

K. Current edition of ASHRAE Standard 62.1.

L. Current edition of ASHRAE Standard 55.

M. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.

ENERGY EFFICIENCY

A. Baseline Construction: The building as a whole including envelope construction, HVAC, plumbing, lighting, etc. shall meet the current edition of ASHRAE STANDARD 90.1.
   1. The local authority having code jurisdiction may also require compliance with the current edition of the International Energy Code.
   2. For compliance with the adopted energy code, a code compliance report must be provided.

B. High Efficiency Construction: The building as a whole including envelope construction, HVAC, plumbing, lighting, etc. shall exceed the current edition of ASHRAE STANDARD 90.1 by **[minimum of 14% and as approved by County Project Manager]** 10% as determined by the energy cost budget method of calculation.
   1. The Owner's project manager shall identify each project criteria as "baseline" or "high efficiency" construction.
   2. Provide an energy use analysis in accordance with Appendix G of ASHRAE Standard 90.1 current edition. Analysis shall show and improvement of 14% for new construction and 7% for existing building renovation.

INDOOR ENVIRONMENTAL QUALITY

A. The building HVAC system shall be designed and constructed to provide the minimum outdoor ventilation airflow at 30% above the minimum rate as determined in accordance with the current edition of ASHRAE Standard 62.1 "Ventilation for Acceptable Indoor Air Quality."

B. The building HVAC systems shall be designed with the capability of monitoring the indoor ventilation requirements. At a minimum this shall include:
   1. Carbon Dioxide monitoring of densely occupied spaces.
   2. Provision for direct measurement of outdoor ventilation airflow being brought into the building.

C. Provide the building with systems and equipment to minimize the exposure of occupants to potentially hazardous particulates and chemical pollutants.

D. Provide comfort controls to at least half of the building occupants for regularly occupied spaces. Controls shall allow adjustment to meet needs of specific tasks and individual preference.

E. Provide comfort controls for each shared/multi-occupant spaces to allow adjustment for suiting user-group requirements.

F. Design HVAC systems to provide a comfortable thermal environment to support the productivity and well-being of building occupants.

G. Implement an ongoing thermal comfort assessment of building occupants for a period of six to 18 months after building occupancy. Use survey results to develop a plan for corrective action if more than 20% of occupants are dissatisfied with interior space conditions.

SUBMITTALS

A. Welding Certificates.

B. Product Data:

   1. Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underline.
   2. Include name, address, and phone number of each supplier.

C. Shop Drawings:
   1. Schematic control diagrams for each separate system.
   2. Other shop drawings required by Division 22 trade Sections.

OPERATION AND MAINTENANCE DATA

A. Provide operation and maintenance manuals, including the following:

   1. Operation manuals for systems, subsystems, and equipment.
   2. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.

B. Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

C. If requested, contractor shall submit sections of manual on specific equipment 2 weeks prior to start up for review by engineer, Cx agent and/or owner's representative.

PRODUCTS

JOINING MATERIALS

A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch maximum thickness unless thickness or specific material is indicated.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12.

DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrours materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure and temperature.

C. Dielectrc Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

UNIONS: Unions shall be used on all connections to automatic valves, on one side of manual valves, on each pipe at a heating or cooling coil, at connections to heating or cooling equipment, and at any plumbing equipment requiring servicing.

ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

B. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

EXECUTION

PIPING SYSTEMS

A. Install piping at indicated slopes and in such manner to allow valve servicing.

B. Install piping free of sags or bends.

PIPING CONNECTIONS

A. Install unions at each valve and at final connection to each piece of equipment and plumbing fixture having 2” diameter and smaller connections.

B. Install flange connections at each piece of equipment larger than 2” diameter.

C. Use dielectric connections for dissimilar metals.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT – (SECTION 230513)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC - SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

A. Polyphase Motors:
   1. Service Factor: 1.15.
   2. Rotor: Random-wound, squirrel cage.
   3. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
   4. Temperature Rise: Class Rating.
   5. Insulation: Class F.

B. Single-Phase Motors:

   1. Motors Larger than 1/20 HP: Permanent-split capacitor; split phase; capacitor start, inductor run; or capacitor start, capacitor run to suit starting torque and requirements of specific motor application.
   2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
   3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
   4. Motors 1/20 HP and Smaller: Shaded-pole type.
   5. Internal thermal protection.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

METERS AND GAGES FOR HVAC PIPING – (SECTION 230519)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

THERMOMETERS:

A. Shall conform with ASTM E.1. Scale ranges for each application shall be specified.

B. Metal-Case, Liquid-in-Glass Type: Aluminum or Brass case organic-liquid filled.

C. Plastic-Case, Liquid-in-Glass Type: Mercury or organic-liquid filled.

D. Duct, Liquid-in-Glass Type: Metal or plastic case, mercury or organic-liquid filled.

E. Direct-Mounting, Vapor-Actuated Dial Type: Liquid-filled type, metal or plastic case.

F. Remote-Reading, Vapor-Actuated Dial Type: Dry type, steel or aluminum case.

G. Bimetallic-Actuated Dial Type: Liquid filled type, stainless-steel case.

PRESSURE GAUGES:

A. Shall conform with ASME B40.1, Grade A phosphor-bronze Bourdon-tube pressure gauge, bottom connection, liquid filled. Range shall be 2 times operating pressure. Install ball valve for steam in piping tee with snubber for water and siphon for steam.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

GENERAL-DUTY VALVES FOR HVAC PIPING – (SECTION 230523)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy efficiency
   5. Submittals
   6. Operation and Maintenance data

PRODUCTS

VALVES

A. Use gate, ball, and butterfly valves for shut-off duty; globe and ball for throttling duty.

EXECUTION

LOCATION

A. Valve shall be located for easy access and provide separate support where necessary.

B. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown and easiest removal of equipment.

C. Unions are not required on flanged devices.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT – (SECTION 230529)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standard
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PERFORMANCE REQUIREMENTS

A. When a "Contractor Performance Specification" is utilized, the contractor shall include the following:
   1. Design supports for multiple pipes and equipment.
   2. Design seismic-restraint hangers and supports and obtain approval from authorities having jurisdiction.
   3. Shop Drawings: Signed and sealed by a qualified professional engineer.

COMPONENTS

A. Steel pipe hangers and supports.

B. Trapeze pipe hangers.

C. Fiberglass pipe hangers.

D. Metal framing systems.

E. Fiberglass strut systems.

F. Thermal-hanger shield inserts.

G. Pipe Stands.

H. Equipment supports.

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT – (SECTION 230548)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy efficiency
   5. Submittals
   6. Operation and Maintenance Data

PERFORMANCE REQUIREMENTS

A. When a "Contractor Performance Specification" is utilized, the contractor shall include the following:
   1. Seismic-Restraint Loading:
      a. Identify the Class as Defined in the IBC: [**A**] [**B**] [**C**] [**D**] [**E**] [**F**].
      b. Identify signed Seismic Use Group or Building Category as Defined in the IBC: [**I**] [**II**] [**III**].
         1) Component Importance Factor: **1.5**.
         2) Component Response Modification Factor: **3.5**.
         3) Component Amplification Factor: **2.5**.
      c. Identify design Spectral Response Acceleration at Short Periods (0.2 Second).
      d. Identify design Spectral Response Acceleration at 1-Second Period.

PRODUCTS

B. Vibration Isolators:

   1. Isolator Pads: Neoprene, Rubber or Hermetically sealed compressed fiberglass.
   2. Mounts: Double-deflection type.
   3. Restrained Mounts: All directional mountings with seismic restraint; cast-ductile-iron housing.
   4. Spring Isolators: Freestanding, laterally stable, open-spring type.
   5. Restrained Spring Isolators: Freestanding, steel, open-spring type with seismic restraint.
   6. Housed Spring Mounts: Ductile-iron or steel housing, with integral, vertically adjustable seismic snubbers.
   7. Elastomeric Hangers: Double-deflection type.
   8. Spring Hangers: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression.
   9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression and with vertical-limit stop.

10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor.
11. Resilient pipe guides.

C. Air-Mounting Systems:

1. Air Mounts: Freestanding, single or multiple, compressed-air bellows.
2. Restrained Air Mounts: Housed compressed-air bellows.

D. Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail; with spring isolators mounted on elastomeric isolation pads, and snubber bushings.

E. Vibration Isolation Equipment Bases:

1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

F. Seismic-Restraint Devices:

1. Snubbers: Welded structural-steel shapes and replaceable resilient isolation washers and bushings.
2. Channel Support System: MFMA-3 slotted steel channels.
3. Restraint Cables: Stainless-steel cables.
4. Anchor Bolts: Mechanical type, seismic rated.
5. Resilient Isolation Washers and Bushings: Molded neoprene.

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT – (SECTION 230553)

PART 1 - SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Quality Standard for Piping Identification: ASME A13.1.

PRODUCTS

VALVES

A. Valve schedules shall be submitted for each piping system and approved by engineer and owner. A valve schedule shall be laminated in plastic and mounted in each applicable room at a location selected by the owner. Tabulate valve number, piping system, area served, normal position, system abbreviation (as shown on tag) location of valve, and variations for identification.

B. Valve shall be tagged with their number and system abbreviation.

C. Valve tags be stamped or engraved with 1/4 inch letters for piping system abbreviation and 1/2 inch identification for valve number. Materials shall be 19-gauge polished brass, 19-gauge stainless steel or 1/32 inch thick plastic laminate having 2 black surfaces and a white inner layer with a mounting hole located no less than a distance equivalent to the hold diameter from the edge. Valve tags shall be affixed with wire link brass chain around the pipe next to the valve.

EQUIPMENT:

A. Equipment nameplates shall be 1/32 inch thick plastic laminate having 2 black surfaces and a white inner layer with lettering at least 3/16 inch high. Mounting holes be located no less than a distance equivalent to the hold diameter from the edge. Information on labels shall include:
   1. Identification number and name.
   2. Capacity of equipment, i.e. for pumps flow and head, for air handlers CFM, etc.
   3. The area the equipment is serving.
   4. If the item is part of a unit, the number and name of the unit served.

B. Mechanical identification materials or devices are blocked or defaced they shall be moved or replaced.

PIPING:

A. All pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. Pipes shall be identified at the following locations:
   1. Adjacent to each valve.
   2. At every point of entry and exit where piping passes through wall or floor.
   3. Spaced at a maximum of 50 feet on long continuous lines.
   4. On each riser and junction.
   5. Adjacent to all special fittings or devices (regulating valves, etc.).
   6. Connections to equipment.
   7. All fill points.
   8. At all access doors or similar access points that permit view of concealed piping.

B. Markers shall be applied so they can be read from the floor.

C. Pipe coding shall be uniform throughout.

D. Labels and marks shall be of the self-sticking, all temperature permanent type as manufactured by W.H. Brady Co. Or Seton Name Plate Corp.

E. Both PVC jacketed insulated piping and non insulated painted piping shall adhere to the following color code:

Fire Protection	Red
Steam Supply	Orange
Condensate Return	Aluminum
Potable Cold Water	Dark Green
Potable Hot Water	Dark Yellow
Chilled Water	Dark Blue
Condenser Water	Light Grey
Natural Gas	Light Yellow
Compressed Air	Dark Brown
Heating Water	Light Brown

Commented [NW1]: Update Request by Jeff Beck extension 2341.

TESTING, ADJUSTING, AND BALANCING FOR HVAC – (SECTION 230593)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR PLUMBING – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy efficiency
   5. Submittals
   6. Operation and Maintenance data

B. Provide testing, adjusting, and balancing for the following:

   1. Air Systems
   2. Hydronic Systems
   3. Steam systems.
   4. Heat exchangers.
   5. Motors.
   6. Chillers.
   7. Cooling towers.
   8. Condensing units.
   9. Boilers.
   10. Heat-transfer coils.
   11. Temperature measurements.
   12. Commercial kitchen, laboratory fume and exhaust hoods.
   13. Space pressurization measurements and adjustments.
   14. Vibration measurements.
   15. Sound-level measurements.
   16. Stair-tower pressurization system measurements and adjustments.
   17. Smoke-control system testing.
   18. Indoor-air quality measurements.
   19. Existing systems.
   20. Temperature-control verification.

C. Refer to Division 01 Sections "General Commissioning Requirements", "HVAC Systems Commissioning Requirements", and "Electrical Systems Commissioning Requirements" for submittals and procedures relating to building systems commissioning and how Testing, Adjusting & Balancing integrate with the building commissioning.

QUALITY ASSURANCE

A. Testing, Adjusting, and Balancing Agent Qualifications: AABC or NEBB certified.

WARRANTY

A. Guarantee: AABC national project performance or NEBB guarantee that a certified agent has performed TAB and optimum performance capabilities have been achieved.

EXECUTION

EXAMINATION

A. Contract Documents, approved submittal data, Project Record Documents, design data, equipment performance data, system and equipment installations, systems and equipment test reports, and automatic controls for deficiencies that may preclude proper TAB of systems and equipment.

B. Submit Deficiencies report.

C. Submit a testing, adjusting, and balancing plan for review by engineer, Cx agent, and/or owner's representative.

D. Submit a systems readiness checks.

TESTING, ADJUSTING AND BALANCE PROCEDURES

A. AABC's "National Standards for Testing, Adjusting, and Balancing Procedures: AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." Or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

HVAC SYSTEMS AIRFLOW AND WATER FLOW RATE TOLERANCES

A. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 percent to plus 10 percent.

B. Air Outlets and Inlets: 0 to minus 10 percent.

C. Heating-Water Flow Rate: 0 to minus 10 percent.
   1. Cooling-Water Flow Rate: 0 to minus 5 percent.

REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents, on adequacy of design for systems' balancing devices.
   1. Status Reports: As Work progresses.

2. Final Report: Certification sheet with content and format according to AABC or NEBB standard forms.

INSPECTIONS

A. Initial Inspections: Random checks by TAB firm to verify final TAB report.

B. Final Inspections: Random checks by Owner or Architect to verify final TAB report.

HVAC INSULATION – (SECTION 230700)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors according to ASTM E 84.

PRODUCTS

HEATING SYSTEMS INSULATION SHALL INCLUDE:

A. Heating water supply and return piping.

B. Heat exchangers, converters and air separators.

COOLING SYSTEMS INSULATION SHALL INCLUDE:

A. Chilled water.

B. Chiller cold surfaces not factory insulation.

C. Cold condensate drains.

D. Refrigerant suction.

E. Refrigerant hot gas.

F. Chilled water pump bodies.

AIR DISTRIBUTION SYSTEM INSULATION SHALL INCLUDE:

A. Interior surfaces of outside air and mixed air plenums and ducts.

B. Exterior surfaces of supply air plenums, not indicated to be lined.

C. Rigid spiral supply air ductwork.

OTHER SYSTEMS INSTULATION SHALL INCLUDE:

A. Piping exposed to freezing with heater tracer.

JACKETING

A. The jacketing shall be a high impact polyvinyl chloride pipe covering on insulated piping. Thickness to be 30 mil. Install per manufacturer's recommendations for hot and cold piping systems. Seal using solvent welding adhesive, providing slip joints as required for expansion and contraction. Ceel-co Ceel-Tite 300 Series, Schuller Zeston 300 Series or approved equal. Jacketing shall be color coded according to piping contents.

B. Piping insulation exposed to weather shall be jacketed with a 0.016-inch thick corrugated aluminum jacket. The seam shall be installed on the bottom of horizontal and angled piping.

EXECUTION

EQUIPMENT ROOMS

A. All piping in equipment rooms shall be covered with a protective insulation jacketing to a height of eight feet above finish floor.

COMMISSIONING OF HVAC – (SECTION 230800)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy efficiency
   5. Submittals
   6. Operation and maintenance data

B. Refer to Division 01 Sections "General Commissioning Requirements", "HVAC Systems Commissioning Requirements", and "Electrical Systems Commissioning Requirements" for submittals and procedures relating to building systems commissioning.

GENERAL

A. All parties shall cooperate and include the requirements for commissioning HVAC&R systems, assemblies, and equipment.

B. All parties shall provide allowances for labor, instrumentation, tools, and equipment costs for technicians for performance of commissioning testing.

C. Contractor's Responsibilities:

   1. Perform commissioning tests at the direction of the CxA.
   2. Attend construction phase controls coordination meeting.
   3. Attend testing, adjusting, and balancing review and coordination meeting.
   4. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection.
   5. Provide information to CxA for final commissioning documentation.
   6. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data.

D. CxA's Responsibilities:

   1. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components.
   2. Direct commissioning testing.
   3. Verify testing, adjusting, and balancing of Work are complete.
   4. Provide test data, inspection reports, and certificates in Systems Manual.

E. Commissioning Documentation:

   1. Submittals delivery and review plan.
   2. Identification of installed systems, assemblies, equipment, and components.

3. Construction checklists.
4. Certificate of completion.
5. Certificate of readiness.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

F. Submittals:

1. Certificates of readiness.
2. Certificates of completion.

G. Procedure
1. Follow requirements as outlined in ASHRAE Guideline 2005.

EXECUTION

A. Testing Preparation: Certification and verification that systems, subsystems, and equipment are ready for testing.

B. Testing and Balance Verification:

1. CxA witnesses testing and balance Work.
2. Verification of final testing and balance report.

C. Scope of Testing:
1. Design engineer shall coordinate with County Project Manager to identify specific systems to require commissioning. These systems shall be listed in the construction documents.
2. Provide testing technicians, instrumentation, and tools.
3. Entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space.
4. All modes of operation.
5. Assist in preparation of testing procedures.
6. Simulation of conditions when required.
7. Boiler testing and acceptance procedures.
8. HVAC&R instrumentation and control system testing.
9. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment.
10. Energy supply system testing.
11. Refrigeration system testing.
12. HVAC&R distribution system testing.
13. Vibration and sound tests.

INSTRUMENTATION AND CONTROL FOR HVAC – BACNET – (SECTION 230900)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standard
   4. Energy efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. **Refer to "HIGH PERFORMANCE BUILDING DESIGN REQUIREMENTS – (SECTION 018113)" for minimum requirements in this area.**

C. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

SUBMITTALS

A. Product Data: For each control device indicated.

B. Shop Drawings:
   1. Schematic flow diagrams.
   2. Power, signal, and control wiring diagrams.
   3. Details of control panel faces.
   4. Damper schedule.
   5. Valve schedule.
   6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
   7. Control System Software: Schematic diagrams, written descriptions, and points list.

C. Software and firmware operational documentation.

D. Field quality-control test reports.

E. Operation and maintenance data.

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. Installer Qualifications: A qualified installer who is an authorized representative, a certified installer, or an approved installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.

C. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

D. Totally native BACnet-based system, including an operators workstation using Microsoft Windows 2000 Professional or XP Professional as the operating system and shall be based on a distributed control system in accordance with this specification. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2001, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers utilizing a proprietary protocol shall be acceptable under this section.

COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 21 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

SCOPE OF WORK INCLUDED

A. Furnish a Microsoft Windows based Direct Digital Control system (DDCS) in accordance with this specification section. Items of work included are as follows:

1. Provide all necessary hardware and software to meet the specified functional requirements.
2. Prepare individual hardware layouts, interconnection drawings and control loop configuration data from project design data.
3. Implement the detailed design for all system input/output points, distributed control and system data bases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
4. Design all equipment cabinets, panels, and the data communication network cables including all associated hardware.
5. Provide and install all cabinets, panels, and data communication network cables including all associated hardware.
6. Provide and install all interconnecting cables between supplied cabinets, controllers, and output devices.
7. Provide and install all interconnecting cables between all operator terminals and peripheral devices (such as printers, etc.) supplied under this section.
8. Provide complete specifications for all items supplied by the Vendor from others (such as printers, instruments, etc.).
9. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, start-up and commissioning.
10. Provide a comprehensive operator and technician training program as describe herein.
11. Provide as-built documentation, software, and all DDC control logic and all associated support documentation, software, and all DDC control logic and all associated support documentation on approved media which accurately represents the final system.

12. All control equipment hereinafter specified shall be provided by the Temperature Control Contractor under this section.
13. All control equipment shall be manufactured by the temperature control companies listed in the bidding section of these documents.
14. Furnish control components (damper actuators, control valves, DDC controller) to unit ventilator manufacturer for factory installation and testing.

B. RELATED WORK IN OTHER SECTIONS
1. Examine all sections for work related to work of this section, principle items of which are:

Finishes	Division 09
Mechanical	Division 23
Electrical	Division 26

2. The following incidental work shall be performed by the designated contractor under the supervision of the Temperature Control Contractor.
3. The Plumbing Contractor shall:
   a. Install automatic valves that are specified to the supplied by the Temperature Control Contractor.
   b. Furnish and install all necessary piping connections required for flow devices and wells.
4. The Sheet Metal Contractor shall:
   a. Provide access doors or other approved means of access through ducts for service to the control equipment.
   b. Install automatic dampers provided by this section.

PERFORMANCE

A. Approved DDC control equipment is:
1. Alerton Technologies, Inc.

B. Approved Installation Contractors:
1. ATC Contractors 486-9364
2. Colt Temperature Control & Tube 943-4195
3. D & L Electric Control 756-3802
4. Mountain Valley Temperature Controls 763-1110

SUBMITTALS

A. The following shall be submitted for approval:
1. Data sheets for all control systems and components.
2. Valve schedules, showing sizes, configuration capacity and location of all equipment.
3. Control system drawings containing pertinent data to provide a functional operating system, including a sequence of operation. Detailed shop drawings may be submitted in an as installed form upon project completion.
4. Programming.

B. Drawings:
1. After completion of contract, the Supplier shall submit review drawings, installation and operation instruction and a recommended spare parts list.
2. Provide three copies of as installed drawings.

C. System documentation by the Vendor shall include the following as a minimum:
   1. System configuration diagrams in simplified block format.
   2. Input/Output point and alarm point summary listing.
   3. Electrical drawings showing all system internal and external connection points, terminal block layouts and terminal identification.
   4. Manufacturer's instructions and drawings for installation, maintenance and operation of all purchased items.
   5. Overall system operation and maintenance instructions, including preventive maintenance and troubleshooting instructions.
   6. Complete recommended spare parts list.

WIRING

A. Electric wiring and wiring connections required for the installation of the temperature control system as herein specified, shall be provided by the Temperature Control Contractor unless specifically shown on the drawings or called for in the specifications to be by the electrical contractor.

B. All wiring shall be installed according to the National Electrical Code and local codes. In addition, all wiring in walls and other inaccessible areas, all line voltage wiring, and exposed wiring where damage may occur shall be in conduit. All wiring shall be installed in a neat workmanlike manner.

CONDUIT

A. All control wiring shall be installed in conduits.

B. Provide flexible connection to all vibrating equipment flexible conduit shall be maximum of 3 feet in length.

INSTRUCTION AND ADJUSTMENT

A. Upon completion of the project, the Temperature Control Contractor shall adjust and validate all thermostats, controllers, valves, damper operators, relays, etc. provided under this section.

B. Sensors shall be field verified and adjusted.

C. Instruction manual shall be furnished covering the function and operation of the control system on the project for use by the owner's operating personnel. An instruction period lasting not less than 16 hours shall be provided to completely familiarize operating personnel with the temperature control system.

PROVIDE ALL REQUIRED SOFTWARE AS PART OF THIS CONTRACT

A. Operator's workstation software shall be Microsoft Windows 2000 Professional or XP Professional as the computer operating system. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after hours billing

program, demand limiting, full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited.

B. Provide any upgrades in Software on a no charge basis for a minimum of 2 years after completion of the project. These upgrades will not include any upgrades in hardware necessary for enhancements in the system but will include any maintenance upgrades at no charge.

PROVIDE ALL TRAINING AS PART OF THIS CONTRACT

A. Provide application engineering to instruct owner in operation of systems and equipment

B. Provide system operator's training to include (but not limited to) such items as the following: Modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of 3 persons.

C. Provide on-site training above as required, up to 16 hours as part of this contract.

D. Provide tuition for at least one individual for a one-week factory training class. If applicable, costs for travel, lodging and meals will be the responsibility of the Owner.

PRODUCTS

SYSTEM DESIGN

A. Provide a Distributed Processing System complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software. System shall be completely based on ANSI/ASHRAE Standard 135-2001, BACnet. This system is to control all HVAC equipment and others specified equipment directly, without intervening conventional controls.

B. All DDC Controllers for terminal units, air handlers, central mechanical equipment, and remote or onsite Windows based operators' terminal(s) shall communicate with each other and share information.

C. The controls supplier shall assume complete responsibility for the entire controls system as a single source and shall certify that he has on staff under his direct employ on a day-to-day basis, factory training technical personnel, qualified to engineer, program, debug, and service all portions of the DDC control system, including central remote or onsite system operators terminal, global controllers, terminal unit controllers, and all other portions of the DDC control system.

D. Basic System Features:
   1. Zone by zone DDC control of space temperature, usage scheduling, optimum starting, equipment failure reporting, and override timers for off-hours usage. A zone is the area served by one HVAC terminal unit (VAV box, heat pump, unit ventilator, fan coil, etc.)
   2. Complete energy management firmware, including self adjusting optimum start, demand limiting, global control strategies and logging routines for use with total control systems. Operators terminal software is to be used for access to remote or onsite field based energy management control firmware only.

3. Priority password security systems to prevent unauthorized use. Each user shall have an individual password. Each user shall be assigned which control functions they have access to.
4. Equipment monitoring and alarm function including information for diagnosing equipment problems.
5. The complete system including, but not limited to terminal unit controllers, Global controllers and Operator terminals shall Auto-restart, without operator intervention, on resumption of power after a power failure. Database stored in Global Controller memory shall be battery backed up for a minimum of 30 days. Unitary controllers shall utilize EEPROM for all variable data storage. Batteries on unitary controllers shall not be allowed.
6. Modular system design of proven reliability.
7. Each field panel capable of independent control.
8. All software and/or firmware interface equipment for connection to remote or onsite operator's terminal including modems at each site specified.
9. Equipment runtime totalization of fans, heaters, boilers, etc., capable of alarm generation and alarm dial out to remote sites.
10. Room sensors with digital readout that allow the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. User shall also be able to shut unit off from sensor.
11. Field control devices such as terminal unit controllers shall have optically isolated communications lines. Controllers not opto-isolated and utilizing a ground referenced communication technique are specifically prohibited.
12. Communication wiring for field control devices shall not be dependent on daisy chaining of communication wiring. Communication wire may be run in star patterns, daisy chained or combination of either, allowing units to be added to a communication line easily in the future.
13. All DDC hardware and software shall be designed and manufactured by U.S. corporations. All hardware shall be U.L. listed with integral labels showing rating.

QUALITY ASSURANCE

A. Responsibility: The supplier of the DDCS shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished by him.

B. Component Testing: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every controller, sensor, and all other DDC components shall be individually tested by the manufacturer prior to shipment.

C. Tools, Testing and Calibration Equipment: Provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the DDS.

REFERENCE STANDARDS

A. The latest edition of the following standards and codes in effect and amended as of date of Supplier's Proposal, and any subsections thereof as applicable, shall govern design and selection of equipment and material supplied:
   1. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers.
   2. IBC International Building Code, including local amendments.
   3. UL 916 Underwriters Laboratories Standard for Energy Management Equipment.

4. NEC National Electrical Code.

B. City, county, state and federal regulations and codes in effect as of date of purchase.

C. Except as otherwise indicated, vendor shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

SCHEDULING AND COORDINATION

A. The Temperature Control Contractor shall coordinate all installation schedules and component delivery schedules with the General Contractor and Mechanical and Sheet Metal contractor on the job.

WARRANTY

A. Warranty shall cover all costs for parts, labor, and associated travel, and expenses for a period of one year from completion of system demonstration.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the Vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.

C. This warranty shall apply equally to both hardware and software.

DDC EQUIPMENT

A. Operator Workstation: PC-based microcomputer with minimum configuration as follows:

1. Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium 4.
3. Random-Access Memory: 2 GB.
4. Graphics: Video adapter, minimum 1280 x 1024 pixels, 256-MB video memory, with TV out.
5. Monitor: 17 inches, LCD color.
6. Keyboard: QWERTY, 105 keys in ergonomic shape.
7. Hard-Disk Drive: 80 GB.
8. CD-ROM Read/Write Drive: 48x24x48.
9. Mouse: Three button, optical.
10. Uninterruptible Power Supply: 2 kVa.
11. Operating System: Microsoft Windows XP Professional with high-speed Internet access.
12. Printer: Color, ink-jet type as follows:
    a. Print Head: 4800 x 1200 dpi optimized color resolution.
    b. Paper Handling: Minimum of 100 sheets.
    c. Print Speed: Minimum of 17 ppm in black and 12 ppm in color.
    d. Application Software.

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
   d. Software applications, scheduling, and alarm processing.
   e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
3. Local operator interface provides for download from or upload to operator workstation.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. Enclosure: Dustproof rated for operation at 32 to 120 deg F.

ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:
   1. Accuracy: Plus or minus 0.5 deg F at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
   4. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
   5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
   6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment: Exposed.
      b. Set-Point Indication: Exposed.
      c. Thermometer: Exposed.
      d. Color: White.
      e. Orientation: Vertical.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
   8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:
   1. Accuracy: Plus or minus 0.2 percent at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
   4. Averaging Elements in Ducts: 24 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
   5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
   6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment: Exposed.
      b. Set-Point Indication: Exposed.
      c. Thermometer: Exposed.
      d. Color: White.
      e. Orientation: Vertical.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
   8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.
   1. Accuracy: 5 percent full range with linear output.
   2. Room Sensor Range: 20 to 80 percent relative humidity.
   3. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment: Exposed.
      b. Set-Point Indication: Exposed.
      c. Thermometer: Exposed.
      d. Color: White.

e. Orientation: Vertical.

4. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
5. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
6. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:

1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg.
   d. Duct Static-Pressure Range: 0- to 5-inch wg.
2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Exposed.
2. Set-Point Indication: Exposed.
3. Thermometer: Exposed.
4. Color: White.
5. Orientation: Vertical.

G. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Metal wire, tamperproof.
3. Adjusting Key: As required for calibration and cover screws.

STATUS SENSORS

A. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

B. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

C. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

D. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

E. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

F. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Common Motor."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers:
   a. Belimo Aircontrols (USA), Inc.
2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
   e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.

f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: 40 to 104 deg F.
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
12. Run Time: 12 seconds open, 5 seconds closed.

CONTROL VALVES

A. Manufacturers:

1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
2. Erie Controls.
3. Honeywell.
4. Johnson.
5. Belimo.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: [**5-psig**] maximum pressure drop at design flow rate or the following:
   a. Two Position: Line size.
   b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
   c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-

way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Ball Valves:
   1. Valves shall be of industrial quality with bronze bodies and female NPT threads. Valve bodies may also be stainless steel.
   2. All valves shall have blowout proof stem design, reinforced Teflon thrust seal washer and stuffing box. Packing gland screw shall be adjustable for wear.
   3. Use chromium-plated bronze ball or where specified, stainless steel ball and stem. All valves shall be provided with reinforced Teflon seats.
   4. All ball valves shall have an equal percent flow characterized disc. Full ported ball valves not acceptable.
   5. Manufacturers:
      a. Belimo Air Controls (USA) Inc.

E. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
   1. Body Style: Wafer or Grooved.
   2. Disc Type: Nickel-plated ductile iron.
   3. Sizing: 1-psig maximum pressure drop at design flow rate.

DAMPERS

A. Manufacturers:
   1. Johnson Control Inc. D-1300
   2. Ruskin Inc.

B. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch-minimum thick, galvanized-steel or 0.125-inch-minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch-thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

   1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
   2. Operating Temperature Range: From minus 40 to plus 200 deg F.
   3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
   4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."

GLOBAL CONTROLLER

A. General:
   1. All communication with operator workstation and all application controllers shall be via BACnet. Building controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz), master slave token passing (MS/TP) LANs, a point-to-point PTP – RS-232) connection and modem.
      a. Each MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.
      b. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).
      c. The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.
   2. Building controller shall be capable of providing global control strategies for the system based on information from any objects in system regardless if the object monitored by the balance controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.
   3. Programming shall be object-oriented using control function blocks, supporting DDC functions. 1000 Analog Values and 0100 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.
   4. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation or field computer.
   5. Building controller shall provide battery-backed real-time (hardware) clock functions.
   6. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).
   7. Global control algorithms and automated control functions should execute via 32-bit processor.
   8. Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.

B. BACnet Conformance:
   1. Building Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
      a. Clock Functional Group
      b. Files Functional Group
      c. Reinitialize Functional Group
      d. Device Communications Functional Group
      e. Event Initiation Functional Group

2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
4. The Building Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

C. Remote Communications:
1. Provide all functions that will allow remote communications via modem to off-site locations. Include one modem along with all cabling necessary for installation for the system. It shall be possible to use the onboard modem or a separate modem connected via the PTP/RS-232 connection.
2. Provide Windows 2000 software for off-site computer that allows operator to view and change all information associated with system on color graphic displays. Operator shall be able to change all parameters in this section from off-site location including all programming of building controllers and all programmable application controllers including all terminal unit controllers.
3. Building controller shall have capability to call out alarm conditions automatically. If desired, controller may also send encoded message to digital pager. If an alphanumeric pager is in use by the operator, building controller shall be capable of sending a text or numeric string of alarm description. All building controllers connected to the local LAN shall be capable of calling out alarm messages through one or more shared modems connected to one or more of the building controllers on the local LAN.
4. Building controller shall have capability to call a minimum of 20 different phone numbers. Numbers called may be controlled by type of alarm or time schedule.
5. Owner shall provide standard voice-grade phone line for remote communication function.
6. Building controller and internal modem shall be capable of modem-to-modem baud rates of 33.6 Kbps minimum over standard voice-grade phone liens. Lower baud rates shall be selectable for areas where local phone company conditions require them.

D. Schedules:
1. Each building controller shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.

E. Logging Capabilities:
1. Each building controller shall log as minimum 1000 trendlogs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
2. Logs may be viewed both on-site or off-site via remote communication.
3. Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired.

4. Archived data stored in database format shall be available for use in third-part spreadsheet or database programs.

F. Alarm Generation:
1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
2. Each alarm may be dialed out as noted in paragraph 2 above.
3. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
4. Controller must be able to handle up to 1500 alarm setups stored as BACnet event enrollment objects – system destination and actions individually configurable.

TERMINAL UNIT CONTROLLERS

A. Provide one native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

B. BACnet Conformance:
1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
   a. Files Functional Group
   b. Reinitialize Functional Group
   c. Device Communications Functional Group
2. Please refer to Section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum – Analog Input, Analog Output, Analog Value, Binary Input Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0.5 VDC, and dry contact signals. Inputs on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall also include binary outputs on board. For applications using variable speed parallel fans, provide a single analog output selectable for 0-10 V or 0-20 mA control signals. Application controller shall include microprocessor driven flow sensor for use in pressure independent control logic. All boxes shall be controlled using pressure independent control algorithms and all flow readings shall be in CFM (LPS if metric).

D. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using the same programming tool as Building Controller and as described in operator workstation section. All programming tools shall be provided as part of system.

E. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence for specific display requirements for intelligent room sensor.

F. On board flow sensor shall be microprocessor driven and precalibrated at the factory. Precalibration shall be at 16 flow points as a minimum. All factory calibration data shall be stored in EEPROM. Calibration data shall be field adjustable to compensate for variations in VAV box type and installation. All calibration parameters shall be adjustable through intelligent room sensor. Operator workstation, portable computers and special hand-held field tools shall not be needed for field calibration.

G. Provide duct temperature sensor at discharge of each VAV box that is connected to controller for reporting back to operator workstation.

OPERATOR WORKSTATION

A. General structure of workstation interaction shall be standard client/server relationship. Server shall be used to archive data and store system database. Clients shall access server for all archived data. Each client shall include flexibility to access graphics from server or local drive. Server shall support a minimum of 50 clients simultaneously.

B. BACnet Conformance:
   1. Operator's workstation shall as a minimum support Point-to-Point (PTP) and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device. Operator's terminal shall comply with the requirements to a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
      a. Clock Functional Group
      b. Event Response Functional Group
      c. Time Master Functional Group
      d. Device Communications
   2. Please refer to Section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
   3. Standard BACnet object types accessed by the workstation shall include as a minimum: Analog Value, Analog Input, Analog Output, Binary Value, Binary Input, Binary Output,

Calendar, Device, Event Enrollment, File, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

4. The Operator Workstation shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.

C. Displays:

1. Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD or Visio drawing files or field installation drawings and wiring diagrams from as-built drawings. Operator's workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
2. All displays and programming shall be generated and customized by the local EMCS supplier and installer. Systems requiring factory programming for graphics or DDC logic are specifically prohibited.
3. Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text. Text shall be justified left, right, or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state graphic objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three graphic files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the object's commanded status when the graphic item is selected with the system mouse. Similarly, allow the workstation operator to toggle the binary object's status by selecting with the mouse a graphic of a switch or light, for example, which then displays a different graphic (such as an "ON" switch or lighted lamp). Additionally, allow binary objects to be displayed as an animated graphic. Animated graphic objects shall be displayed as a sequence of multiple graphics to simulate motion. For example: when a pump is in the OFF condition, display a stationary graphic of the pump. When the operator selects the pump graphic with the mouse, the represented objects status is toggled and the graphics of the pump's impeller rotates in a time-based animation. The operator shall be able to click on an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change graphic file assignment and also create new and original graphics online. System shall be supplied with a library of standard graphics, which may be used, unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.

4. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the system graphic. Each analog input object may be assigned a minimum of five graphic files, each with high/low limits for automatic selection and display of these graphics. As an example, a graphic representation of a thermometer would rise and fail in response to either the room temperature or it's thermometer would rise and fall in response to either the room temperature or it's deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the "increase" or "decrease" arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trendlogs.
5. Analog objects may also be assigned to an area of a system graphic, where the color of the defined area changes based on the analog object's value. For example, an area of a floor-plan graphic served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.
6. A customized menu label (push-button) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label push buttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A security level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.
7. A mouse shall be used to move the pointer arrow to the desired item for selection of new display or to allow the operator to make changes to object data.

D. Password Protection

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above. Each operator's terminal shall provide security for 200 users minimum. Each user shall have an individual user ID, user name and password. Entries are alphanumeric characters only and are case sensitive (except for user ID). User ID shall be 0-8 characters, user name shall be 0-29 characters, and password shall be 4-8 characters long. Each system user shall be allowed individual assignment of only those control functions and menu items to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users. System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after auto logout occurs.

E. Operator Activity Log

1. Operator Activity Log shall be included with system that tracks all operator changes and activities. System shall track what is changed in the system, who performed this change, date, and time of system activity and value of the change before and after operator

activity. Operator shall be able to display all activity, sort the changes by user and also by operation.

2. Log shall be gathered and archived to hard drive on operator workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.
3. Any displayed data, that is changeable by the operator, may be selected using the right mouse button and the operator activity log shall then be selectable on the screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.

F. Scheduling:

1. Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily with events being the highest.
2. Holiday and special event schedules shall display data in calendar format. Operator shall be able to schedule holidays and special events directly from these calendars.
3. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
4. System shall include a Schedule Wizard for set up to schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting Schedule.
5. Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previously starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.

G. Alarm Indication and Handling

1. Operator's workstation shall provide audible, visual and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s) currently running. Printout of alarms shall be sent to the assigned terminal and port.
2. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment and identification of operator acknowledging alarm.
3. Alarm messages shall be in user-definable test (English or other specified language) and shall be entered either at the operator's terminal or via remote communication.
4. System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own pull-down selection for start-up or may be started by right clicking on value displayed on graphic and then selecting alarm setup.

H. Trendlog Information:

1. System server shall periodically gather historically recorded data stored in the building controllers and archive the information Archived files shall be appended with new sample

data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator's workstation. Operator shall be able to scroll through all trended data. All trendlog information shall be displayed in standard engineering units.

2. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to ten object types at the same time in different colors. Graphs shall show object values relative to time.
3. Operator shall be able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.
4. System shall include a trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right clicking on value displayed on graphic, and then selecting Trendlogs from the displayed men.

I. Energy Log Information

1. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.
2. All data shall be stored in data base file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
3. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.
4. System shall display archived data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format the user shall be able to select a specific period of data to view.

J. Demand Limiting:

1. System shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed to restore settings. The other type of shedding shall adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connectioned to system.
2. Binary shedding shall include minimum of 5 priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one the loads just shed/restored in a linear fashion.
3. Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.
4. Status of each and every load shed program shall be capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.

K. Tenant Activity:
1. System shall include program that monitors after-hours overrides by tenants, logs the data and generates a bill based on usage and rate charged for each tenant space. Tenant activity program shall be able to assign multiple zones, from a list of every zone connected to system, to a particular tenant. Every zone is monitored for after-hour override usage and that data logged in server. Operator may then generate a bill based on the usage for each tenant and the rate charged for any overtime use.
2. Configuration shall include entry of the following information for use in logging and billing.
   a. Tenants contact name and address.
   b. One or multiple tenant zones that make up a total tenant space including a separate billing rate for each separate zone.
   c. Minimum and maximum values and event duration and even limit.
   d. Property management information.
   e. Overall billing rate.
   f. Seasonal adjustments or surcharge to billing rate.
   g. Billing notification type such including, but not limited to printer, file and e-mail.
   h. Billing form template.
3. Logging shall include recording the following information for each and every tenant event.
   a. Zone description.
   b. Time the event beings.
   c. Total override time.
   d. Limits shall be applied to override time.
4. A tenant bill shall be generated for a specific period using all the entered configuration data and the logged data. User with appropriate security level shall be able to view and override billing information. User shall be able to select a billing period to look to view and be able to delete events from billing and be able to edit a selected tenant activity event's override time.

L. Configuration/Setup:
1. Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.

M. Field Engineering Tools:
1. Operator's workstation software shall include field-engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.
2. User shall be able to pick graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.
3. Programming tools shall include a real time operation mode. Function blocks shall display real time data and be animated to show status of data inputs and outputs when in real time operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.

4. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and other items that define unit to be controlled. Supply minimum of 250 applications as part of workstation software.
5. Field engineering tool shall include Device Manager for automatic detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computers hard drive. If needed, this file shall be downloaded to the appropriate controller by selection using the mouse.
6. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media.

N. Workstation Hardware
1. Provide operator's workstation(s) at location(s) noted on the plans.
2. Workstation/Server Computer Minimum Requirements.
   a. Pentium IV, 1.5 GHz or better.
   b. 256 MB RAM or better.
   c. 20GB hard disk or better.
   d. High-performance graphics adapter.
   e. Ethernet 10/100 network interface card.
   f. Keyboard, monitor, mouse, 3.5-inch disk drive, and CD-ROM.
   g. Windows 2000 Professional.
   h. Modem, 56Kb Minimum.
   i. Color Printer (Inkjet, Color Dye or Laser).

O. Software:
1. At the conclusion of project, contractor shall leave with owner a CD ROM that includes the complete software operation system and project graphics, setpoints, system parameters, etc. This backup shall allow the owner to completely restore the system in the case of a computer malfunction.

TEMPERATURE SENSORS

A. General:
1. All temperature sensors to be solid state electronic, factory calibrated to within one-half degree F, totally interchangeable. Wall sensors to be housed in enclosure appropriate for application. Duct and well sensors to be electronically identical with housing appropriate for application. Provide appropriate wells for installation by others.
2. Outside air sensor shall be located on north wall in location that is not subject to vandalism.

B. Intelligent Room Sensor with LCD Readout:
1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use – all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
2. The Intelligent Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This

unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developed should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.

3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.
4. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
5. Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to VAV controller, VAV box shall be balanced and all air flow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

C. Wall Sensor:
1. Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be store in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to Field Service Tool through wall sensor port.

D. Control Points:
1. At a minimum, the following equipment shall include control points as listed.
   a. Boiler
      1) Enable/disable
      2) Alarm
      3) Boiler temp. (each boiler)
      4) Hot water supply (system or individual)
      5) Hot water return (system or individual)
      6) Pump s/s and status for each boiler needs to be included.
   b. Chiller
      1) Chiller enable/disable
      2) Chiller alarm
      3) Chilled water supply temp.
      4) Chilled water return temp.
      5) Condensate water supply temp (water cooled).
      6) Condenser water supply temp. (water cooled).
      7) Chiller load or reset input (optional).
      8) Chilled water pump start/stop.
      9) Chilled water pump status (true flow indication).
   c. Cooling Tower
      1) Condenser water supply temp.
      2) Condenser water return temp.
      3) Tower fan start/stop or speed if VFD controlled.
      4) Condenser water pump start/stop.
      5) Condenser water pump status (true flow indication).
   d. Air Handling Devices (Air Handling Units, fan coil units).

1) Supply fan start/stop or speed control.
2) Return fan start/stop (if used).
3) Fan status (supply and return).
4) Heating coil valve control.
5) Cooling coil valve control.
6) Economizer damper control.
7) Evaporative cooling enable/disable.
8) Supply air temperature.
9) Return air temperature.
10) Mixed air temperature (optional).
11) Filter differential pressure switch.
12) Duct static pressure.
13) Building static pressure (if used).

e. VAV Boxes
1) Space temperature.
2) T-stat offset (if adjustable).
3) Damper position.
4) Air flow (cfm).
5) Discharge air temp.

EXECUTION

INSTALLATION

A. Verify mounting heights in first paragraph below with authorities having jurisdiction to comply with requirements of the Americans with Disabilities Act.

B. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation.
1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

E. Install labels and nameplates to identify control components according to Division 23 Section " Identification for HVAC Piping and Equipment." Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

F. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

G. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

H. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."
   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Install exposed cable in raceway.
   3. Install concealed cable in raceway.
   4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
   5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
   6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
   7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

FIELD QUALITY CONTROL

A. Retain first paragraph below to require a factory-authorized service representative to perform, or assist Contractor with, field inspections, tests, and adjustments. Retain one of two options to suit Project; delete both to require only an inspection before field testing.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect**,** test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
   2. Test and adjust controls and safeties.
   3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
   4. Test each point through its full operating range to verify that safety and operating control set points are as required.
   5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
   6. Test each system for compliance with sequence of operation.

7. Test software and hardware interlocks.

D. DDC Verification:
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.

E. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

PROGRAMMING

A. Contractor to include programming of trend logs for use in commissioning control zones.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 1 Section “Demonstration and Training.”

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS (SECTION 230993)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. This Section includes control sequences for HVAC systems, subsystems, and equipment.

C. See Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

SUBMITTALS

A. Shop Drawings: Written descriptions and diagrams of operational sequences.

SEQUENCES

A. List systems and related sequences appropriate for specified project application.

FACILITY NATURAL-GAS PIPING – (SECTION 231123)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

   1. Piping and Valves: 100 psig.

B. Natural-Gas System Pressures within Buildings:

   1. Single Pressure: 0.5 psig or less.
   2. Two Pressure Ranges: More than 0.5 psig but not more than 2 psig, and 0.5 psig or less.
   3. Two Pressure Ranges: More than 2 psig but not more than 5 psig, and more than 0.5 psig but not more than 2 psig.

PRODUCTS

A. Piping Specialties:

   1. Appliance flexible connectors.
   2. Quick-disconnect devices.
   3. Strainers.
   4. Weatherproof vent cap.

B. Manual Gas Shutoff Valves:

   1. One- and two-piece ball valves.
   2. Two-piece, full-port bronze ball valves with bronze trim.
   3. Bronze plug valves.
   4. Cast-iron, lubricated plug valves.
   5. Valve boxes.

C. Earthquake Valves with Switch: Cast-aluminum body:
   1. Approved Manufacturer
      a. Quake Pro by Koso International

D. Pressure Regulators:

1. Service pressure regulators.
2. Line pressure regulators.
3. Appliance pressure regulators.

E. Dielectric Fittings: Dielectric unions, dielectric flanges and dielectric-flange kits.

F. Indoor Piping
1. Black steel Schedule 40 pipe with threaded joints or welded joins as appropriate for pressure and location.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

HYDRONIC PIPING – (SECTION 232113)

PART 1 - SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Quality Standard: ASME B31.9.

PRODUCTS

VALVES:

A. Bronze, Calibrated-Orifice, Balancing Valves: Ball or plug type.

B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves: Ball, plug, or globe pattern.

C. SDPressure-Reducing Valves: Bronze or brass.

D. Safety Valves: Bronze or brass.

AIR CONTROL DEVICES:

A. Air Vents: Manual and automatic.

B. Expansion Tanks: ASME labeled with bladder or diaphragm.

C. Air Separators: Tangential type.

D. Supplies bypass chemical feeder and chemicals and glycol for first year of operation.

PIPING APPLICATIONS

A. Hydronic piping, aboveground, NPS 2 and smaller shall be any of the following:

1. Copper tubing and soldered, brazed or pressure-seal joints.
2. Steel pipe, cast or malleable-iron fittings, and threaded joints.
3. Steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.

B. Hydronic piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Copper tubing and soldered or brazed joints.
2. Steel pipe and welded and flanged joints.
3. Steel pipe and grooved, mechanical joints.

C. Makeup-water piping installed aboveground shall be the following:

1. Copper tubing, wrought-copper fittings, and soldered or brazed joints.

D. Condensate-Drain Piping: Copper tubing, wrought-copper fittings, and soldered joints or PVC plastic pipe and fittings and solvent-welded joints.

VALVE APPLICATIONS

A. Shutoff-duty valves are for each installation in branch connection to supply mains, and at supply connection to each piece of equipment.

B. Calibrated-orifice, balancing valves are for installation in each branch connection to return main.

C. Calibrated-orifice, balancing valves are for installation in return pipe of each heating or cooling terminal.

D. Check valves are for installation in each pump discharge and elsewhere as required to control flow direction.

E. Safety valves are for installation in hot-water generators.

F. Pressure-reducing valves are for installation in makeup-water connection to regulate system fill pressure.

CHEMICAL TREATMENT

A. Chemical Treatment: Water analysis by Contractor.

B. Propylene glycol solutions for freeze protection.
1. Minimum concentration shall be 30% by volume.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

HYDRONIC PUMPS – (SECTION 232123)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Quality Standard: UL 778.

PRODUCTS

Hydronic Pumps:

A. Close-Coupled, In-Line Centrifugal Pumps:

B. Close-Coupled, End-Suction Centrifugal Pumps:

C. Separately Coupled, Horizontal, In-Line Centrifugal Pumps:

D. Separately Coupled, Vertical, In-Line Centrifugal Pumps:

E. Separately Coupled, Base-Mounted, End-Suction Centrifugal Pumps:

F. Separately Coupled, Base-Mounted, Double-Suction Centrifugal Pumps:

G. Separately Coupled, Vertical-Mounted, Double-Suction Centrifugal Pumps:

H. Separately Coupled, Vertical-Mounted, Turbine Centrifugal Pumps:

AUTOMATIC CONDENSATE PUMP UNITS:

A. Package units with corrosion-resistant pump, plastic tank with cover, and automatic controls.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

STEAM AND CONDENSATE HEATING PIPING – (SECTION 232213)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Quality Standard: ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping."

PRODUCTS

DIELECTRIC FITTINGS:

A. Dielectric unions.

B. Dielectric flanges.

C. Dielectric-flange kits.

STRAINERS:

A. Y-pattern.

B. Basket.

FLASH TANKS:

A. Fabricated according to ASME Boiler and Pressure Vessel Code.

SAFETY VALVES:

A. ASME labeled.

PRESSURE-REDUCING VALVES:

A. Cast iron; pilot operated; diaphragm type.

STEAM TRAPS:

A. Thermostatic.

B. Thermodynamic.

C. Float and thermostatic.

D. Inverted bucket.

PIPING

A. Low Pressure (LP) Steam Piping:

1. LP Steam Piping, NPS 2 and Smaller: Steel pipe, cast-iron fittings, and threaded joints.
2. LP Steam Piping, NPS 2-1/2 through NPS 12: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
3. LP Steam Piping, NPS 14 through NPS 18: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
4. Condensate Piping above Grade, NPS 2 and Smaller:

    a. Steel pipe, cast-iron fittings, and threaded joints.

5. Condensate Piping above Grade, NPS 2-1/2 and Larger:

    a. Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
    b. RTRP and RTRF with adhesive or flanged joints.

6. Condensate Piping below Grade, NPS 2 and Smaller:

    a. Steel pipe, cast-iron fittings, and threaded joints.
    b. RTRP and RTRF with adhesive or flanged joints.

7. Condensate Piping below Grade, NPS 2-1/2 and Larger:

    a. Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
    b. RTRP and RTRF with adhesive or flanged joints.

B. High Pressure (HP) Steam Piping:

1. HP Steam Piping, NPS 2 and Smaller: Steel pipe, cast-iron fittings, and threaded joints.

2. HP Steam Piping, NPS 2-1/2 through NPS 12: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
3. HP Steam Piping, NPS 14 through NPS 18: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

C. Condensate Piping above Grade, NPS 2 and Smaller:
1. Steel pipe, cast-iron fittings, and threaded joints.
2. RTRP and RTRF with adhesive or flanged joints.

D. Condensate Piping above Grade, NPS 2-1/2 and Larger:
1. Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
2. RTRP and RTRF with adhesive or flanged joints.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

STEAM CONDENSATE PUMPS – (SECTION 232223)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Quality Standard: ASME Boiler and Pressure Vessel Code.

PRODUCTS

ELECTRIC-DRIVEN STEAM CONDENSATE PUMPS:

A. Number of Pumps per Unit: Duplex.

PRESSURE-POWERED STEAM CONDENSATE PUMPS:

A. Number of Pumps per Unit: Duplex.

B. Pump Media: Compressed air or Steam.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

REFRIGERANT PIPING – (SECTION 232300)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

B. Quality Standards: ASHRAE 15 and ASME B31.5.

C. Comply with current USGBC LEED®-Rating System, "Enhanced Refrigerant Monitoring."

PRODUCTS

VALVES AND SPECIALTIES:

D. Diaphragm packless valves.

E. Packed-angle valves.

F. Check valves.

G. Service valves.

H. Solenoid Valves.

I. Safety relief valves.

J. Thermostatic expansion valves for 40 deg F suction temperature.

K. Hot-gas bypass valves with equalizer.

L. Straight-type strainers.

M. Angle-type strainers.

N. Moisture/liquid indicators.

O. Replaceable-core filter dryers with activated media.

P. Permanent filter dryers with activated media.

Q. Mufflers.

R. Receivers.

S. Liquid accumulators.

PIPING

A. Piping Applications for Refrigerant R-134a: Maximum NPS 4.

1. Suction, Hot-Gas, and Liquid Lines: ACR copper with brazed joints.
2. Safety-Relief-Valve Discharge Piping: ACR copper with brazed joints.

B. Piping Applications for Refrigerant R-410A: Maximum NPS 4.

1. Suction Lines for Conventional Air-Conditioning Applications: ACR copper.
2. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

a. NPS 2 and Smaller: ACR copper with brazed-joints.
b. NPS 2-1/2 and Larger: Schedule 40, black steel with welded joints.

3. Safety-Relief-Valve Discharge Piping:

a. NPS 2 and Smaller: ACR copper with brazed joints.
b. NPS 2-1/2 and Larger: Schedule 40, black steel with welded joints.
c. Schedule 40, black steel with welded joints.

Note: Refrigerant joints must be brazed not soldered.

Commented [NW1]: Update Request by Jeff Beck

JOINTS

A. ACR copper joint connections shall be with silfos or high silver solder. Soft solders are not acceptable.

SUBMITTAL

High Performance Submittals:

A. Manufacturers' product data for refrigerants, including printed statement that refrigerants are free of HCFCs.

B. Documentation from manufacturer showing effective annual refrigerant leakage rate for equipment provided on project.

EXECUTION

CONNECTIONS

A. Nitrogen shall be circulated in pipes during soldering or brazing.

TESTING

A. Make evacuation and leak tests in presence of engineer, Cx agent and/or owners representative after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
   1. Draw vacuum on each entire system with two-stage vacuum pump. Draw vacuum to 500 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
   2. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 500 microns without vacuum pump running.
   3. Conduct tests at 70 deg F ambient temperature minimum.
   4. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule starting and testing if prevented by outdoor conditions before this time.
   5. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
   6. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

HVAC WATER TREATMENT – (SECTION 232500)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. This Section includes the following HVAC water-treatment systems:

   1. Bypass chemical-feed equipment and controls.
   2. Biocide chemical-feed equipment and controls.
   3. Ozone-generator biocide equipment and controls.
   4. Chemical treatment test equipment.
   5. HVAC water-treatment chemicals.
   6. Makeup water softeners.

MAINTENANCE

A. Chemical and Service Program: For one year following date of Substantial Completion.

PRODUCTS

A. Manual Chemical-Feed Equipment: Bypass feeders.

B. Automatic Chemical-Feed Equipment:

   1. Water Meters
   2. Inhibitor injection timers
   3. pH controllers
   4. TDS controllers
   5. Biocide feeder timers.
   6. Polyethylene chemical solution tanks.
   7. Polyethylene chemical solution tubing.
   8. Positive-displacement chemical solution injection pumps.
   9. Injection assembly.

C. Chemical treatment test equipment with the following components:

   1. Test kit.
   2. Sample cooler.
   3. Corrosion test-coupon assembly.

D. HVAC Makeup Water Softener: Twin mineral tanks and one brine tank, factory mounted on skid; with water test kit.

WATER ANALYSIS

A. Water Analysis: By Contractor.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

METAL DUCTS – (SECTION 233113)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Current edition of SMACNA duct construction standards

PRODUCTS

DUCT MATERIALS

A. Single-wall rectangular ducts and fittings.

B. Double-wall rectangular ducts and fittings.

   1. Fibrous-glass or Flexible elastomeric duct liner for interstitial insulation.
   2. Perforated or Solid inner duct.

C. Single-wall round and flat-oval ducts and fittings.

D. Double-wall round and flat-oval ducts and fittings.

   1. Fibrous-glass or Flexible elastomeric duct liner for interstitial insulation.
   2. Perforated or Solid inner duct.

E. Sheet Metal Materials:

   1. Galvanized sheet steel with G90 finish.
   2. PVC-coated, galvanized sheet steel.
   3. Carbon-steel sheets.
   4. Stainless-steel sheets.
   5. Aluminum sheets.
   6. Fiberglass.

F. Duct Liner:

1. Fibrous glass, Type I, flexible
   a. With antimicrobial erosion-resistant coating.

2. Flexible elastomeric.
3. Natural fiber.

G. Sealant Materials:

1. Two-part tape sealing system.
2. Water-based joint and seam sealant.
3. Solvent-based joint and seam sealant.
4. Flanged joint sealant.
5. Flange gaskets.
6. Round duct joint O-ring seals.

SEISMIC-RESTRAINT DEVICES

A. Channel support system.

B. Stainless-steel restraint cables.

C. Hanger Rod Stiffener

DUCT SCHEDULE

A. All ducts shall be galvanized steel with G90 coating except as follows:

1. Commercial Kitchen Hood Exhaust Ducts:

   a. Exposed to View: Type 304, stainless-steel sheet finish.
   b. Concealed: Type 304, stainless-steel sheet or Carbon-steel sheet.
   c. Welded seams and joints.

2. Dishwasher Hood Exhaust Ducts:

   a. Type 304, stainless-steel sheet.
   b. Welded seams and flanged joints with watertight EPDM gaskets.

3. Acid-Resistant (Fume-Handling) Ducts:

   a. Type 316 or 304, stainless-steel sheet.
4. Moist Environment Duct Material: Aluminum.
5. Underground Ducts: PVC-coated galvanized steel with thicker coating on duct exterior or fiberglass.

AIR DUCT ACCESSORIES – (SECTION 233300)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Installation Standards: NFPA 90A and NFPA 90B.

DUCT ACCESSORIES

PRODUCTS

A. Backdraft and Pressure Relief Dampers: Multiple, center-pivoted blade, parallel action, gravity balanced.

B. Barometric Relief Dampers: Horizontal or vertical mounting.

C. Manual Volume Dampers: Standard steel multiple or single blade, parallel- or opposed-blade design, with linkage outside airstream.

D. Control Dampers: Parallel or Opposed-blade design.

E. Fire Dampers: Static and dynamic, replaceable or electric heat-responsive device.

F. Ceiling Dampers: Replaceable heat-responsive device.

G. Smoke Dampers:

H. Combination Fire and Smoke Dampers: Static and dynamic, replaceable or electric heat-responsive device.

I. Turning Vanes: Single-blade with railing edge, galvanized sheet steel.

J. Duct-Mounted Access Doors: Double wall, rectangular, galvanized sheet steel with insulation.
   1. Minimum size shall be 10"x10".

K. Flexible Connectors: Indoor and outdoor.

L. Flexible Ducts: Insulated.
   1. Limited to 36 inches in length.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

AIR TERMINAL UNITS – (SECTION 233600)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

A. Installation Standard: NFPA 90A.

B. Rated according to ARI 880.

PRODUCTS

DUAL-DUCT AIR TERMINAL UNITS:

A. Configuration: Two volume dampers inside unit casing.

B. Casing: Steel with removable access panels.
   1. Casing Lining: 1/2-inch- (minimum) thick, coated, fibrous-glass duct liner.

   2. Volume Damper: Galvanized steel with maximum airflow leakage of 3 percent at 3-inch wg.

C. Attenuator Section: Steel.
   a. Lining: 1/2-inch-thick, coated, fibrous-glass duct liner.

FAN-POWERED AIR TERMINAL UNITS:

A. Configuration: Volume-damper assembly inside unit casing.

B. Casing: Steel with removable access panels.
   1. Casing Lining: 1/2-inch- thick, coated, fibrous-glass duct liner.

C. Volume Damper: Galvanized steel with maximum airflow leakage of 3 percent 3-inch wg.

D. Fan Section: Galvanized-steel plenum, acoustically lined, housing a direct-drive, forward-curved fan, motor, filter, and backdraft damper.
   1. Lining: 1/2-inch-thick, coated, fibrous-glass duct liner.

2. Air Filter: Fiberglass throwaway.

E. Attenuator Section: Steel, internally insulated.
   a. Lining: 1/2-inch-thick, coated, fibrous-glass duct liner.

F. Hot-Water Heating Coil: Copper tube and aluminum fins.

SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS:

A. Configuration: Volume damper assembly inside unit casing.

B. Casing: Steel with removable access panels.
   1. Casing Lining: 1/2-inch-thick, coated, fibrous-glass duct liner.

   2. Regulator Assembly: Aluminum or steel, automatic flow-control assembly.

C. Volume Damper: Galvanized steel with maximum airflow leakage of 3 percent 3-inch wg.

D. Attenuator Section: Steel, internally insulated.
   1. Lining: 1/2-inch-thick, coated, fibrous-glass duct liner.

E. Hot-Water Heating Coil: Copper tube and aluminum fins.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

HEAT EXCHANGERS FOR HVAC – (SECTION 235700)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Shell-and-tube and plate heat exchangers.

QUALITY ASSURANCE

A. Quality Standard: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

PRODUCTS

SHELL AND TUBE EXCHANGERS:

A. Configuration: U-tube with removable bundle.

B. Shell Material: Steel.

C. Support Saddles: Fabricated of material similar to shell. Foot mount with provision for anchoring to support.

GASKETED PLATE HEAT EXCHANGERS:

A. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.

B. Frame: Capacity to accommodate 20 percent additional plates. Painted carbon steel with provisions for anchoring to support.

C. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.

D. End-Plate Material: Painted carbon steel.

BRAZED PLATE HEAT EXCHANGERS:

A. Configuration: Brazed assembly consisting of two end plates, one with threaded nozzles and pattern-embossed plates.

B. End-Plate Material: Type 316 stainless steel.

C. Threaded Nozzles: Type 316 stainless steel.

D. Plate Material: Type 316 stainless steel.
   1. Brazing Material: Copper or nickel.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

DIFFUSERS, REGISTERS, AND GRILLES – (SECTION 233713)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

DIFFUSERS:

1. Round ceiling diffusers, fixed.
2. Rectangular and square ceiling diffusers, fixed.
3. Louver face diffusers.
4. Linear bar diffusers with pencil-proof core spacing arrangement.
5. Linear slot diffusers.
6. Ceiling-integral continuous diffusers.
7. Drum louvers.

REGISTERS AND GRILLES:

1. Adjustable bar registers and grilles.
2. Security registers and grilles.
3. Fixed face registers and grilles.

HVAC GRAVITY VENTILATORS – (SECTION 233723)

GENERAL

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

A. Louver Penthouse
   1. Tier Type
   2. Aluminum

B. Roof Hoods
   1. Aluminum

PACKAGED COMPRESSOR AND CONDENSER UNITS – (SECTION 236200)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warrantee
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Factory-assembled and -tested, air-cooled condensing units.

WARRANTY

A. Materials and Workmanship: Five years.

PRODUCTS

AIR-COOLED UNITS, 1 TO 5 TONS (13 SEER MINIMUM):

A. Compressor: Scroll, hermetically sealed and isolated, single-speed.

B. Condenser: Copper-tube, aluminum-fin coil with liquid subcooler.

C. Accessories: low ambient controller, crankcase heater, automatic reset timer, and PE mounting base.

D. Casing: Galvanized steel.

E. Must use HFC refrigerant.

F. Approved Manufacturers:
   1. York
   2. Carrier

AIR-COOLED UNITS, 6 TO 120 TONS:

A. Compressor: Hermetically or semihermetically sealed.
   1. Capacity Control: Cylinder unloading and/or Hot-gas bypass.

B. Condenser: Copper-tube, aluminum-fin coil with subcooler.

C. Controls: Factory mounted and wired.

D. Accessories: Low ambient controller, and crankcase heater.
   1. Casing: Galvanized or zinc-coated steel, with nonfused, factory-mounted and -wired disconnect switch.

SUBMITTAL

High Performance Submittals:

A. Manufacturers' product data for refrigerants, including printed statement that refrigerants are free of HCFCs.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

COMMERCIAL-KITCHEN HOODS (SECTION 233813)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

HOOD MATERIALS:

A. Stainless-steel sheet.
   1. Minimum Thickness as required by code
   2. Concealed Stainless-Steel Surfaces: Bright, cold-rolled, unpolished finish.
   3. Exposed Surfaces: Polished.

TYPE 1 EXHAUST HOODS:

A. UL Listed

TYPE II EXHASUT HOODS

A. SMACNA's "HVAC Duct Construction Standards: Metal and Flexible."

WET-CHEMICAL FIRE-SUPPRESSION SYSTEM:

A. Automatic detection and release or manual release of fire-suppression agent; with control cabinet mounted on hood or wall.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

WATER-TUBE BOILERS – (SECTION 235233)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Packaged, factory-fabricated and field-assembled, atmospheric-gas or forced-draft gas-fired, water-tube boilers, trim, and accessories for generating hot water or steam.

QUALITY ASSURANCE

A. Quality Standard: ASME Boiler and Pressure Vessel Code.

B. Minimum Efficiency: ASHRAE/IESNA 90.1 and 10 CFR 430.

C. I=B=R compliance.

D. UL Compliance: UL 795 for gas-fired boilers.

WARRANTY

A. Materials and Workmanship for Heat Exchangers: 20 years.

B. Materials and Workmanship for Vent Dampers: Five years.

C. Materials and Workmanship for Drums, Tubes, Headers, Cabinets, and Burner: Five years.

D. Materials and Workmanship for Pressure Vessel: 20 years.

PRODUCTS

FLEXIBLE WATER-TUBE BOILERS

A. Heat Exchangers: Bent steel tubes wedged or welded into steel headers.

B. Combustion Chamber: Poured refractory on floor and lap-jointed cast refractory with fiber-blanket joint seals on side walls. Flame observation ports in front [and] [or] back.

C. Casing: Stainless steel or Sheet metal, with insulation.

D. Forced-Draft Gas Burner: Multivane, stainless-steel, flame-retention diffuser for natural gas.

1. Blower: Forward-curved centrifugal fan integral to burner, directly driven.
2. Gas Train: Modulating control sequence.
3. Pilot: Electric-spark pilot ignition.
4. Flue-gas recirculation.
5. Manufacturer shall be Gordon Piate.

E. Hydrants Trim:

1. Aquastat controllers.
2. Safety Relief Valve: ASME rated.
3. Pressure and temperature gage.
4. Boiler Air Vent.
5. Drain valve.
6. Tankless heater.

F. Steam Trim:

1. Pressure controllers.
2. Safety Relief Valve: ASME rated.
3. Pressure gage.
4. Water column.
5. Drain valves.
6. Blowdown valves.
7. Stop valves.
8. Stop-check valves.
9. Tankless heater.

G. Approved boiler manufacturer shall be Bryant.

EXECUTION

START-UP

A. Boiler shall be started by factory-trained technician in presence of County Mechanical Operations Manager.

B. Start-up form shall be submitted to owner's representative and included in project systems manual.

C. Refer to Division 1 Section "Demonstration and Training."

CENTRIFUGAL WATER CHILLERS – (SECTION 236416)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

B. Certification: ARI 550.

C. Compliance: ASHRAE 15 and 147, ASHRAE/IESNA 90.1, ASME, NFPA 70, UL.

D. Performance Rating: ARI 550/590.

E. Sound Rating: ARI 575.

PRODUCTS

WATER COOLED CHILLER

A. Compressor-Drive Assembly: Variable displacement with open or hermetic, direct or gear drive.

   1. Capacity Control: Variable-inlet, guide-vane assembly combined with hot-gas bypass, if necessary, to achieve performance indicated.
   2. Oil Lubrication System (if necessary): Consisting of pump, filtration, heater, cooler, factory-wired power connection, and controls.

B. Refrigeration:

   1. Refrigerant : High Performance Design Projects must be free of HCFCs
   2. For Chillers Using R-134a: ASME-rated, spring-loaded, pressure relief valve.

C. Evaporator: Shell-and-tube design with carbon steel shell and individually replaceable tubes.

D. Condenser: Shell-and-tube design with carbon steel shell and individually replaceable tubes .

E. Heat-Reclaim Condenser: Shell-and-tube design with carbon steel shell and individually replaceable tubes.

F. Insulation for Cold Surfaces: Closed cell, flexible elastomeric.

G. Electrical: Single-point, field-power connection.

H. Motor Controllers: Variable frequency controller (if used).

1. Accessories:

a. Push-button stations.
b. Time-delay relays.
c. Elapsed-time meters.
d. Panel-type meters.
e. Multifunction digital-metering monitor.
f. Phase-failure and undervoltage relays.

I. Controls: Microprocessor based.

1. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, digital display.
2. BAS Interface: Communication interface shall be BACnet compatible.

J. Accessories:

1. Flow switch.
2. Vibration Isolation: Neoprene pads.
3. Sound Barrier: Removable and reusable sound-barrier covers over the compressor housing, hermetic motor, compressor suction and discharge piping, and condenser shell.

K. Approved Manufacturers:
1. York
2. Carrier
3. McQuay

SUBMITTAL

High Performance Submittals:

A. Product Data for refrigerants, indicating printed statement that refrigerants are free of HCFCs.

EXECUTION

START-UP

A. Chiller shall be started by factory trained technician in presence of County Mechanical Operations Manager.

B. Chiller start-up report shall be submitted to the Owner's representative and included in the project systems manual.

C. Refer to Division 1 Section “Demonstration and Training.”

FURNACES – (SECTION 235400)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Refer to "HIGH PERFORMANCE BUILDING DESIGN REQUIREMENTS – (SECTION 018113) for High Performance Design criteria.

PRODUCTS

MANUFACTURED UNITS

A. Gas-Fired Furnaces, Noncondensing: Factory assembled, piped, wired, and tested; ANSI Z21.47/CSA 2.3.

   1. Cabinet: Galvanized steel, with interior insulation.
   2. Fan: Centrifugal, belt drive.
   3. Fan Motors: Multiitapped, multispeed.
   4. Type of Gas: Natural.
   5. AFUE: 80 percent.
   6. Heat Exchanger: Aluminized steel.

B. Gas-Fired Furnaces, Condensing: Factory assembled, piped, wired, and tested; ANSI Z21.47/CSA 2.3.
   1. Cabinet: Galvanized steel, with interior insulation.
   2. Fan: Centrifugal, direct drive.
   3. Fan Motors: Multitapped, multispeed
   4. Type of Gas: Natural.
   5. AFUE: 90 percent.
   6. Automatic solid-state controls; diagnostic light with viewport.
   7. Accessories: Combination combustion-air intake and vent.

C. Refrigeration Components:
   1. Evaporator Coil: Copper tubes expanded into aluminum fins; size matched with furnace.
   2. Refrigerant: Must use HFC based refrigerant.

D. Approved Manufacturers
   1. York
   2. Carrier

SUBMITTALS

A. High PerformanceSubmittals:

Manufacturers' product data for refrigerants, including printed statement that refrigerants are free of HCFCs.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

FUEL-FIRED UNIT HEATERS – (SECTION 235533)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

WARRANTY

A. Materials and Workmanship: Two years.

PRODUCTS

GAS-FIRED UNIT HEATERS:

B. Type of Gas: Natural.

C. Venting: Gravity, Powered or Separated.

D. Housing: Steel, with integral draft hood.

E. Heat Exchanger: Aluminized steel.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

AIR COOLED WATER CHILLERS – (SECTION 236419)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Packaged, air-cooled, reciprocating water chillers.

QUALITY ASSURANCE

A. Certification: ARI 590.

B. Performance Rating: ARI 550/590.

C. Compliance: ASHRAE 15, ASHRAE/IESNA 90.1, ASME Boiler and Pressure Vessel Code, and NFPA 70.

PRODUCTS

AIR COOLED WATER CHILLER

A. Compressors: Positive-displacement, direct drive, semihermetic of the reciprocating or scroll type.

B. Compressor Motors: Hermetically sealed, refrigerant cooled.

C. Evaporator: Brazed-plate or shell-and-tube direct-expansion design.

D. Air-Cooled Condenser: Copper tubes with aluminum or copper fins leak tested at 150 psig.

E. Electrical Power: Factory wired for single-point field power connection.

F. Controls: Microprocessor based.

   1. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, backlit, liquid-crystal display or light-emitting diodes.
   2. Building Management System Interface: Communication interface shall be BACnet compatible.

G. Insulation for Cold Surfaces: Closed cell, flexible elastomeric.

H. Accessories:

1. Factory-installed, hot-gas bypass capacity control.
2. Low ambient control.
3. Chilled-water flow switch.
4. Suction and discharge pressure gages.

I. Approved Manufacturers:
1. York
2. Others as approved by County Operations Manager.

SUBMITTAL

High Performance Submittals:

A. Product Data: For refrigerants, indicating printed statement that refrigerants are free of HCFCs.

EXECUTION

START-UP

A. Chiller shall be started by factory trained technician in presence of County Mechanical Operations Manager.

B. Start-up forms shall be turned into Owner's representative and included in operations manual.

C. Refer to Division 1 Section "Demonstration and Training."

HELICAL ROTARY-SCREW WATER CHILLERS – (SECTION 236426)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Packaged, water-cooled, water chillers.

QUALITY ASSURANCE

A. Certification: ARI 550 for water-cooled chillers and ARI 590 for air-cooled chillers.

B. Compliance: ASHRAE 15 and 147, ASHRAE/IESNA 90.1, ASME, NFPA 70, UL.

C. Performance Rating: ARI 550/590.

D. Sound Rating: ARI 575 for chillers located indoors.

PRODUCTS

PACKAGED, WATER-COOLED, SINGLE-COMPRESSOR CHILLERS

A. Compressor: Hermetic.

B. Capacity Control: Modulating slide-valve assembly or port unloaders combined with a variable frequency controller and hot-gas bypass, if necessary, to achieve performance indicated.

   1. Operating Range: From 100 to 20 percent of design capacity.
   2. Condenser-Fluid Unloading Requirements over Operating Range: Drop-in entering condenser-fluid temperature of 2.5 deg F drop for each 10 percent in capacity reduction.

C. Oil Lubrication System:

   1. Pump.
   2. Oil filter.
   3. Heater.
   4. Refrigerant- or water-cooled oil cooler.
   5. Factory-wired power connection.
   6. Controls.

D. Refrigerant Circuit:

1. Refrigerant Type: HFC based.
2. ASME-rated, spring-loaded, pressure relief valve.
3. Refrigerant circuit isolation valves.

E. Evaporator:
1. Tubes: Copper or copper-nickel alloy.

F. Condenser:
1. Tubes: Copper or copper-nickel alloy.

G. Heat-Reclaim Condenser:
1. Tubes: Copper or copper-nickel alloy.

H. Electrical Power: Single-point, field-power connection.

I. Motor Controllers: Variable frequency (if used).

J. Controls: Microprocessor based.

1. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, digital display.
2. BAS Interface: Communication interface shall be BACnet compatible.

K. Insulation for Cold Surfaces: Closed-cell, flexible elastomeric.

L. Accessories:

1. Flow Switch
2. Vibration Isolation: Neoprene pads.
3. Sound Barrier: Removable and reusable sound-barrier covers over the compressor housing, hermetic motor, compressor suction and discharge piping, and condenser shell.

M. Approved Manufacturers:
1. Carrier
2. Others as approved by County operations manager.

SUBMITTAL

High Performance Submittals:

A. Product Data for refrigerants, indicating printed statement that refrigerants are free of HCFCs.

EXECUTION

START-UP

A. Chiller shall be started by factory trained technician in presence of County Mechanical Operations Manager.

B. Submit startup form to Owner's representative and include in systems manual.

C. Refer to Division 1 Section "Demonstration and Training."

COOLING TOWERS – (SECTION 236500)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

QUALITY ASSURANCE

B. ASME Compliance: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 for heat-exchanger coils.

C. CTI Certification: CTI STD 201 for thermal performance.

WARRANTY

A. Materials and Workmanship: Five years.

PRODUCTS

OPEN-CIRCUIT, FORCED-DRAFT, COUNTERFLOW COOLING TOWERS

A. Casing: Galvanized steel.

B. Collection Basin: Polymer-coated galvanized steel.

C. Collection Basin Water-Level Control: Mechanical float assembly and valve or Electric/electronic water-level controller with solenoid valve.

D. Basin Heater: Electric.

E. Pressurized Water Distribution Piping: PVC pipe with nonclogging nozzles.

F. Fill: PVC.

G. Drift Eliminator.

H. Air-Intake Screens: Removable-steel wire mesh.

I. Fan: Centrifugal, double-width, double-inlet, with grease-lubricated bearings or fan axial blade.

1. Personnel Access Components: Ladders and cages, platforms, and handrails, constructed of galvanized steel.

J. Approved Manufacturer:
   1. Baltimore Air Coil
   2. Others as approved by County Operations Manager

EXECUTION

START-UP

A. Boiler shall be started by factory trained technician in presence of County Mechanical Operations Manager.

B. Submit startup form to Owner's representative and include in systems manual.

C. Refer to Division 1 Section "Demonstration and Training."

MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS – (SECTION 237313)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Constant-air-volume, single-zone air-handling units.

C. Variable-air-volume, single-zone and dual-duct air-handling units.

QUALITY ASSURANCE

A. Quality Standards: ARI 430, NFPA 70, and NFPA 90A.

PRODUCTS

COMPONENTS

A. Unit Casing:

   1. Outside Casing: Galvanized steel.
   2. Coatings.
   3. Inside Casing: Galvanized steel; solid or perforated.
   4. Floor Plate: As specified.
   5. Cabinet Insulation: 1 inch-thick.
   6. Inspection access panels and access doors.
   7. Condensate Drain Pans: Single-wall, stainless-steel sheet double sloped to drain, and extension enough to catch condensate of top of coil.

B. Supply Fan Section:

   1. Drive: V-belt or Direct.
   2. Fan Wheels: Centrifugal or plug .
   3. Internal vibration control.
   4. Motors.
   5. Variable frequency controllers (if required).

C. Return Fan Section (if required):

1. Drive: V-belt or Direct.
2. Fan Wheels: Centrifugal or plug.
3. Internal vibration control.
4. Motors.
5. Variable frequency controllers (if required).

D. Coils:

1. Coil Sections: Common or individual, insulated, galvanized-steel casings.
2. Preheat Coil: Hot water or Steam.
3. Heating Coil: Hot water or Steam.
4. Cooling Coil: Chilled water or Refrigerant.
5. Water Coils: Continuous circuit, Self-draining and Cleanable.

    a. Tubes: Copper.
    b. Fins: Aluminum or Copper.

6. Steam Coils: Distribution header type (non-freeze type).

    a. Tubes: Copper.
    b. Fins: Aluminum or Copper.

7. Refrigerant Coils: Designed for use with HFC refrigerant.

    a. Tubes: Copper.
    b. Fins: Aluminum or Copper.

E. Prefilters:

1. Extended surface, disposable panel with 30% minimum efficiency.

F. Filters: (as per project requirements)
1. Extended-surface, disposable panel.
2. Activated-carbon panel.
3. Activated carbon.
4. HEPA.

G. Filter gages.

H. Dampers.

I. Lights: Provide lights in accessible sections with wire guards, factory wired to an illuminated switch mounted on the exterior.

J. Manufacturers (custom built)
1. Governair
2. Temtrol
3. Haakon

K. Manufacturers (packaged)
1. York

2. Trane
3. Carrier

SUBMITTAL

A. High Performance Submittals:

1. Product Data for "Construction IAQ Management Plan": Replacement filtration media for occupancy.
2. Product Data for continuous metering equipment for outdoor airflow and energy consumption.

EXECUTION

STARTUP

A. Unit shall be started by factory trained technicians in presence of County Mechanical Operations Manager.

B. Submit startup form to Owner's representative and include in systems manual.

C. Refer to Division 1 Section "Demonstration and Training."

CLEANING

A. Replace filters immediately prior to occupancy according to the "Construction IAQ Management Plan."

PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS – (SECTION 237413)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General.
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

PRODUCTS

MANUFACTURED UNITS

A. Casing:

   1. Galvanized steel painted with baked enamel.
   2. Galvanized-steel liner.
   3. Insulated with fiberglass.
   4. Stainless steel drain pans located under the cooling coil section shall be extensive enough to catch condensate leaving coil at highest catalogued face velocity. Pans shall be double sloped to a drain and designed in such a manner that they do not retain water.

B. Supply-Air Fan: Direct driven, double width, [forward curved] [backward inclined], centrifugal.

C. Condenser-Coil Fan: Direct-driven propeller.

D. Relief-Air Fan: Propeller, Forward curved or Backward inclined.

E. Supply-Air Refrigerant Coil:

   1. Aluminum or Copper-plate fins and seamless copper tube.

F. Outdoor-Air Refrigerant Coil:

   1. Aluminum or Copper-plate fins and seamless copper tube.

G. Refrigerant Circuit Components:

   1. Number of Refrigerant Circuits: Number as scheduled.
   2. Compressor: Hermetic reciprocating, Semihermetic reciprocating or Hermetic scroll.
   3. Refrigerant Charge: HFC based refrigerant.
   4. Low-ambient kit.

5. Hot-gas reheat valve.
6. Hot-gas bypass valve.
7. Minimum 13 seer rating.

H. Filters: Disposable, pleated.

I. Gas Furnace:

1. Heat Exchanger and Drain Pan: Stainless steel or aluminized steel.
2. Fuel: Natural.
3. Ignition: Electronic.
4. Minimum AFUE of 80%.

J. Outdoor- and Return-Air Mixing Dampers: 0 to 100 percent economizer with motorized dampers and hood.

K. Electrical Power Connection: Single with unit-mounted disconnect.

L. DDC Controllers:
1. System shall be BACnet compatible.
2. Safety controls.
3. Scheduled controls.
4. Unoccupied period controls.
5. Supply fan controls.
6. Refrigerant circuit controls.
7. Hot-gas reheat-coil controls.
8. Gas furnace controls.
9. Electric-heating-coil controls.
10. Fixed minimum outdoor-air controls.
11. Economizer dry-bulb or (if required) enthalpy-based controls.
12. Carbon dioxide sensor.

M. Accessories:

1. Gas burner compartment heater.
2. Duplex electrical outlet.
3. Low-ambient kit.
4. Filter differential pressure switch.
5. Coil guards.

N. Roof Curb.

O. Approved Manufacturers:
1. Carrier
2. York
3. Aaon

SUBMITTAL

A. High Performance Submittals:

1. Product Data for "Construction IAQ Management Plan": Replacement filtration media for occupancy.

2. Product Data for continuous metering equipment for outdoor airflow and energy consumption.

EXECUTION

START-UP

A. Unit shall be started by factory trained technician in presence of County Mechanical Operations Manager.

B. Submit startup form to owner's representative and include in systems manual.

C. Refer to Division 1 Section "Demonstration and Training."

CLEANING

A. Replace filters immediately prior to occupancy according to the "Construction IAQ Management Plan."

SPLIT-SYSTEM AIR-CONDITIONERS – (SECTION 238126)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Split-system air-conditioning and heat pump units with separate evaporator-fan and compressor-condenser components.

C. US Green Building Council's Current Rating System.

WARRANTY

A. Materials and Workmanship: Five years.

PRODUCTS

WALL- OR CEILING MOUNTED EVAPORATOR FAN

A. Enameled-steel cabinet, copper-tube refrigerant coil, electric heating coil, centrifugal fan, multispeed motor, and permanent filters.

AIR COOLED, COMPRESSOR-CONDENSER

A. Enamel-steel casing, hermetically sealed [reciprocating] [scroll] compressor, copper-tube refrigerant coil, [heat pump components,]and aluminum-propeller fan.

ACCESSORIES

A. Wireless infrared thermostat ,Refrigerant line kits].

APPROVED MANUFACTURERS

A. Mitsubishi

B. Friedrich

REFRIGERANT PIPING

A. See Section 232300 for specific requirements.

SUBMITTAL

High Performance Submittals:

A. Manufacturers' product data for refrigerants, including printed statement that refrigerants are free of HCFCs.

QUALITY ASSURANCE

A. Comply with current USGBC LEED® Rating System, Energy and Atmosphere "Enhanced Refrigerant Monitoring."

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

FAN COIL UNITS – (SECTION 238219)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

B. Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

C. Vertical or Horizontal Ducted Fan-Coil Units: Hydronic or Direct-expansion cooling coil and hot-water and steam heating coil.

PRODUCTS

MANUFACTURED UNITS

A. Fan-Coil Units:

   1. Insulation: 1-inch.
   2. Drain Pans: Insulated galvanized steel with plastic liner.
   3. Chassis: Galvanized steel where exposed to moisture.
   4. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.
   5. Outdoor-air damper.
   6. Filters: Pleated disposable.
   7. Hydronic Coils: Copper tube with aluminum fins.
   8. Steam Coils: Copper tube with aluminum fins.
   9. Fan and Motor Board: Removable.

      a. Fan: Double width, forward curved, centrifugal.
      b. Motor: Permanently lubricated, multispeed.

   10. Unit Control: DDC BACnet compatible.

B. Ducted Fan-Coil Units:

   1. Insulation: 1-inch glass fiber.
   2. Drain Pans: Stainless steel or Insulated galvanized steel with plastic liner.
   3. Chassis: Galvanized steel where exposed to moisture.
   4. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color.
   5. Mixing Plenum: Outdoor- and return-air dampers with.

6. Filters: Pleated disposable.
7. Hydronic Coils: Copper tube with aluminum fins.
8. Steam Coils: Copper tube with aluminum fins; distributing type.
9. Indoor Refrigerant Coils: Copper tube with aluminum fins.
10. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet.
11. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable, resiliently mounted fan base.
12. Unit Control: DDC BACnet compatible.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

UNIT HEATERS – (SECTION 238239)

SUMMARY

A. Refer to "COMMON WORK RESULTS FOR HVAC – SECTION 230500" for minimum requirements in the following areas:
   1. General
   2. Warranty
   3. Standards
   4. Energy Efficiency
   5. Submittals
   6. Operation and Maintenance Data

MANUFACTURED UNITS

B. Propeller Unit Heaters:

   1. Cabinet: Removable panels for maintenance access to controls, with manufacturer's standard baked-enamel finish.
   2. Hot-Water Coil: Copper tube with aluminum fins; minimum working pressure of 200 psig.
   3. Steam Coil: Copper tube with aluminum fins; minimum working pressure of 75 psig.

DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain system and components. Refer to Division 1 Section "Demonstration and Training."

DIVISION 26: ELECTRICAL STANDARDS

GENERAL REQUIREMENTS (SECTION 260000)

A. Design Engineer shall use the CSI format for specifications.

B. Contractor must pay for his own electricity during construction. If utility service is available from the County, then the contractor will pay the County pro rata share of applicable electrical services fees and usage costs.

C. Do not assume the County will provide, connect or otherwise perform any services without specific prior agreement.

D. The County must schedule interruptions of service when contractor wishes to make **utility connections.** Notify in writing, the owner's representative 72 hours prior to time when interruption is desired. Interruption must be at the County's convenience. Overtime, if required for this work, is to be at contractor's expense.

E. Prior to planning a full load on the electric service, the County will be notified and the activation of full load into this service will be at a time agreeable to the County.

F. No final payment will be made by the County without prior delivery of performance data, spare parts lists, operating instructions and equipment descriptive literature that contains complete numbered replacement parts list.

G. It is Salt Lake County's desire that all new buildings over 5000 sq. feet and all major renovations requiring fifty percent or more structural changes achieve and certify to the **LEED® "Gold standard."** There may be exceptions to this requirement for technical and budgetary reasons; however, those design exemptions will only be at the direction of the County Project Manager. For facilities with minor renovations, the County will mandate the use of the most efficient design and construction techniques wherever possible. The ultimate goal is that all County facilities achieve the highest rate of energy efficiency possible. It should be further noted that the LEED Gold facilities should be made as energy efficient as possible. At minimum, they should achieve 75 points under the Energy Star program. This obligation applies to all buildings currently under construction or being proposed.

QUALITY ASSURANCE (SECTION 260001)

A. Perform work in accordance with all governing codes, rules, and regulations including the latest version of the following codes and standards:

National Electric Code (NEC)

International Building Code (IBC)
International Fire Code (IFC)
International Mechanical Code (IMC)
International Energy Conservation Code (IECC)
National Fire Protection Association (NFPA)
American Disability Application Guideline (ADAAG)

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

Underwriter's Laboratories (UL)
American Society for testing Materials (ASTM)
Certified Ballast Manufacturers (CBM)
Insulated Power Cable Engineers Association (IPCEA)
National Electrical Manufacturer's Institute (NEMA)
American National Standards Institute (ANSI)
Electrical Testing Laboratories (ETL)
National Fire Protection Association (NFPA)

C. Comply with all state and local codes and ordinances. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. The contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

FEEDERS AND BRANCH CIRCUITS (SECTION 260519)

A. Feeders shall be specified as copper only. Where market conditions of copper cause the project budget to be exceeded at bid time, the A/E and County representative may elect to obtain a VE cost savings from the contractor for aluminum alloy Stabiloy feeders for sizes 1/0 and larger. Before proceeding with aluminum, the A/E and contractor shall obtain written approval and acceptance of the cost savings from the County representative. All aluminum feeders shall use compression only lugs and connectors.

B. Feeders shall have type THHN/THWN insulation except where extreme heat or water conditions exist requiring special insulation.

C. No wire smaller that No. 12 AWG shall be used except for low voltage, signal, fire alarms, and intercom systems.

D. Main Secondary feeders to lighting and power panel board shall be sized to include 50% future additional capacity at original design voltage drop.

E. Branch circuit conduits between outlets and also between outlets and distribution panel boards shall not have more than four wires. Shared neutrals on branch power receptacles feeding computer loads shall be #10 or larger.

RACEWAYS AND BOXES (SECTION 260533)

A. Conduit systems:
   1. Rigid Metal Conduit (RMC)**:** Provided Zinc- coated, hot-dipped galvanized, rigid metallic conduit in wet locations or areas subject to damage.
   2. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in wet locations or areas subject to damage. Wrap in PVC tape where buried in concrete or underground.
   3. Electric Metallic Tubing (EMT): Provide electric metal tubing with insulated throat, non-indenter, set screw, malleable steel fittings. Obtain County written approval for EMT application within suspended slabs. Where approved, provide concrete-tight fittings in suspended slabs.
   4. Flexible Metal Conduit: Provide zinc-coated, Flexible Metal conduit for connections to motors, transformers, or other equipment subject to movement or vibration.
   5. Liquid Tight Flexible Metal Conduit: Provide Galvanized, flexible metal conduit with liquid tight, PVC coated, moisture and oil proof cover for connections to motors where exposed to moisture or in mechanical rooms.
   6. Provide PVC conduit, schedule 40, where buried below grade in exterior application, or where buried below slab on grade. Do not bend PVC conduit more than 25 degrees. For larger bends, provide RMC with PVC wrap. Do not use PVC conduit for suspended slabs or for interior application.

B. Electric Nonmetallic Tubing (ENT) shall not be used.

C. Metal Clad (MC) or Aluminum Clad (AC) cabling shall only be used when approved by Salt Lake County in writing.

D. Minimum size conduit shall be ¾” for interior application, 1” for Fire, Security, AV and Voice, and 1" for conduit buried below grade in exterior application.

SEISMIC SUPPORT OF ELECTRICAL EQUIPMENT (SECTION 260548)

A. Supporting Devices: Securely anchor and seismically brace all electrical equipment in accordance with regulations contained in the most recently adopted edition of the IBC, and the guideline for Seismic Restraints for Electrical Systems (SMACNA). Provide all materials to meet such requirements for complete raceway support systems, including, but not necessarily limited to steel channel, support clips, clamps, bracket supports, hangers, nuts, bolts, fittings, brackets, expansion anchors, threaded rods, and all associated accessories.

B. Bolt all switchboards, transformers, generators, and other floor mounted electrical equipment securely to a raised housekeeping pad.

C. Provide seismic support wires for all lighting fixtures.

D. Provide lateral and longitudinal diagonal bracing for all conduit racks, cable tray, and busduct exceeding 20 feet in length, or as otherwise calculated by the design engineer.

IDENTIFICATION AND LABELING (SECTION 260553)

A. Mark buried conduit with a magnetic yellow marker ribbon 8" to 12" below finished surface.

B. Provide conductor color coding for all secondary service, feeder and branch circuit conductors as follows:

120/208 volt	Phase	277/480 Volt
Black	A	Yellow
Red	B	Brown
Blue	C	Purple
White	Neutral	Gray
Green	Ground	Green
Green/w stripe	Isolate Gnd	NA

C. Directories for panel boards and the like shall be made after the buildings permanent room numbers are installed on the doors and shall use these numbers rather than the area numbers on the construction drawings. Information to be typewritten.

D. Consistent labeling of panels throughout the County is required. Therefore, the following method of labeling shall be adhered to.

1. Branch panels:
   Identify the floor level-B, 1, 2, Etc.
   Identify the voltage- High 277/480 or low 120/208, etc.
   Identify the panel-A, B, C, etc.

   Example: Panel ‘BHA’ = Basement level, high voltage – 277/480, Panel A- First panel on basement level
2. Distribution Panels: Example: ‘IDPHA’ = first level, distribution panel, high voltage – 277/480, Panel A- first distribution panel on first level
3. Main Panels: Example: ‘MDP’ = Main distribution panel. ‘MPE’= Main Emergency Panel.
4. All emergency panel names shall use the letter ‘E’, i.e. Panel “BHAE”, etc.
5. All UPS panels shall be labeled with Orange labels and white letters, and use the letter ‘U’, i.e. Panel “BHAU”, etc.
6. Apply Equipment identification labels of engraved plastic laminate on each major piece of electrical equipment. Minimum size ½ inch high lettering or 1 ½ inch high label- 2 inches high for two lines. Normal power equipment

shall be labeled with a black field and white lettering. All emergency panels shall be labeled with Red labels and white letters. All UPS panels shall be labeled with Orange labels and white letters.

7. Labeling is required for all of the following equipment.
   a. Panelboards
   b. Switch boards
   c. Motor Control Centers
   d. Motor Starters
   e. Transformers
   f. Major Junction Boxes
   g. Disconnect Switches
   h. Breakers, Push Buttons, etc.
   i. Timeclocks and relay panels
   j. UPS systems
   k. Emergency transfer switches

D. All panel circuit directories are to be typewritten with specific circuit designation.

E. Provide Power Single Line Diagram, sealed in plastic at the main switchboard. Verify location with the County Representative.

F. Mark with a permanent marker the circuit and panel numbers on all outlet and switch boxes- inside device boxes, outside j boxes.

G. Use wire marker books -3M or Ideal- to mark circuit number on each switch and convenience outlet- stick number to the device.

COMMISSIONING ELECTRICAL SYSTEMS (SECTION 260800)

A. Where indicated by contract, the Design Engineer shall integrate commissioning requirements in the electrical specifications as indicated in the commissioning section of this design standard.

LIGHTING CONTROL DEVICES (SECTION 260923)

A. Lighting Control should be web-based
B. Lighting Control vendors shall be approved by the County.
C. Design Engineer shall provide automatic controls for all buildings exceeding 5000 square feet. Controls may be either occupancy sensor or timeclock (relay) based, or a combination of both. Ceiling mounted occupancy sensors shall be dual technology to prevent false on and false off operation.

D. Design Engineer shall provide a control schedule approved by the County's representative for the contractor to program timeclock control systems.

E. Dimmers, if used, shall be approved by the County's electrical representative.

F. HIGH PERFORMANCE DESIGN -

1. All non-emergency interior lighting shall be automatically controlled to turn off during non-business hours. Provide manual override capability for after hours use.

2. Provide a high level of lighting system control to 90% of building occupants.

3. Occupancy sensors required.

ELECTRICAL UTILITY SERVICE (SECTION 261000)

A. Electrical power is furnished to the County buildings through Rocky Mountain Power systems. The Design Engineer and the Contractor will be required to contact and coordinated all electrical service work through Rocky Mountain Power and will not be paid any costs for work performed without the consent of Rocky Mountain Power.

B. Main power service to the utility transformer, utility metering, and/or building shall be underground. Service entering a building shall be in conduit.

C. In most cases, the service shall be designed at 277/480 volt 3 phase, 120/208 3 phase, or 120/240 single phase, depending on available service and size of building or service. A few county facilities take delivery from the Utility at Medium voltage, such as 12,470 volt. It should be noted that the County does not have the in-house expertise, knowledge, or time to maintain expensive Medium Voltage systems. Therefore, if the Design Engineer is contemplating the distribution of a new facility at Medium Voltage, the Engineer shall provide a life cycle cost analysis showing the value provided to the County. The Design Engineer shall then obtain the written permission from Salt Lake County to proceed with Medium Voltage Distribution, and will obtain any voltage discounted rate schedule from the Utility company.

D. If Medium Voltage distribution systems are approved, specifications for all Medium Voltage equipment, cable, testing, and commissioning shall be coordinated with the Salt Lake County electrical representative.

E. Electric meters: Provide Metering switchboard, cabinet, or box according to service size in accordance with written Rocky Mountain Power requirements. Location shall be within 25 feet of the utility transformer, and accessible to meter readers and other utility personnel.

F HIGH PERFORMANCE DESIGN

1. Provide on-site renewable energy source from one or more of the following: solar panels, wind, geothermal, low-impact hydro, biomass or bio-gas strategies.

2. As a contingency credit, the Owner may elect to engage in 2 year contract to provide 35% of building power to come from renewable energy source.

UTILITY TRANSFORMERS (SECTION 261200)

A. Transformers for individual buildings shall typically be pad mounted, on grade, with utility approved wiring vault located underneath pad.

B. Where space does not allow a pad mounted transformer, a transformer vault may be used. The transformer vault should be approved by the power utility company. When transformers must be located inside the building, transformer vaults must be arranged in relation to the other parts of the building such that transformers may be changed without removal of permanently placed concrete or machinery.

C. Utility required clearances to gas meter, windows, doors, and structures shall be maintained and approved by the Power Company.

SWITCHBOARDS AND PANELBOARDS (SECTION 262400)

A. Switchboards shall be provided with 30% spare capacity and spaces. Power and lighting branch panels shall be provided with 50% spare capacity and spaces.

1. Minimum size panel to be 100 amp with 100 amp rated feeder conductors Size conductors to each panel to the size of the buss i.e. 100 A #1, 225A #4/0.
2. Flush-mounted panels should be provided with spare conduits stubbed into accessible areas above and/or below sufficient to wire in spare capacity of the panel.
3. Where feasible, door in door construction may be considered for branch panels.

B. Bussing shall be specified as copper only. Where market conditions of copper cause the project budget to be exceeded at bid time, the A/E and County representative may elect to obtain a VE cost savings from the contractor for aluminum bussing. Before proceeding with aluminum, the A/E and contractor shall obtain written approval and acceptance of the cost savings from the County representative.

C. All breaker panels shall have bussing complete, ready to receive breakers.

MOTOR CONTROL CENTERS (SECTION 262419)

A. Motor Control Centers shall be provided where the number of motor controllers in the same area exceed 7 units.

B. Motor Control Centers shall be provided with 30% spare capacity and spaces.

C. Bussing shall be specified as copper only. Where market conditions of copper cause the project budget to be exceeded at bid time, the A/E and County representative may elect to obtain a VE cost savings from the contractor for aluminum bussing. Before proceeding with aluminum, the A/E and contractor shall obtain written approval and acceptance of the cost savings from the County representative.

MULTIOUTLET ASSEMBLIES (WIREMOLD OR EQUAL) (SECTION 262719)

A. Multioutlet assemblies shall be provided with all appropriate data plates to match with specified telecommunications outlets.

B. Multioutlet assemblies shall be mechanically fastened. Adhesive backed systems are not acceptable.

WIRING DEVICES (SECTION 262726)

A. Wall switches shall be 20A. capacity, specification grade.

B. Duplex convenience outlets should be 20 AMP, specification grade, grounding type, smooth face. Provide Hospital grade in clinics. Provide safety style in childcare areas.

C. The contractor shall install blank cover plates on all junction boxes that do not have duplex or switch cover plates, etc.

ENCLOSED CONTROLLERS (MOTOR STARTERS) (SECTION 262913)

A. Provide enclosed combination motor controllers with pilot light, hand-off- auto switch, and fused disconnect

B. Provide manual thermal switches with pilot light.

C. Electric motor safety switches: all fan, pump and chiller motors shall have lockable motor switches.

VARIABLE FREQUENCY MOTOR CONTROLLERS (VFD'S) (SECTION 262923)

A. Provide adjustable speed drives in sizes exceeding 10 HP with bypass.

B. Provide adjustable speed drives in sizes exceeding 5 HP with input line reactor.

C. Provide adjustable speed drives in sizes exceeding 25 HP with harmonic filter.

D. Specifications shall require commissioning and testing of all VFD's.

PACKAGED GENERATOR ASSEMBLIES (SECTION 263200)

A. Generators shall be considered for all facilities exceeding 50,000 SF, and may be considered for special needs smaller facilities.

B. All engine sets shall meet the EPA Tier 3 emissions standard.

C. Fuel source shall have on-site storage, and shall be coordinated and approved with the County representative. Minimum capacity of fuel system shall be 24 hours.

D. Where located outdoors, generator shall have block heater, battery warmer, and fuel line insulation to allow cold weather start.

E. Specifications shall require commissioning and testing of all packaged generator systems. Start up forms to be submitted to owner's rep and included in project systems manual.

BATTERY UNITS (SECTION 263319)

A. Individual Battery units intended for egress lighting or exit signs shall only be used for facilities less than 10,000 SF, or on buildings with existing individual battery units.

B. The designer shall consider the environment the battery is located at. NiCad for long life, Lead-Acid for cold weather applications. Where possible, locate batteries indoors for remote heads on the exterior of the building.

CENTRAL BATTERY EQUIPMENT (SECTION 263323)

A. Central Battery equipment shall be considered for all facilities between 10,000 SF and 50,000 SF.

B. Central battery equipment shall be "always on", similar to modern UPS systems.

C. Locate central battery equipment indoors in electrical closets.

UNINTERRUPTIBLE POWER SUPPLY EQUIPMENT (SECTION 263353)

A. The designer shall determine with the county any need for UPS equipment prior to Design Development.

B. Where required, UPS equipment shall be located either in the computer room, IT closet, or electrical room, as close as possible to the load served.

POWER FACTOR CORRECTION (SECTION 263533)

A. On service sizes exceeding 1200 amp at 120/208 volt or 600 amp at 277/480 volt, the power factor shall be maintained at a minimum of 95 percent lagging for all load conditions at the metering location. This may require the addition of power factor correction capacitors.

B. On large services where loads are expected to change dramatically, automatic switching power factor correction equipment shall be used.

TRANSFER SWITCHES (SECTION 263600)

A. Where used on generator systems, separate transfer switches shall be provided for life safety devices, and for optional backup systems.

B. For larger systems exceeding 225 amps, 4 pole transfer switches shall be specified.

C. For large data centers and critical applications such as emergency centers, provide bypass isolation type transfer switches.

FACILITY LIGHTNING PROTECTION (SECTION 264100)

A. On new facilities exceeding 20,000 SF, the designer shall provide a lightning analysis per NFPA 780, and discuss results of analysis with the County representative. Where requested by the County, specify a Master UL labeled lightning protection system.

TRANSIENT VOLTAGE SURGE SUPPRESSION (SECTION 264300)

A. All services, regardless of size, shall be provided with Transient Voltage Surge Suppressors, with illuminated indication of function, and audible alarm capable of silencing, and transient counter. Include remote contacts for future interface with remote monitoring systems.

B. TVSS may be located at other locations through the building where appropriate, particularly where large number of computer systems or high dollar equipment is located.

INTERIOR LIGHTING (SECTION 265100)

A. The designer shall review Energy Code and Local Jurisdiction requirements before Design Development. Comcheck or similar verification software will be used to show compliance. Where specified, the designer shall either provide Base Line compliance which is minimum code requirements, or High Performance Standards as predetermined by the Contract negotiation.

B. High performance Standard: Specifier will beat Maximum wattage by 10%.

C. High Performance Standard:

1. Light Pollution Reduction - The angle of maximum candela from each interior luminaire as located in the building shall intersect opaque building interior surfaces and not exit out through the windows.

2. Controllability of Systems - Designer shall provide lighting controls in selected areas to allow individual occupants to turn off light when there is sufficient daylight illumination.

3 Daylight and Views - basic requirements of this point are to provide the building occupants a connection between indoor spaces and the outdoors via the introduction of daylight and views into provide a minimum daylight level of 25 horizontal foot-candles under clear sky conditions at noon on the equinox at the work plane for 90% of all regularly occupied spaces in the building. Daylight and Views is a major architectural aspect of the building, contingent on building geometry and window placement, but does impact electrical design elements with respect to lighting controls and daylight harvesting. Design of lighting controls shall be applied in a multitude of applications depending on the architectural design strategies employed, which could include, operation of automatic interior shades or blinds, photoelectric control of lighting within areas of daylight harvesting, and automatic dimming controls to change artificial lighting levels proportional to the amount of daylight infiltrating the occupied spaces.

D. Baseline: Light all areas per IESNA Standards. Footcandle levels listed are only a guideline. Other factors include uniformity, glare control, vertical illumination, age of patrons, etc. Where appropriate, lower general illumination and higher task

lighting is encouraged. Except where noted otherwise, the following light levels shall be provided:

AREAS	MAINTAINED FC AT 30 INCHES
Offices	40-70
Classrooms	50-70
Laboratories	70-100
General Shop Area	50-200
Sewing & Drafting	50-200
Library, Reading areas	50-80
Stack areas: Active	20-50
Stack areas: Inactive	5-10
Storage Areas& Mechanical Rooms	10-20
Hallways	15-20
Foyers	20-30
Restrooms	25-30
Main Frame Computer Rooms	40-50

E. Light fixture placement is important for offices with PC's. Veiling reflections cause glare on reading materials and on CRT surfaces causing the eye to see the light reflection rather than the text. Fixtures are to be placed so as not to cause veiling reflections on reading materials or on CRT surfaces. The use of low brightness parabolic louvers, lens, or screens or indirect lighting in CRT or PC areas is a necessity. Where parabolic louvers are used, the designer is encouraged to light perimeter walls, or provide daylighting, to help eliminate the dark ceilings and "cave" effect. The best way to light an area with PC's is with indirect or direct/indirect lighting. Linear suspended Direct/Indirect lighting should be discussed and approved by County personnel before specifying.

F. Light fixtures schedules shall be shown on the electrical drawings, not in the specifications.

G. Sole sourcing is not allowed, unless a specific valid reason (such as matching an existing adjacent fixture) is required. Designer shall specify a minimum of 3 manufacturers for each fixture type, unless approved in writing in advance from the County representative.

H. Emergency circuits inside the facility shall be shut off. Night lights are not allowed except with written permission from the County representative.

INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS (SECTION 265113)

A. Provide light fixtures complete with, not necessarily limited to, housing, lamps, lamp holders, reflectors, ballast, starters, wiring, etc.

B. Provide all light fixtures with safety latches where applicable. Provide all detachable fixture parts, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chains, or safety cables. Provide all light fixtures and support accessories as required for a complete system.

C. Fluorescent Lamp Ballast: Provide premium, low ballast factor < 0.8), energy saving electronic ballast for each type of fluorescent fixture capable of operating lamps indicated; Advance Centium or equal. Where available, programmed start ballasts are encouraged.

D. Comply with all manufacturer's written recommendations for all lamp-ballast combinations.

E. Fluorescent Lamps: All interior fluorescent lamps shall be T-8 with color rendering index CRI equal to 841 series. Provide high lumen 3100 lumen lamps in combination with energy saving ballasts.

F. Lensed fluorescent fixtures shall have a .125", 100" virgin acrylic plastic lenses.

G. Tritium powered, self-illuminated signs shall not be used.

H. Minimize the use of incandescent fixtures. Where required for accent, track lighting, etc. provide long life halogen. Low voltage halogen sources are encouraged in these applications.

I. All light fixtures in plumbing chases, tunnels, etc. are to be fluorescent. Do not use incandescent lights in these spaces.

J. Use fluorescent in place of incandescent fixtures wherever possible. Preferred lamp sources are T8 Premium 3100 lumen lamps, compact fluorescent, or biaxial twin tube long compact fluorescent. T5 and T5HO lamps shall not be used without written permission from the County Representative.

K. All fluorescent lamps shall be low mercury, green end, TCLP compliant where available as standard products.

L. Metal Halide sources are discouraged for interior application. Where used, specify "pulse start" technology and/or ceramic Metal halide for fast warm up and color consistency. Consider the higher wattage compact fluorescent for gymnasium applications.

M. Coordinate location of gymnasium fixtures with basketball standards. Provide enclosed fixtures to avoid ball damage.

EXTERIOR LIGHTING (SECTION 265600)

A. The designer shall review all local codes and ordinances in relation to wattage, color, light trespass, pole heights, facade lighting, and other lighting related ordinances prior to Design Development.

B. Light Pollution Reduction - The designer shall review and implement current High Performance Design documents to meet/exceed requirements of the IESNA classification zone for the project.

C. Where located in residential neighborhoods, the Designer shall specify Cutoff Luminaires. Where light exceeds 0.05 FC at property line, designer shall specify house side shields to control light trespass.

D. Light all areas per IESNA Standards. Footcandle levels listed are only a guideline. Other factors include uniformity, glare control, vertical illumination, etc. Except where noted otherwise, the following light levels shall be provided:

AREAS	MAINTAINED FC AT SURFACE (HOR)
Parking	1
Entry sidewalk	2
Driveways	1

E. Designer shall shut down at least ½ of remote exterior lighting poles and fixtures after Midnight in a fairly even pattern. Fixtures nearest the building may be left on all night for security purposes.

F. Equip all exterior light fixtures with low temperature starting ballast

G. Exterior lighting (Yards, parking and roadways) shall be accomplished by using an HID source. Color may vary for different areas.

H. Where HID is used, specify Horizontal or Vertical burn lamps for maximum lumen output. Universal burn lamps are not allowed.

I. Ground mounted floodlights shall have glare control where located adjacent to pedestrian walkways.

J. Building mounted exterior lighting may either be HID or compact fluorescent.

K. All lights in entry or outdoor soffits are to be sealed against any air infiltration into the soffit.

L. Designer shall specify battery or generator backed up lighting systems near each exit from the building, to illuminate either to the public way, or as specified by the Authority Having Jurisdiction.

DIVISION 27: VOICE/DATA COMMUNICATIONS CABLING

GENERAL (SECTION 270500)

A. Telecommunications cable wire plant is designed to transport high speed voice and data signals. The design and installation must adhere to the specifications provided in this document. Any exceptions must be approved by the Telecommunication Section of Facilities Management prior to design or installation.

B. The architect/engineer will provide the drawings and specifications, based on these standards, for the number and location of voice/data jacks, terminal blocks, conduit runs, cabling, trays and other cable paths. County Telecommunications will provide the design for BDF and IDF terminal layouts, feeder and riser cable pair counts and may review the design drawings and specifications prepared by the architect/engineer.

C. See Cabling Attachment in Appendix for further information. In case of conflict with this document and Cabling Attachment, Cabling Attachment shall be considered governing document. Verify all questions with County Project Manager.

DEFINITION AND TERMS (SECTION 270501)

A. The following terms and definitions are applicable to the telecommunications system and facilities:

BDF (Building Distribution Frame): The main protector and cross-connect terminal or building entrance terminal for each building. The BDF is located in the “master communications room”. The building feeder cable(s) terminate of the BDF.

Bonding Conductor: A conductor that connects the non-current-carrying parts of electrical equipment, raceways, or enclosures to the building ground conductor and having the capacity to conduct safely and current likely to be imposed on it.

Bonding: A low-impedance path obtained by securely joining all non-current-carrying metal parts to assure electrical continuity.

Cabling: “Cable”, in this document, refers to multiple wires or optical fibers in a single sheath.

CMP Cable: Plenum communication riser cable (See NEC article 800)

CMR Cable: Non-plenum fire resistant communication riser cable (See NEC article 800)

Electrical Protection Device: The electrical protection devices protect the personnel and equipment against electrical surges and other potentially harmful electrical currents or transient voltages from lightning or other power sources.

Feeder Cable: The cable providing connection form the Service Provider to the BDF of each individual building. Sometimes referred to as "Entrance" or "Trunk" cables.

Home Run: Designates the station cables in a building that are terminated at the BDF. A building with no IDF's would have all stations "home-run" to the BDF.

IDF (Intermediate Distribution Frame): Cross-connect terminals for riser cables and station wire in large buildings that cannot be services by a single BDF terminal. IDF's are located in the "Intermediate communication rooms". IDF's are connected to the BDF by vertical or Horizontal riser cables.

Location Code: The number assigned by Telecommunications Installer to each individual jack to station termination. A duplex jack would have two location codes assigned; one for each jack.

Riser Cable: The cable that connects BDF to an IDF.

Sleeves: Sleeves are short pieces of pipe or conduit that are installed through the floor structure.

Station Cable or Station Wire: The cable used to connect from the IDF to a voice/data jack.

QUALITY ASSURANCE (SECTION 270502)

A. Companies or individuals performing work of this section must be licensed telecommunications contractors with minimum three (3) years experience in telecommunications installations of a similar type.

B. Comply with NFPA 70, "National Electrical Code."

C. Provide only materials that are listed and labeled by a "Nationally Recognized testing Laboratory."
   1. The terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
   2. FCC regulations: Comply with FCC part 68, Chapter 1, "US Code of Federal Regulations," Title 47 for all telephone system wire and cable connection

components.

D. Coordination of Work: Coordinate the work of this section with the requirements of the County's voice/data instrument suppliers and of the telephone service utility.
   1. Meet jointly with the representatives of the utility and the County's representative to exchange information and agree on details of installation interfaces.
   2. Record agreements reached in the meeting and distribute the record to the other participants.

PATHWAYS FOR COMMUNICATIONS SYSTEMS (SECTION 270528)

A. The electrical contractor shall provide and install all cable trays, conduits, conduit fittings and boxes.

B. No conduit shall be smaller than one inch in diameter.

C. The conduit, outlet and fittings shall not contain more than the equivalent of four quarter bends (360 degrees total), including bends located immediately at the outlet or fittings.

D. Conduits runs shall have no reverse bends.

E. Conduits shall be extended from the outlet box to a communications room or cable tray.

F. Pull lines shall be installed in all conduits.

G. All cable trays shall be bonded to the building ground with a No. 6 AWG or larger wire.

H. Sleeves shall be used to connect vertically aligned communication rooms.

I. Sleeve diameter shall be a minimum of 4-inches.

J. Sleeves shall be aligned vertically between floors to permit pulling of cables between floors.

K. The sleeve shall be placed immediately adjacent to the wall, allowing room for bushings or caps.

L. Sleeves are to be stubbed at least 1-inch and no more than two-inches above the floor and threaded for collars. The collars shall be installed, and the inner edge of both ends of the sleeve shall be reamed.

M. With communication rooms aligned in a vertical pathway, some means for cable pulling shall be provided above and in line with the sleeves at the uppermost closet of each vertical stack. A steel anchor pulling iron/eye embedded in the concrete is an example. Similar techniques may be required for long horizontal pathways.

N. Appropriate fire barriers shall be placed around the cables in the sleeves, and unused sleeves are to be fire-sealed.

COMMUNICATION ROOMS (SECTION 271100)

A. General: Communication rooms shall be provided in the building design to accommodate voice/data communications BDF and IDF terminals and equipment.

B. The communication rooms shall be dedicated to building communications only.

C. Communication rooms shall not contain high voltage transformers and/or power panels.

D. Communication room walls shall be of reinforced material to accommodate the weight of terminals and other wall mounted equipment.

E. Building design shall provide for a communication room on every floor. Communication rooms shall be located such that station cables will not exceed 300 feet in length. When building design allows, communication rooms shall be aligned in a vertical pathway. For example, the second floor communication room will be located directly above the master, the third floor room directly above the second and so forth.

F. In buildings that design will not allow for vertically aligned communication rooms, 4-inch conduits shall be placed between each room to accommodate riser cables. When multiple communication rooms are necessary on one floor, cable trays will be placed between communications rooms (IDF's).

G. Line all room walls with ¾-inch by 8 foot fire- retardant treated plywood, painted.

H. Environmental: Each room shall be designed to allow adequate cooling for communications equipment.

I. Grounding: Provide termination point to the building ground in each communication room.
   1. All grounding shall be installed by the contractor to specifications in NEC article 250- GROUNDING and article 800- COMMUNICATIONS CIRCUITS, local codes and specifications.

J. Power:
   1. In the master communications room provide a minimum of six 110-volt duplex outlets. Each outlet shall be on a separately fused 20 Amp. 3-wire grounded circuit.
   2. In the intermediate communications room provide a minimum of two 110-volt duplex outlets. Each outlet shall be on a separately fused 20 AMP. 3-wire grounded circuit.
   3. All outlets shall be on non-switched circuits.
   4. Provide a separate 110-volt utility outlet for power tools and test equipment.

UNDERGROUND SERVICE ENTRANCE (SECTION 271300)

A. Conduits from tunnels or manholes to the master communication room shall be 4-inch in diameter and consist of corrosion resistant material encased in concrete.

B. All conduit bends shall be long sweeping bends with a radius of not less then ten (10) times the internal diameter of the conduit. No conduit run shall have more than two (2) 90-degree bends.

C. All conduit bends equal to 22-degrees or greater shall be of rigid metallic conduit.

D. Place rigid metallic conduit sleeves through the foundation wall. To prevent shearing, the sleeves should extend 10-feet beyond the foundation wall and reach undisturbed soil. The sleeves shall have a downward slope of 1-inch per foot for the length of the sleeve.

E. Rigid metallic conduits shall be reamed and bushed.

F. Pull- strings shall be provided in all conduits.

G. Both ends of the conduits will be plugged or capped.

COMMUNICATION HORIZONTAL CABLING (SECTION 271500)

A. Station Cable: 4 pair, No. 24 AWG, solid copper, unshielded, twisted-pair construction in polyvinylchloride sheath. Conform to “Insulated Cable Engineers Association” (ICEA) Standard s-80-576 “Communication Wire and Cable For Wiring of Premises.”
   1. Cable to be placed in plenum space shall be listed for plenum use.

B. Terminal Blocks: Type 110, mounted on stand-off brackets. 50 pair, Category V Amp Catalog number 558839-1.

C. Jack Assemblies: 8-position modular, latching, plug type, in flush-mounting wall plate except as otherwise specified. Installation Kit, Amp Catalog Number 558621-1. Insert Category V, Amp catalog number 555672-1.
   1. All jacks will be clearly and neatly labeled. Each individual jack (Top and bottom) shall be labeled with the location code.
   2. Wall plates: Designed for telephone/data service. Match material and finish of wall plated specified for power receptacles and switches.

D. Cabling: All cables shall be installed in a neat and orderly manner. Multiple cables shall be neatly bundled and attached to approved attachments. No cable shall be attached to, resting on or otherwise touching electrical, plumbing, mechanical, fire sprinkler pipes, supports or components.
   1. Cable shall be neatly bundled using wire-ties spaced 18 to 24- inches apart. Cable bundles shall not exceed 30 cables per bundle.
   2. There shall be NO kinks or sharp bends.
   3. Cables shall be attached to wire trays and wall attachments to provide strain relief and cable support. Cable bundles shall NOT be attached to the ceiling grid support wires.
   4. Cables shall have sufficient slack to allow for proper routing and strain relief.
   5. When cables are routed in drop ceiling they shall be dressed in a neat bundle and must be suspended at least twelve inches above the ceiling tiles and light fixtures.
   6. There shall be no excessive slack left in the ceiling.

E. Station Wiring: Two (2) four-pair cables will be installed from each duplex jack to the intermediate distribution frame (IDF).
   1. No station cable shall exceed 300 feet in length from IDF to jack.
   2. Station cables shall be pulled to the communication room (IDF) located on the same building floor as the jack.
   3. Twelve inches of slack shall be left at the jack end of each station cable.
   4. Station cables will be labeled with the jack location code eight to twelve inches from the jack.
   5. The appropriate 110 type punch tool (88 tip) shall be used to terminate the station cable on the jack.

F. Terminal Block: Terminate conductors of cables on terminal blocks using tools and methods recommended by terminal block manufacturer.

TESTING (SECTION 271700)

A. The contractor shall test al cable conductors (Pairs) for continuity, pair reversals, transposed pairs, split pairs or grounded conductors.
   1. Cables with less than 100-pairs, such as station cable, shall have zero bad pairs or conductors.
   2. Cables with 100-pairs or greater shall have no more than 1% cable pair failures. For example, a 200- pair cable shall have no more than 2 bad pairs.

3. Cables with greater than 1% failed pairs, or any failed pairs for a cable less than 100-pair, will not be accepted by and must be replaced by the contractor at the contractor's expense.

B. The contractor shall provide Telecommunications Section a complete list of all pairs tested. (See Documentation Section)

DOCUMENTATION (SECTION 271800)

A. The contractor shall provide Telecommunication Section complete documentation for all cables installed. All lists shall be listed by feeder pair, riser pair or station location code. Documentation shall include.
1. Cable pair number or location code.
2. Building and room numbers for beginning and ending terminations.
3. Cable type such as CMR, CMP etc.
4. Cable lengths. All cable lengths must be documented and be certified with a Time Domain Reflectometer (TDR) or other reliable cable measuring device.
5. Cable test documentation shall include the test results i.e. "OK", "Short", "Open", "Ground", "Reversal", "Transposed" or "Split".

INSPECTION AND WARRANTY (SECTION 171900)

A. Telecommunications Section personnel shall perform inspections of communications cable, jack and terminal block installation during and at completion of the installation. The work shall not be accepted until all inspections and testing is completed. The contractor will be provided with a list of items to be corrected by the contractor before acceptance.

B. Upon acceptance by the telecommunications Section, The contractor shall warrant and guarantee, without limitations or qualifications, that all equipment, components, materials and workmanship shall perform in accordance with local and national codes and the specifications of this document. The warranty period shall be for one year or greater from the time of acceptance.

SECTION 28 00 00: ELECTRONIC SAFETY AND SECURITY STANDARDS

ACCESS CONTROL SYSTEMS (SECTION 281300)

A. Description: System shall be fully integrated and installed as a complete package by the Access controls/Security contractor.

B. System shall be based on a distributed, stand alone controllers, operating in a local network. System shall monitor, record, and display card access activity on a real time basis.

C. Specifications, part numbers, approved manufacturer's and the county's vendors tend to change from year to year. Designer shall coordinate exact system specifications with the County's most current master specification.

ACCESS CONTROL MISC. SYSTEM REQUIREMENTS (SECTION 281301)

A. Designer shall coordinate with Salt Lake County to determine exact needs and total quantity of doors for each project.

B. Coordinate and interface with elevator control systems, if necessary.

C. System shall be based on Windows operating platform.

D. Access Cabinets shall be installed in electrical or telecommunications rooms.

E. Specifications shall include system commissioning and owner training.

F. 1" Minimum size Conduit run from each reader back to reader controllers.

ACCESS CONTROLS QUALITY ASSURANCE (SECTION 281302)

A. Installer Qualifications: Experience with systems of the type and scope indicated, minimum 3 years experience.

B. Comply with UL Standard 1076, "Proprietary Burglar Alarm Units and Systems."

ACCESS CONTROLS APPROVED MANUFACTURERS (SECTION 281303)

A. TAC/CSI – I-Net 2000 as distributed by Utah Controls, Inc.

B. Equals will be considered as approved by the County.

INTRUSION DETECTION SYSTEMS (IDS) (SECTION 281600)

A. Description: System uses a central microprocessor, remote intrusion sensors and detection devices, and a communications link to perform monitoring and alarm functions. System is physically and electronically modular and has provisions for the field expansion. System is self-monitoring and self-diagnostic.

B. Communications Link: Multiplexed and dedicated to intrusion detection, alarm service, and control of security related functions.

C. Specifications, part numbers, approved manufacturer's and the county's vendors tend to change from year to year. Designer shall coordinate exact system specifications with the County's most current master specification.

IDS FUNCTIONAL PERFORMANCE (SECTION 281601)

A. Intrusion Detection: Performed by indicated intrusion detection devices. Each device is assigned to an individual zone.

B. Alarm Indication: Audible signal sounds and a plain-language identification of the zone originating an alarm appears on a liquid crystal display or L.E.D. at the alarm control panel.

C. Control systems includes one or more remote addressable microprocessor control units operating in a multiplexed distributed control system or as part of a network under signal transmission from a central microcomputer. Control units receive programming by multiplexed signal transmission from a central microprocessor or microcomputer and hold data in nonvolatile memory. System reboots program automatically without error or loss of status or alarm data after a power outage.

D. An alarm message displayed at the annunciator with an audible tone for trouble conditions.

IDS QUALITY ASSURANCE (SECTION 281602)

A. Installer Qualifications: Experience with systems of the type and scope indicated.

B. Comply with UL Standard 1076, "Proprietary Burglar Alarm Units and Systems."

IDS APPROVED MANUFACTURERS (SECTION 281603)

A. Control Panels-Digital Monitoring Products-XR 500

B. Door Contacts- to be specified by designer.

C. Expansion Modules-Digital Monitoring Products-714X loop expander located next to DMP XR500 Panel.

D. Key Pads- Digital Monitoring Product Model 7060W with back boxes.

E. Dual Phone Module Expansion Module- Digital Monitoring Products-893

F. Motion Detectors: Microprocessor based; dual IR and MW thermal frequency detection with L.E.D. Display. Must be Bosh Blue Line Gen, 40 foot or greater range.

G. Exp. Components may be required for additional Exp. Modules, and require their own power supply with back-up battery power.

IDS ELECTRICAL POWER (SECTION 281604)

A. Normal System Power Supply: Dedicated 120 V 60 Hz feed to 16.5 volt A.C. transformer to supply power through the system control panel.

B. Power Source Transfer: When normal power is interrupted, system is automatically switched to backup supply without degradation of critical system function or loss of signals or status data.
   1. Backup Source: Batteries in power supplies of individual system components. Such Batteries are an integral part of power supplies of the components. 12 Volt, 7 A H.
   2. Annuciation: Switching of the system or any system component to backup power is indicated on the system control panel as a change in system condition.

C. Phone Line Requirements: Two dedicated phone lines shall be provided to the D.M.P. XR 200 Security panel to provide UL listing for the fire protection and NFPA standard 72 Fire Marshall Standard.

IDS MISCELLANEOUS (SECTION 281605)

A. Door Switches:
   1. Comply with UL Standard 634, Connectors and Switches For Use With Burglar- Alarm Systems."
   2. Description: Balanced magnetic type. Magnet part is designed for installation on the door; the magnetically operated switch is installed recessed when possible or on the door frame when condition does not possible with E.O.L.

resistor on device. Unit employs a bias magnet and a sensitive reed switch to resist comprise by introduction of foreign magnetic fields.

a. Flush- Mounted Units: Unobtrusive, flush with surface of door frame and door.

3. Door Switch for Overhead Door: Balance magnetic type with door-mounted magnet and floor-mounted switch. Unit is listed for outdoor locations.
4. Auto Entry Doors shall be equipped with door contacts as part of door opening.

B. Wire and Cable:

1. Cable for Low-Voltage Control and Signal Circuits: Unshielded, twisted-pair cable, except where manufacturer recommends shielded cable. Comply with Division 16 Section "Control/Signal Transmission Media."
2. Provide one ¾ inch conduit homeruns to security equipment. Plenum based wiring systems is not acceptable for security systems.

IDS INSTALLATION (SECTION 281606)

A. General: Install system according to NFPA 70, applicable codes, and manufacturer's printed instructions.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams.

C. Install power supplies and other auxiliary components for detection devices and the alarm control panel or at a data-gathering panel except as otherwise indicated. Do not install such items in the vicinity of the devices they serve.

D. Conduit raceways are preferred for all system wiring.

E. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk and other impairments.

F. Testing: Provide at least 10 days' notice of acceptance test performance schedule. Testing to be performed in presence of County personnel.

G. Motion detector devices and all magnetic door contacts shall be installed with end of line resistor on the device.

IDS DEMONSTRATION (SECTION 281607)

A. Coordinate User's training with County personnel. Train User's maintenance personnel in the procedures and schedules involved in preventive maintenance

and in programming, operating, adjusting, troubleshooting, and servicing of the system.

B. Provide a minimum of 8 hours training.

C. Schedule training with advance notice of at least 7 days.

VIDEO SURVEILLANCE SYSTEMS (VSS) (SECTION 282300)

A. Description: System uses a DVR based recording system.

B. System includes color cameras, fixed and/or Pan-Tilt-Zoom (PTZ) as required for particular project. Recreation centers and library's will generally be provided with fixed cameras. Larger facilities may require PTZ. Consult with County representative prior to Design Development to determine type of system and quantity/location of cameras.

C. Specifications, part numbers, approved manufacturer's and the county's vendors tend to change from year to year. Designer shall coordinate exact system specifications with the County's most current master specification.

VSS FUNCTIONAL PERFORMANCE (SECTION 282301)

A. Indoor/Outdoor PTZ camera dome, Manual control speed: 80 degree pan per second standard, 150 degree pan per second in turbo mode.

B. Interior dome, fixed: acrylic lower dome with smoked face. High resolution, 530 TUL min., 1/8" cod, Auto-iris 3.0 – 8.0 or similar Vary – Vocal Lenses.

C. Monitor: 19 LCD inch color computer monitor.

D. DVR: Pelco DX8100. Pentium 4, 2.8 GHZ processor, 256 MB RAM to 500 to 2000 MB RAM Hard Drive depending on quantity of Cameras. DVD Recording System.

E. Equipment Rack: Provide rack to house all equipment.

F. Provide one inch minimum conduit, homerun to VSS equipment. Open plenum wiring will not be acceptable for security systems.

G. Power supply and cable: as appropriate for installation.

VSS QUALITY ASSURANCE (SECTION 282302)

A. Installer Qualifications: Experience with systems of the type and scope indicated.

B. Comply with NFPA 70, "National Electrical Code."

C. Comply with UL Standard 1076, "Proprietary Burglar Alarm Units and Systems."

VSS APPROVED MANUFACTURERS (SECTION 282303)

A. Pelco, Honeywell, Bosch, Visual Gate, or County approved equal.

FIRE ALARM GENERAL SYSTEM DESCRIPTION (SECTION 283100)

A. General: Systems shall be addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation, analog addressable smoke detectors, heat detectors, and pull stations and automatic alarm verification for alarms initiated by certain and pull stations zones as indicated.

B. Signal Transmission: Hard wired, using separate individual circuits for each zone of alarm initiation and alarm device operation.

C. Audible Alarm Indication: By sounding of horns, or speakers.

D. System connections for alarm-initiation and alarm-indicating circuits: Class A wiring.

E. Fire alarm shall be connected to Security panel for monitoring trouble and alarm conditions.

F. Functional Description: The following are required system functions and operating features:
   1. Priority of Signals: Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone are not altered by subsequent alarms. The highest priority is an alarm signal. Supervisory and trouble signals have second-and third-level priority. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annuciate all alarm signals regardless of priority or order received.
   2. Non-interfering: Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually resetable from the FACP after the initiating device or devices are restored to normal. Systems that require the use of batteries or battery backup for the programming function are not acceptable.

3. Resound capabilities: Provide resound capabilities.
4. Signal Initiation: The manual or automatic operation of an alarm,-initiating or supervisory- operating device causes the FACP to transmit an appropriate signal including:
   a. General Alarm
   b. Fire Suppression system operation alarm.
   c. Smoke detector alarm
   d. Valve tamper supervisory
   e. System trouble.

5. Transmission to Remote Central Station: Automatically route alarm, supervisory and trouble signals to a remote central station service transmitter using listed and approved equipment.
6. Silencing at FACP: Switches provide capability for acknowledgement of alarm; supervisory, trouble, and other specified signals at the FACP; and capability to silence the local audible signal and light and light emitting diode (LED). Subsequent zone alarms to cause the audible signal to sound again until silenced in turn by switch operation. Restoration to normal of alarm, supervisory, and trouble conditions extinguish the associated LED and cause the audible signal to sound again until the restoration is acknowledged by switch operation.
7. Loss of primary power at the FACP sounds trouble signal at the FACP and indicates at the FACP when the system is operating on an alternate power supply.
8. Annuciation: Manual and automatic operation of alarm –and supervisory- indicating the location and type of device.
9. General Alarm: A system general alarm includes:
   a. Indication the general alarm conditions at the FACP
   b. Identifying the device that is the source of the alarm at the FACP
   c. An audible and visible alarm signals to remote central station.
10. Manual station alarm operation initiates a general alarm.
11. Water-flow alarm switch operation:
    a. Initiates a general alarm
12. Smoke detection initiates a general alarm
13. Sprinkler valve tamper switch operation causes or initiates the following:
    a. A supervisory audible and visible “Valve Tamper” signal indication at FACP.
    b. The location-indicating LED display for the device that has operated.
    c. Transmission of supervisory signal to remote central station.
14. Fire pump power failure, including a dead phase or phase-reversal condition causes or initiates the following:
    a. A supervisory audible and visible “fire pump power failure” signal indicated at FACP and annunciator.
    b. Transmission of trouble signal to remote central station.
15. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control

of changes in those settings. The same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors.

FIRE ALARM QUALITY ASSURANCE (SECTION 283101)

A. Installer Qualifications: A factory-authorized installer is to perform the Work of this Section.

B. Compliances With Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authority having jurisdiction.

C. Comply with NFPA 70, "National Electrical Code"

D. NFPA Compliance: Provide fire alarm and detection systems conforming to the requirements of the following publications.
   1. NFPA 72

E. UL Listings: Provide system and equipment that are UL listed and labeled.
   1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA regulations 1910.7.

F. FM Compliance: Provide fire alarm systems and components that are FM-approved.

G. Single- Source Responsibility: Fire alarm components all come from a single source who assumes responsibility for components all come from a single source who assumes responsibility for compatibility for system components. Only products which comply with the installed system's UL Listing shall be connected to the system.

FIRE ALARM MISCELLANEOUS (SECTION 283102)

A. Wire
   1. Twisted Shielded, #16 or larger installed in raceways.
   2. Color Coding: Color-Code fire alarm conductors differently from the normal building power wiring. Use Red/Black for Initiating Devices, Yellow/Purple for Horn Strobes, and Blue/Orange for Speakers. Use one color code for alarm circuits wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visual alarm-indicating devices, and different colors for fan shutdown, door holders, and relay circuits.

3. Provide 2, 2-C 22 Solid Conductors from fire alarm panel to XR 500 DMP Security Panel for alarm and trouble conditions.

B. Tags
1. Tags for identifying tested components: comply with NFPA 72

C. Raceway
1. ¾" minimum conduit for all fire alarm system wiring, or larger as required for wire fill.
2. Paint covers of fire alarm boxes red.
3. Paint couplings or paint conduit with red stripe, 1-1/2 inches wide, every 10 feet on concealed conduit.

D. Fire Alarm Power breaker: Paint red and Label "Fire Alarm." Provide with lockable handle or cover.

E. Ground equipment and conductor and cable shields. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

FIRE ALARM CONTROL EQUIPMENT (SECTION 283103)

A. Fire Alarm Control Panel: Provide solid-state, modular design with integral static protection and features as follows:
1. Acceptable panels: Notifier FACP 6 AMP.
2. Fire panel shall have a minimum of 25% additional loop expansion for future demands.

B. General: Comply with UL 864, "Control Units for Fire-Protective Signaling System.

C. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing of for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of panels as well as field wiring. Identify each enclosure by an engraved, red- laminated, phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than 1-inch high. Identify individual components and modules within the cabinets with permanent labels.

D. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator and FACP and addressable system components, including annunciation and supervision. A display with a minimum of 40 characters displays alarm, supervisory, and components status message.

Arrange keypad for use in entering and executing control commands to be located by Main Entrance.

FIRE ALARM EMERGENCY POWER SUPPLY (SECTION 283104)

A. General: Components include valve-regulated, recombinant lead acid battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 10 years minimum.

B. Battery capacity is adequate to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode for a period of 15 minutes. Provide, in addition, 25% spare capacity.

C. Battery charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges then fully within four hours. Charger output is supervised as part of system power supply supervision.

D. Automatic transfer switch transfers the load to the battery without loss of signals or status indications when normal power fails.

FIRE ALARM INITIATING DEVICES (SECTION 283105)

A. Manual Pull Stations: Double-action type, fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color. Stations requiring and breaking of a glass panel are not acceptable. Stations requiring the breaking of a concealed glass rod may be provided.

B. Smoke Detectors: Comply with UL 268, “Smoke Detectors for Fire Protective Signaling Systems. “Include the following features:
1. Factory Nameplate: Serial number and type identification.
2. Operating Voltage: 24-V d.c., nominal.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Plug-in Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring.
5. Visual Indicator: Connected to indicate detector has operated
6. Addressability: Detectors include a communication transmitter and receiver having unique identification and capability for status reporting to the FACP.

7. Remote Controllability: Individually monitor detectors at the FACP for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity from the FACP.
8. Ionization-Type Smoke Detector: Multiple-chamber-type operating on the ionization principal and actuated by the presence of invisible products of combustion.

C. Addressable Thermal Detector: Rate-Compensated/Fixed-temperature type with plug-in base and alarm indication lamp. Detectors have communication transmitter and receiver with unique identification and capability for status-reporting to the FACP.

FIRE ALARM AUDIO-VISUAL EVACUATION SYSTEMS (SECTION 283106)

A. General: provide terminal blocks for system connections.

B. Fire Alarm Horns: The appliance shall be listed by Underwriters Laboratories Inc. for use with Fire Protective Signaling Systems, (Hearing Impaired) in accordance with NFPA 72, UBC standards and the local authority having jurisdiction. The appliance shall produce a minimum 82 db at 10ft. The appliance shall be of solid state construction and be polarized to allow for supervision. All models shall have an operating range of 21-30V.

C. Visual Alarm Devices: Shall be A.D.A approved 24-volt D.C. strobe lights with clear poly carbonate lens and zenon flash tube. Mount lenses on an aluminum face plate. The word “Fire” is engraved in minimum 1-inch-high letters on the lens.
1. Lamps have a minimum peak intensity of 8,000 candle power. Strobe leads are factory-connected to screw terminals.

F. Combination devices consist of factory-combined, audible and visual alarm units in a single mounting assembly.

G. Speakers may be required instead of horns for evacuation purposes for certain location depending on type of facility.

H. Voice EVAC System as Design Requires.

I. Remote Annunciator.

FIRE ALARM INSTALLATION, GENERAL (SECTION 283107)

A. Install system according to NFPA Standards.

B. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing and adjustment of the system.

C. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72, Chapters 2 and 4, and NFPA 72, Chapter 8.

FIRE ALARM TESTING AND DEMONSTRATION (SECTION 283108)

A. Provide the services of a factory-authorized service representative to demonstrate the system and train County maintenance personnel as specified below.
   1. Train County maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing and preventative maintaining of the system. Provide a minimum of 8 hours' training.
   2. Schedule training with the County at least seven days in advance.

DIVISION 31 EARTHWORK

SITE CLEARING – (SECTION 311000)

SUMMARY

A. This Section includes the following:

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

MATERIAL OWNERSHIP

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

PROJECT CONDITIONS

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

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

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

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

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

SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."

   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PREPARATION

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

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

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

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

TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan, specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

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

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

D. Comply with all local and jurisdictional requirements and plans.

FUGITIVE DUST CONTROL

A. Fugitive dust control plan, tailored to specific operations and sites of operations, shall be required for:

   1. All operations with material storage, handling and/or hauling operations and areas of source operations, construction sites; and all sources or operations which have the potential to produce fugitive dust in nonattainment areas along the Wasatch Front;

2. All temporary relocation under current State regulation. Sources will be required to develop site specific dust control plans for each temporary relocation of permitted equipment;

3. All sources and areas of source operations, pits and yards, statewide, which have been issued a Notice of Violation for excess fugitive dust.

4. Refer to Current Fugitive Dust Documents found at the following:

http://www.airquality.utah.gov/Permits/Permitting_Forms.htm#OtherForms

TREE PROTECTION

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

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

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

UTILITIES

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

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

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

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

C. Removal of underground utilities is included in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 Sections covering site utilities.

CLEARING AND GRUBBING

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

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

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

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

SITE IMPROVEMENTS

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

HIGH PERFORMANCE DESIGN

A. RAP base course to be considered for use in pavements, refer to Grading Target and Recycled Aggregate-Base Properties below.

1.5" RECYCLED GRADING TARGET	
Sieve Size	Recycled Spec. - % Passing
2"	100%
1.5"	85 - 100
1"	
3/4"	60 - 80
3/8"	
#4	30 - 50
#50	
#200	5.0 - 12.0

Notify testing agency whenever there is a change in the material or its gradation, color, or mixture to verify any change in properties and/or values.

1.5" RECYCLED AGGREGATE-BASE PROPERTIES

Description	Test Method	Specification
Dry Rodded Unit Weight	AASHTO T-19	75 lbs/pcf - Min.
Plasticity Index	ASTM D-4318	4 Max.
L.A. Abrasion @ 500 rev.	ASTM C-131	40% Max.
California Bearing Ratio (C.B.R.)	ASTM D-1883	100 Min.
Maximum Dry Density (proctor)	ASTM D-1557	N/A
Optimum Moisture Content (proctor)	ASTM D-1557	N/A
**Nuclear Density Guage - Moisture Correction Factor	ASTM D-2216	N/A
Flat and Elongated Particles	ASTM D4791	< 8%
Sand Equivalent	ASTM D-2419	> 35%
Apparent Specific Gravity	ASTM C-127 & 128	N/A
Aggregate Absorption	ASTM C-127	N/A
Fractured Face Count (2+ Fractured)	ASTM D-3821	N/A
Organic Impurities	ASTM C 40	Pass
Clay Lumps & Friable Particles	ASTM C-142	< 2%

**Nuclear density/compaction testing in the field should be reported utilizing a moisture correction factor. This factor should be applied to the % moisture reading of the guage, and % compaction calculated off of the corrected dry density. This value should be verified frequently, as it may change with material changes. Verify by obtaining a representative moisture sample from beneath a nuclear guage measurement. Dry back in lab oven at low temperature (165 deg. F) and subtract difference of lab moisture from field moisture.

Due to the nature of the material, constant monitoring of the material and quality control testing be performed during crushing operations.

DISPOSAL

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

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

EARTH MOVING – (SECTION 312000)

SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

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

I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than **4 inches** in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

ACCESSORIES

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

PREPARATION

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

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.

EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

   1. Clearance: [12 inches each side of pipe or conduit]

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete or Miscellaneous Cast-in-Place Concrete."

D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 18 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of subbase material or satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

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

SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than **8 inches** in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 or ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percentage percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus **1 inch**.
2. Walks: Plus or minus ½ inch.
3. Pavements: Plus or minus **1/2 inch,** complying with accessibility requirements.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Shape subbase and base course to required crown elevations and cross-slope grades.
2. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM 698 or ASTM D 1557.

DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

DISPOSAL OF SURPLUS AND WASTE MATERIALS

D. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

DIVISION 32 EXTERIOR IMPROVEMENTS

ASPHALT PAVING – (SECTION 321216)

SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt curbs.
6. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

B. Material Certificates: For each paving material, from manufacturer.

C. High Performance Project Submittals:

1. Product Data for products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Salt Lake Public Works or UDOT.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of 2005 edition of the Utah Department of Transportation Standard Specifications for Road and Bridge Construction for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

C. Preinstallation Conference: Conduct conference at project site with appropriate representatives in attendance.

PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials and 50 deg F for water-based materials, and not exceeding 95 deg F.

AGGREGATES

A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

B. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

C. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.

B. Tack Coat: ASTM D 977 -12 or AASHTO M 140-03 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.

   1. Color: White, Yellow, Blue, As indicated.

C. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.

   1. Color: White, Yellow, Blue, As indicated.

D. Glass Beads: AASHTO M 247, Type 1.

E. Wheel Stops: Precast, air-entrained concrete, 3000-psi minimum compressive strength, 6-inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

   1. Dowels: Galvanized steel, 3/4-inch diameter, 12-inch minimum length. Revise materials or dimensions of wheel stops, dowels, and adhesive in paragraph below to suit Project. Many manufacturers produce recycled rubber and plastic wheel stops.

MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **10** percent or more than **25** percent by weight.

   1. Surface Course Limit: Recycled content no more than **10** percent by weight.

B. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction**;** designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types**";** and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Base Course: UDOT 1-inch gradation.
   3. Surface Course: UDOT ½-inch or ¾-inch Mix Design.

EXAMINATION

A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

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 a depth of 2 inches, unless noted otherwise**.**

PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

   1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.15 to 0.25 gal./sq. yd.

   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.15 to 0.25 gal./sq. yd.

   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Spread mix at minimum temperature of 250 deg F .
2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for

indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.
   1. Asphalt Mix: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch .
2. Surface Course: 1/8 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 7 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Replace and compact hot-mix asphalt where core tests were taken.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill and as required by “Construction Waste Management and Disposal” requirements.

CONCRETE PAVING - SECTION 321313

SUMMARY

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

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.

SUBMITTALS

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

B. Design Mixtures: For each concrete pavement mixture. Use Salt Lake County approved 5000 AE Titan

QUALITY ASSURANCE

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

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

STEEL REINFORCEMENT

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

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

D. Plain Steel Wire: ASTM A 82, as drawn.

E. Deformed-Steel Wire: ASTM A 496.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

CONCRETE MATERIALS

A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement: ASTM C 150**,** Type II/ V. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class C or F.
      b. Silica Fume: ASTM C 1240
   2. Blended Hydraulic Cement: ASTM C 595, Type I (PM), pozzolan-modified portland cement.

B. Normal-Weight Aggregates: ASTM C 33, Class 4M coarse aggregate, uniformly graded. Provide aggregates from a single source.

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

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: ASTM C 494/C 494M, of type suitable for application, certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

FIBER REINFORCEMENT

A. Synthetic Fiber: **Monofilament or fibrillated** polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, **1/2 to 1-1/2 inches** long

CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

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

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: **ASTM D 1751, asphalt-saturated cellulosic fiber**

B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

D. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than [**3**]minutes.

1. Color: **White**, **Yellow** or **Blue, As indicated.**

WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete.

1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

CONCRETE MIXTURES

A. Prepare the salt resistant design mixtures, proportioned according to ACI 301 and ACI 318, meeting the minimum following properties (AE Titan mix code 3326880):

1. Compressive Strength (28 Days): 5000 psi
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.40
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Air Content: 6 percent plus or minus 1.5 percent.
5. Designed Unit Weight: 141.6 lb/ft3
6. Fly Ash: ASTM C-618 Class F
7. Silica Fume: ASTM C-1240
8. Water Reducer: ASTM C-494 Type F
9. Air Entrainment: ASTME C-260

B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. Yd. Copmply with ASTM C 1116// C 1116 M.

C. Color Pigment: Add liquid coloring pigment to concrete mixture according to manufacturer's written instructions. Typically require a mockup for this use.

CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116 (when using fiber-reinforced concrete). Furnish batch certificates for each batch discharged and used in the Work.

EXAMINATION

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

EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

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

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

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

CONCRETE PLACEMENT

A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

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

E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
4. Provide mock-ups as required for finish quality control.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.

1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

PAVEMENT TOLERANCES

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

1. Elevation: 1/4 inch .
2. Thickness: Plus 3/8 inch , minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

PAVEMENT MARKING

A. Allow concrete pavement to cure for **28** days and be dry before starting pavement marking.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

REPAIRS AND PROTECTION

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

B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.

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

PLANTING IRRIGATION/SPRINKLING SYSTEM (SECTION 328400)

Performance Standard Criteria (PSC)

The Facilities Management Division shall designate whether the project will utilize criteria for Baseline Performance Standards, or High Performance Standards.

High Performance Standard:
Drip irrigation or other low water use system approved by the County shall be required for all high performance projects.

Exemption. The Salt Lake County Facilities Management Project Manager may determine exemption from this standard on a case by case basis. Exemption shall be based on unique site, project, or existing conditions. Proposed exemptions shall be reviewed by the Project Manager on each project. The County project manager will present the proposed exemption to the PDT for review and comment.

Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

Layout of Irrigation Components: During layout and staking, consult with Project Manager to verify proper placement of irrigation components and to provide Contractor recommendations for changes, where revisions may be advisable. Small or minor adjustments to system layout are permissible to avoid existing field obstructions such as utility boxes or street light poles. Contractor shall place remote control valves in groups as practical to economize on quantity of valve clusters. Quick coupler valves shall be placed with valve groups as shown on plans.

General

A. The Contractor shall operate, maintain until acceptance, and guarantee the new system until all lawn and plants planted on this project have become established and have been

approved by the Landscape Architect and/or County representative. Provide 100 percent coverage on all lawns and planting areas on the site.

B. Certifications: All General laborers or workers on the Project shall be previously trained and familiar with sprinkler installation, and have a minimum of one-year experience. Those workers performing tasks related to PVC pipe and electrical components shall have certificates designated below:

1. Certified Irrigation Contractor
2. All workers engaged in handling, assembling and gluing of PVC pipe shall carry on Project site a Certificate of Training from the IPS factory representative authorizing said worker to prime and glue PVC pipe. (Contact Bill Godwin, G & S Sales, 801-972-0659).
3. All workers engaged in the handling and installation of buried power wire, emote control valve wire, wire connectors, controllers and grounding equipment shall carry on Project site a Certificate of Training from Paige Wire factory representative authorizing said worker to install wire, wire connectors and grounding equipment. (Contact Vince Nolletti, Vice President Irrigation Operations, Paige Electric Co., LP, 559-431-2346).
4. Documents verifying Certified Irrigation Contractor, PVC Pipe Certification and Electrical Component Certification shall be provided to Project Manager at least 30 days in advance of any irrigation installation on project site.

C. All landscape and hardscape areas disturbed shall be restored to original or better condition.

C. Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

D. Layout of Irrigation Components: During layout and staking, consult with Project Manager to verify proper placement of irrigation components and to provide Contractor recommendations for changes, where revisions may be advisable. Small or minor adjustments to system layout are permissible to avoid existing field obstructions such as utility boxes or street light poles. Contractor shall place remote control valves in groups as practical to economize on quantity of valve clusters. Quick coupler valves shall be placed with valve groups as shown on plans.

E. Controller map: Upon completion of system, place in each controller, a color-coded copy of the area that controller services; indicating zone number, type of plant material and location on project that zone services. Laminate map with heat shrink clear plastic.

F. Existing Sprinkler Irrigation System

1. If there is an existing sprinkler irrigation system on the site, the Contractor shall remove any lines being abandoned, and cap or plug the ends of lines remaining in service with proper fittings and thrust blocks. The Contractor shall remove or relocate existing heads and/or connect new lines to existing lines, as indicated on

the plans. Any existing heads or other hardware so removed, which are not to be relocated, will be returned directly to the Maintenance Personnel.

2. Any existing head, valve, valve marker, valve box, or other existing equipment located where there will be a grade or surface material change, shall be adjusted up or down to its proper position in relation to the new finished grade, at no additional cost to the County, unless the plans show it to be relocated.

G. Electric Power Service

1. All electrical lines or conduit, entering onto the site, shall be buried a minimum of 24 inches or as required by applicable codes, whichever is greater.

H. System Pressure

1. The sprinkler irrigation system is designed for 60 pounds per square inch static pressure unless otherwise specified and is schematic only, with the intent to convey full coverage of the lawn and planting areas affected. The system must also provide the manufacturer's recommended minimum operating pressure or greater to every head while maintaining sufficient pressure to overcome the losses due to friction in the piping, fittings, and all other equipment.

1.1 SCOPE OF WORK

A. The work to be performed under this Section shall consist of furnishing all labor and materials necessary to construct a complete working and tested automatic sprinkler irrigation system as per all drawings and specifications, providing 100 percent coverage on all lawns and planting areas on the site.
B. All landscape and hardscape areas disturbed shall be restored to original or better condition.
C. The Contractor shall operate, maintain until acceptance, and guarantee the new system until all lawn and plants planted on this project have become established and have been approved by the Owner's Authorized Representative, hereafter listed as **Project Manager**.

1.2 RELATED WORK

A. The following item(s) of related work are specified and included in other sections of the County's specifications. Section headings and reference numbers may not correspond exactly.
   1. Section 312000 – Earthwork
   2. Section 312216 – Landscape Fine Grading
   3. Section 329300 – Plants
   4. Section 329200 – Turf and Grasses
   5. Section 160000 – Electrical

1.3 SYSTEM DESCRIPTION

A. <u>Design of irrigation components</u>: Locations of irrigation components on Construction Drawings may be approximate. Piping, sleeving and/or other components shown on Construction drawings may be shown schematically for graphic clarity and demonstration

of component groupings and separations. All Irrigation components shall be placed in landscaped areas, with the exception of pipe and wire in sleeving under hardscapes.

B. Construction requirements: Actual placement may vary as required to achieve a minimum of 100% coverage without overspray onto hardscape, buildings or other features.

C. Layout of Irrigation Components: During layout and staking, consult with Project Manager to verify proper placement of irrigation components and to provide Contractor recommendations for changes, where revisions may be advisable. Small or minor adjustments to system layout are permissible to avoid existing field obstructions such as utility boxes or street light poles. Contractor shall place remote control valves in groups as practical to economize on quantity of valve clusters. Quick coupler valves shall be placed with valve groups as shown on plans.

1.4 DEFINITIONS

A. Water Supply - Piping and components furnished and installed to provide irrigation water to the Project. Including but not limited to nipples, spools, shut off valves, corporation stop valves, water meters, pressure regulation valves, and piping upstream of (or prior to) the Point of Connection.

B. Point of Connection: Location where the Contractor shall tie into the water supply. May require nipples, spools, isolation valves, meter, back flow device, flow sensor, or stop & waste valve for landscape irrigation needs and use.

C. Main line piping: Pressurized piping downstream of the Point of Connection to provide water to remote control valves and quick couplers. Normally under constant pressure.

D. Lateral line piping: Circuit piping downstream of remote control valves to provide water to sprinkler heads, drip systems or bubblers.

E. PROJECT MANAGER: Owner's Authorized Representative.

1.5 REFERENCES

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

1. ASTM – American Society for Testing and Materials
2. IA – The Irrigation Association: Main BMP Document.
3. ASIC – American Society of Irrigation Consultants: ASIC Grounding Guideline.

1.6 CONTRACTOR QUALIFICATIONS:

A. Contractor shall provide document or resume including at least the following items:

1. That Contractor has been installing sprinklers on commercial projects for ten previous consecutive years.
2. Contractor is licensed to perform landscape construction in the State of Utah.
3. Contractor is bondable for the work to be performed.
4. References of five projects of similar size and scope completed within the last ten years. Three of the projects listed shall be local.
5. Project On-site Foreman or Supervisor has at least five consecutive years of commercial irrigation Installation experience.
   a. Project Foreman shall be a current Certified Irrigation Contractor in good standing as set forth by the Irrigation Association.
   b. Project Foreman shall be on Project site 100% of each working day.

6. Provide evidence that Contractor currently employs workers in sufficient quantities to complete Project within time limits that are established by the Contract.
7. Provide list of employees to be assigned to this Project and their irrigation installation experience.

B. Certifications: All General laborers or workers on the Project shall be previously trained and familiar with sprinkler installation, and have a minimum of one-year experience. Those workers performing tasks related to PVC pipe and electrical components shall have certificates designated below:
   1. Certified Irrigation Contractor
   2. All workers engaged in handling, assembling and gluing of PVC pipe shall carry on Project site a Certificate of Training from the IPS factory representative authorizing said worker to prime and glue PVC pipe. (Contact Bill Godwin, G & S Sales, 801-972-0659).
   3. All workers engaged in the handling and installation of buried power wire, remote control valve wire, wire connectors, controllers and grounding equipment shall carry on Project site a Certificate of Training from Paige Wire factory representative authorizing said worker to install wire, wire connectors and grounding equipment. (Contact Vince Nolletti, Vice President Irrigation Operations, Paige Electric Co., LP, 559-431-2346).
   4. **Documents verifying Certified Irrigation Contractor, PVC Pipe Certification and Electrical Component Certification shall be provided to Project Manager at least 30 days in advance of any irrigation installation on project site**.

1.7 SUBMITTALS

A. Materials: At least thirty (30) days prior to ordering of any materials, the Contractor shall provide manufacturer catalog cut sheet and current printed specifications for each element or component of the irrigation system.
   1. Submittals shall be in electronic format, on DVD or CD, as Adobe PDF documents.
   2. Provide three copies of submittals to Project Manager. No material shall be ordered, delivered or any work preceded in the field until the required submittals have been reviewed in its entirety and stamped approved.
   3. Delivered material shall match the approved samples.
   4. Substitutions: The Contractor shall use only materials and equipment that matches existing materials and equipment that are being replaced. No substitutions of materials will be approved on the sprinkler irrigation system!

B. Invoices: Contractor shall provide to Project Manager any and all Distributor invoices containing Rain Bird products.

C. Operation and Maintenance Manual:
   At least thirty (30) days prior to final inspection, the Contractor shall provide Operation and Maintenance manual to Project Manager, in Adobe PDF format, containing:
   1. Manufacturer catalog cut sheet and current printed specifications for each element or component of the irrigation system.
   2. Parts list for each operating element of the system.
   3. Manufacturer printed literature on operation and maintenance of operating elements of the system.
   4. Section listing instructions for overall system operation and maintenance. Include directions for Spring Start-up and Winterization.

D. Owner's instruction: After system is installed, inspected and approved, instruct County in complete operation and maintenance procedures. Coordinate instruction with references to previously submitted Operation and Maintenance Manual.
   1. Contractor shall provide adequate notice to Owner for scheduling.

E. Materials to be furnished: The following items shall be supplied as part of this contract and shall be turned over to Owner at Final Inspection.
   1. Two (2) special tools / wrenches for disassembly and adjustment of each type of irrigation equipment/heads installed that require such special tools/wrenches.
   2. Two keys for each type of automatic controller.
   3. One valve box cover key.
   4. Documentation of Water Department's inspection and acceptance of backflow device and flow sensor.

F. Project Record Copy**:**
   1. Maintain at project site one copy of all project documents clearly marked "Project Record Copy". Mark any deviation in material installation on Construction drawings. Maintain and update drawing at least weekly. Project Record Copy to be available to Project Manager on demand.
   2. Completed Project As-built Drawings:
      a. Prior to final inspection, prepare and submit to Project Manager accurate as-built drawings.
      b. Show detail and dimension changes made during installation. Show significant details and dimensions that were not shown in original Contract Documents.
      c. Field dimension locations of sleeving, points of connection, main line piping, wiring runs not contained in main line pipe trenches, valves and valve boxes, quick coupler valves, color of hot and spare wires – splice boxes, and the size of all underground piping, valves, and drains.
         1). Dimensions are to be taken from permanent constructed surfaces, features or finished edges located at or above finished grade.
   3. The Contractor shall provide a GPS coordinate location for each of the following items: point of connection, water meter, backflow device, isolation valves, control valves, gate valves, filters, quick coupling valves, controller, flow meters, manual drain valves, and any other pertinent component of the irrigation system. Provide coordinates on as built drawings and recorded on a CD in WR format.

G. Controller map: Upon completion of system, place in each controller, a color-coded copy of the area that controller services; indicating zone number, type of plant material and location on project that zone services. Laminate map with heat shrink clear plastic.

1.8 INSPECTIONS

A Inspections will be required for:
   1. Hydrostatic test of irrigation main line.
   2. Continuity test of spare wires from controller to last valve with Project Manager.
   3. All piping system layout before backfilling.
   4. Coverage test.
   5. Final inspection / Start of Maintenance.
   6. Final inspection.

B. Inspection Requests: Contractor shall notify the Project Manager a minimum of 48 hours (two working days) in advance for all inspection.

C. Closing in Un-inspected Work: No work of this section shall be covered up or enclosed until it has been inspected, tested and approved by Project Manager.

1.9 WORKMANSHIP AND MATERIALS

A. It is the intent of this specification that all material herein specified and shown on the construction documents shall be of the highest quality available and meeting the requirements specified.
B. All work shall be performed in accordance with the best standards of practice relating to the trade.

1.10 DELIVERY—STORAGE—HANDLING

A. During delivery, installation and storage of materials for Project, all materials shall be protected from contamination, damage, vandalism and prolonged exposure to sunlight. All material stored at Project site shall be neatly organized in a compact arrangement and storage shall not disrupt Project Owner or other trades on Project site. All material to be installed shall be handled by Contractor with care to avoid breakage or damage. Damaged materials attributed to Contractor shall be replaced with new at Contractor's expense.

1.11 WARRANTY

A. Contractor shall provide one year Warranty. Warranty shall cover all materials, workmanship and labor. Warranty shall include filling and or repairing depressions or replacing turf or other plantings due to settlement of irrigation trenches or irrigation system elements. Valve boxes, sprinklers or other components settled from original finish grade shall be restored to proper grade. Irrigation system shall have been adjusted to provide proper, adequate coverage of irrigated areas.

1.12 MAINTENANCE

A. Provide the following services:
   1. Winterize entire irrigation system installed under this contract with Project Manager.
   2. Winterize by 'blow-out' method using compressed air. Compressor shall be capable of minimum of 175 CFM. This operation shall occur at the end of first growing season after need for plant irrigation but prior to freezing. Compressor shall be capable of evacuating system of all water from main line pipe and lateral line pipe.
      a. <u>Contractor shall retrofit compressor with adjustable pressure regulation device. Compressor shall be regulated to not more than 60 PSI.</u>
   3. Start up system the following spring after danger of freezing has passed. Contractor shall train Owner's Representative in proper start-up and winterization procedure.
   4. Check coverage and adjust as necessary.

<u>PART 2 - PRODUCTS</u>

2.1 GENERAL

A. Any discrepancies between existing site conditions and those indicated on the plans shall be called to the attention of the Project Manager, prior to continuance of the project.
B. If there is an existing sprinkler irrigation system on the site, the Contractor shall remove any lines being abandoned, and cap or plug the ends of lines remaining in service with

proper fittings and thrust blocks. The Contractor shall remove or relocate existing heads and/or connect new lines to existing lines, as indicated on the plans. Any existing heads or other hardware so removed, which are not to be relocated, will be returned directly to the Salt Lake County Parks Department.

C. Any existing head, valve, valve marker, valve box, or other existing equipment located where there will be a grade or surface material change, shall be adjusted up or down to its proper position in relation to the new finished grade, at no additional cost to the owner, unless the plans show it to be relocated.

2.2 PIPE AND FITTINGS

A. General: Polyvinyl Chloride Schedule 40 Pipe and Fittings. This specification covers requirements for Schedule 40 PVC pipe and fittings made from Type 1 Polyvinyl Chloride.
   1. Materials: Pipe and fittings shall be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1 Polyvinyl Chloride, as outlined in ASTM D-1684. A Type 1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.
      a. PVC Type 1, Grade 1 pipe compound shall have a 2000 P.S.I. design stress at 74 degrees F., which is listed by the Plastic Pipe Institute (PPI). Materials, from which pipe and fittings are manufactured, shall have been tested and approved for conveying potable water by the National Sanitation Foundation Testing Laboratory (NSF).

B. Pipe: All pipe used on the project for the sprinkler irrigation system shall conform to the requirements of ASTM D-1685.
   2. All pipe, 3 inches diameter and smaller, shall be schedule 40 PVC.
   3. All pipe, 4 inches diameter and larger shall be PVC Class 200 0-ring pipe.
   4. 4 inch and larger pipe shall have M.J. or Harco type fittings with transition gaskets at all changes of direction tees, ells, caps, etc.
      a. M.J. or Harco type fittings to have bolted end flanges and be wrapped in plastic. Bolts and nuts to be greased prior to assembly.
      b. An optional exception for automatic valves: Fitting transition from main line pipe may be M.J. or Harco type with bolted end flanges.
   5. No bends other than very gradual in pipe shall be permitted. The Contractor shall use elbow fittings of 90 and 45 degrees as the situations demand.

C. Fittings:

   1. Fittings: All fittings used on the project for the sprinkler irrigation system shall conform to the requirements of ASTM D-2466.
      a. All solvent weld fittings on PVC lateral lines shall be schedule 40.
      b. All solvent weld fittings on PVC main lines shall be schedule 80.
      c. M.J. or Harco tees, schedule 80 S tees with SXT on 2” lines, schedule 80 bushings are approved on PVC main lines for automatic sprinkler valve installation.
      d. M.J. fittings with transition gaskets are required for all change of direction on 3" or larger PVC IPS main lines.

D. Pipe Sleeves: Pipe sleeves shall be required under all new concrete or other new paving.
   1. The size of the sleeve shall be at least 2 times (2X) (I.D.) larger than the pipes or wires, required for the sprinkler system.
   2. Wires shall be sleeved separately within their own sleeve.
   3. All pipe sleeves shall be PVC Schedule 40 pipe.

2.3 VALVES AND VALVE BOXES

A. Valves:

1. The Contractor shall provide adequate material for the connection of valves to the system, i.e., adapters, flanges, nuts, bolts, gaskets, etc.
2. Main line or Isolation Gate Valves: Shall be Gate Valves and conform to AWWA specification C 509.
   a. Gate Valves shall be of Class 200 cast iron body.
   b. Resilient-seated Gate Valve and shall have a non-rising stem with rubber "0" rings.
   c. Stems shall be of cold rolled, solid bronze, high tensile strength.
   d. Valve shall be high strength cast iron, fully encapsulated urethane rubber wedge.
   e. Valves 2" and larger shall be iron flanged with 2" square operating nut. See detail for installation.
   f. Gate valves shall be hydrostatically pressure tested for 400 P.S.I. and shall be designated for a working pressure of 200 P.S.I.
   g. Manufacturers (American made only):
      1) Waterous
      2) Matco-Norca brand
      3) or approved equal.
3. Manifold or RCV Isolation Valves: Shall be brass or bronze, American made gate valves. Valves shall be Class 125, non rising stem, with a wheel top. RCV isolation valves shall be same size as RCV valve they supply. Valves shall be FIPT threaded on both sides. Milwaukee brand or approved equal (American made only).
4. Quick Coupler Valves: Quick coupler valves shall be installed where specified on the plans. Each valve shall be a Rainbird 44 LRC heavy duty brass, two-piece, single lug locking cap. Each valve shall also be teed off the supply line with at least 24 inches of galvanized iron pipe and all fittings from that point up shall be galvanized iron. A Ford B11444 heavy duty ball manual valve shall be installed upstream from each quick coupler or group of quick couplers on one supply line for water shut-off and maintenance. Access ball valve with a 2" PVC sleeve-capped by a Weathermatic 906L cap, within a 10" round Carson Box with tee lid.
   a. Quick coupler valves shall be installed within a 10" round Brooks Bolt Down Box with tee lid unless next to concrete pad, then install to grade.
   b. The Contractor shall provide to the Project Manager at least 1 cap lock key and 1 quick coupling key with a swivel hose bib attached. These keys shall be delivered prior to final acceptance of the project.
5. Control Valves: Control valves shall be installed as specified by the plans. Each valve shall be PEB/PESB plastic globe diaphragm and electrically activated as specified on the plans. No valve shall be installed more than 12 inches below finished grade. All pipe on the control valve manifolds shall be Schedule 80 PVC pipe.
6. Manual Drain Valves: Manual drain valves shall be required at all low points in the main lines. See plans, notes, and details.
   a. All manual drains shall be Ford B11333 heavy duty brass, ball valves.
   b. The location of each manual drain shall be shown on the "as built" drawing with dimensions from the nearest permanent fixture, such as a building corner, etc.

7. Automatic Drain Valves: Automatic drain valves shall not be allowed on this project.

B. Valve Boxes:

1. All main line buried gate valves shall be fitted with a 6" minimum diameter pipe sleeve and 10" round Carson valve box, tee lid with stainless steel bolt. Install a quick coupler just down stream of each gate isolation valve, for blow out purposes.
2. Control Valve Boxes: All control valves shall be housed in a Carson 1419 standard or 1220 Jumbo series heavy duty plastic valve box, with a tee top, bolt-down lid, using stainless steel bolts.

C. Valve Assembly Marking

1. Each valve assembly and valve box must be permanently marked with the appropriate controller station number. Marking must be done in a manner which allows replacement of component parts without loss of marking.

2.4 BACKFLOW PREVENTION DEVICE

A. The Contractor shall install backflow prevention equipment after the point of connection (downstream) to the supplying utility lines and shall comply with local water district or State (whichever is most restrictive) requirements for such. See plans and details for more information.
B. Install a quick coupler just downstream of backflow device, for blow out purposes.

2.5 IRRIGATION HEADS

A. General

1. All heads used on this project shall be as specified in the materials list on the plans.

2.6 ELECTRICAL MATERIALS

A. Conduit:

1. All conduit below grade shall be schedule 40 PVC of sufficient size to carry all proposed wiring.
2. Conduit above grade shall be galvanized steel.
3. Low voltage (24 V) wiring shall be provided with a separate conduit/sleeve from both high voltage wiring (110/120 volt and higher) and the irrigation mainline sleeve.

B. Control Wires: All irrigation control wire shall bear approval as UF/UL PE type of underground feeder and each conductor shall be of electrical conductivity grade copper in accordance with ASTM-30.

1. All control wire shall be specifically designed for direct burial use.
2. Sizes shall be #14 ga for control wire and spare wire, and #12 ga. for common wire.
3. A minimum loop of 24 inches shall be left at each valve, at each splice, and at each controller for expansion and/or servicing of the wire.
4. All splices shall be water-tight, as specified above. All wire, crossing water, attached to bridges, going under paving, or where conditions require protection, shall be housed in conduit or sleeves, all out of ground conduits shall be metal rigid conduit. All buried conduit can be PVC conduit.
5. Multiple wires in the same trenches shall be banded together at 10 foot intervals for protection. Where wires pass under paved areas, Schedule 40 PVC sleeves shall be installed prior to installation of the paving, if possible, and prior to installation of the

wires. Sleeves shall be sized as follows: 1-11 wires in 1-1/4 inch pipe; 12-15 wires in 1-1/2 inch pipe; etc.

6. All common or ground wires shall be White. 3. The pigment or color of the wires shall be integrated into the covering, rather than painted on. No aluminum wire shall be used on this project!

2.7 CONTROLLERS

A. Valve Controllers:

1. A valve controller of the type specified on the plans shall be mounted at eye level on the wall of the structure designated on the plans or if no structure, the controllers are to be mounted inside a stainless steel strong box, in field applications.

PART 3 – EXECUTION

3.1 GENERAL

A. Irrigation System Design & Water Supply

1. The sprinkler irrigation system is designed for [60] pounds per square inch static pressure unless otherwise specified and is schematic only, with the intent to convey full coverage of the lawn and planting areas affected. The system must also provide the manufacturer's recommended minimum operating pressure or greater to every head while maintaining sufficient pressure to overcome the losses due to friction in the piping, fittings, and all other equipment.
2. Adequate water supply:
   a. Perform static pressure test prior to commencement of work.
   b. Verify that proper connection is available, and is of adequate size. Verify that culinary connection components may be installed as necessary. Notify Project Manager in writing of problems encountered prior to proceeding.

B. Electrical Service

1. If electrical service is not already in place, the Contractor will be required to make all necessary arrangements with Rocky Mountain Power Company including, but not limited to, making power connections, providing poles, weather head and meter, etc., as specified on the plans.
2. All permits and compliance with electrical company requirements shall be the Contractor's responsibility. All electrical lines or conduit, entering onto the site or within the site, shall be buried a minimum of 24 inches or as required by applicable codes, whichever is greater.

C. Construction Staking

1. The Contractor shall provide the necessary staking to obtain the layout shown on the plans. The points of reference shall be the existing walks, buildings, curbs, etc... The staking shall be approved by the Project Manager prior to commencing installation operations. Any changes in the system which appear necessary, due to field conditions, must be called to the attention of the Project Manager and approved at the time.

3.2 SEQUENCING

A. Perform site survey, research utility records, contact utility location services. The Contractor shall familiarize himself with all hazards and utilities prior to work commencement. Install sleeving prior to installation of concrete, paving or other permanent site elements. Irrigation system Point of Connection components, backflow

prevention and pressure regulation devices shall be installed and operational prior to all downstream components.

1. All main lines shall be thoroughly flushed of all debris prior to installation of Remote Control Valves. All lateral lines shall be thoroughly flushed of all debris prior to installation of any sprinkler heads.
2. Irrigation Contractor shall be required to submit detailed Construction Schedule to Owner prior to commencement. Schedule shall be updated weekly.

B. Contractor shall schedule and organize work to minimize impact on project usage during public hours. Contractor shall confine work efforts to areas or zones which he can reasonably fence or protect, rather than spreading out trenching or other tasks across large areas of the site.
   1. Contractor shall schedule his work to reduce or eliminate open trenches at the end of each work day.

C. Contractor is responsible to supply water to existing portions of the project during construction.

D. Contractor is responsible to maintain existing turf and plant material in healthy condition. Any loss of turf or plant material due to Contractor neglect shall be replaced by Contractor at no cost to Owner. Water to existing turf or plant material shall not be turned off for more than 48 consecutive hours.

3.3 EXISTING FIELD CONDITIONS

A. Preserve and protect all existing trees, plants, structures, hardscape, and architectural elements from damage due to work in this section. In the event that damage does occur to landscaping or structures, the contractor will repair or replace damage.

B. Trenching or other work required in this section under limp spread of existing trees shall be done by hand or by other methods so as to prevent damage or harm to limbs, branches, and roots.

C. Trenching in areas where root diameter exceeds 2 inches shall be done by hand. Exposed roots of this size shall be heavily wrapped with moistened burlap to avoid scarring or excessive drying. Where trenching machine is operated in proximity to roots that are less than 2 inches, the wall of the trench shall be hand trimmed, making clean cuts through roots.

D. Trenches adjacent to or under existing trees shall be closed within 24 hours, and when this is not possible, the side of trench closest to tree or trees affected shall be covered with moistened burlap.

3.4 TRENCHING AND BACKFILLING

A. <u>Excavation and Trenching</u>:

1. Excavation work shall be as deep and as wide as will be required to safely perform the work, such as making mainline connections or forming vaults.
2. Trenches shall be deep and wide enough to provide working space for placing 2 inches of mortar sand bedding underneath all new mainline pipe and fittings where the soil is rocky or gravelly.
   a. <u>18 to 30 inches of cover shall be placed over the top of all pipe and fittings on main lines</u> (lines which maintain a constant water pressure).
   b. All trench bottoms shall be sloped so that the pipes will gravity drain back to the main connection point or the nearest manual drain.
   c. <u>If the existing main line is deeper than 30 inches, the Contractor shall install a riser to a depth of 18 to 30 inches and then install the new line at the required 18-</u>

30" depth. At no time will the mainline be installed deeper than 30" unless prior approval by Project Manager.

3 Trenches for lines supplying large rotors, shall be deep enough to maintain a minimum of 8 to 16 inches of cover over the top of all pipe and fittings. Trenches shall also be deep enough to guarantee that all swing joints drain back to the lateral and supply lines. Lateral lines may be pulled by a mechanical puller provided minimum uniform depth and all other applicable specifications are met.

4. Trenches for lines supplying small heads shall be deep enough to maintain a minimum of 8 to 14 inches of cover over the top of all pipe and fittings. Trenches for these lines shall be a minimum of 6 inches away from any walks, curbs, and of sufficient width to accommodate tees coming out sideways (horizontally) from the laterals.
5. Any rocks or other debris over one inch in diameter uncovered during excavation or trenching shall be removed from the area.
6. If more than one line is required in a single trench, that trench shall be deep and wide enough to allow for at least 6 inches of separation horizontally between pipes.
7. Any existing utility lines damaged during excavating or trenching shall be repaired immediately after notification of the utility owner and to his satisfaction. Should utility lines be encountered, which are not indicated on the plans, the Project Manager shall be notified. The repair of any damage shall be done as soon as possible by the Contractor or the utility owner, and proper compensation will be negotiated by the County. Such utility locations shall be noted on the "as built" drawings required before final payment of the sprinkler irrigation system contract.

B. Backfill:

1. No backfilling of trenches shall be done until the system has been inspected for proper trench depths, installation of equipment, control wire, and location of heads by the Project Manager.
2. Before trenches are backfilled, the Contractor must show the Project Manager, the redlined "as built" drawing he has been keeping on the site, showing that changes and corresponding dimensions have been recorded where changes have been made.
3. The system shall be tested under pressure for leaks, and general operation of the equipment. It must maintain a minimum pressure of 60 P.S.I. from the main connection to the farthest head. This may be tested and certified by the Project Manager. All defects disclosed by the pressurization and operation test shall be corrected before proceeding with further work.
4. Backfill under and around the lines to the center line of the pipe shall be placed in maximum layers of 6 inches and thoroughly compacted.
5. Special care shall be taken to assure complete compaction under the haunches of the pipe. Backfill compaction under the haunches of the pipe shall be compacted to the original density. Compaction requirements by mechanical compactor, i.e. jumping jack, above the pipe shall be the same as for surrounding areas.
6. No rocks larger than 1 inch in diameter, nor any other debris, shall be backfilled into the trenches. All trenches shall be backfilled then saturated with water sufficiently to insure no settling of the surface after lawn is planted or sod is replaced.
7. Where trenching is done in established lawn, care will be taken to keep the trenches only as wide as is necessary to accomplish the work. The trenches shall be backfilled as specified above and then 4 inches of topsoil will be placed to bring the trench up to existing grade so that sod can be laid. The new sod shall be first grade sod per specifications of standard width and shall be laid along the trenches so as to match

the existing sod. No small pieces of sod shall be used and only standard lengths shall be accepted. No sod from the construction site shall be used unless otherwise specified

3.5 PIPE INSTALLATION

A. General:

1. Handling and unloading of pipe and fittings shall be in such a manner as to insure delivery at the job site in a sound, undamaged condition. Any pipe found to be damaged or defective in workmanship or materials shall be rejected or taken out if found installed.

B. Plastic Pipe:

1. Installation: The ends of all threaded pipe shall be reamed and free of all inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1-1/8 times the length of the female thread receiving the pipe. The threaded pipe shall be screwed into a full length of the female thread.

C. Fittings:

1. All tees coming out of main lines or valves and other fixtures, shall be horizontal so that no weight or pressure may be exerted through the fixture on the top or bottom of the main line.
2. Tees shall be M.J., Harco with bolted end flanges, with TXT Schedule 80 bushing of appropriate size to the valves and Schedule 40 SXT tees for the head. or heads. See detailed drawings.
3. Maximum of two auto valves per main line tee.
4. All tees coming out of the lateral lines for heads and other fixtures shall be horizontal so that no direct weight or pressure may be exerted through the head to the top or bottom of the lateral line. Tees on lateral lines shall also be SXSXT to the head swing joints. See detailed drawings.
5. All pipe joints shall be properly sealed with pipe dope applied to and well worked over the areas to be joined. The dope for galvanized pipe shall be a white lead and pure linseed oil mixed to be a consistency of thick paint or it may be Teflon tape.
6. Every care shall be taken during installation to prevent dirt and debris (especially rocks) from getting into the pipes.

D. Thrust Blocks

1. Thrust blocks are needed on pipe sized 2” and larger, wherever the main pipe line:

a. Changes any direction at tees, angles, and crosses vertical and horizontal.
b. Changes size at reducers.
c. Stops at a dead-end.
d. Valves at which thrust develops when closed.

2. The size and type of thrust block depends on pressure, pipe size, kind of soil, and type of fitting. As a general rule, one cubic foot (minimum) of class AA (AE) Type II concrete is required for each thrust block.
3. Thrust blocks shall rest against undisturbed original earth in the direction of thrust.
4. Upward Thrusts at Fittings: Where a fitting is used to make a vertical bend, use a bar to anchor the fitting to a thrust block braced against undisturbed soil. The thrust block should have enough resistance to withstand upward and outward thrusts at the fitting.

5. All pipes, lines, and risers shall be flushed thoroughly with water before installation of any heads. All debris and rocks found at that time shall be removed from the area as soon as possible.

E. Sleeves:

1. Verify all sleeve locations below future hardscape. Flag all existing sleeves and conduits installed by other trades.

3.6 BACKFLOW INSTALLATION

A. Install backflow assemblies at locations shown on drawings.

3.7 VALVE AND VALVE BOX INSTALLATION

A. VALVES:

1. Manual Drain Valves: Manual drain valves shall be required at all low points in the main lines. See plans, notes, and details.
   a. Each manual drain valve will be accessed by a 2 inch PVC Schedule 40 pipe sleeve, capped by a Weathermatic 906L locking valve cap with a RLK-1 key, no approved equals, enclosed within a 10" round Brooks Bolt down box top of drain sleeve to be 3" - 6" below lids of Brooks Box.
   b. Each manual drain shall empty into a gravel sump, a minimum of 18 inches by 18 inches by 12 inches deep. The gravel shall be washed 3/4 inch rock. No pea gravel will be allowed.

B. VALVE BOXES:

1. Control Valve Boxes: No valve box shall rest directly upon the valve or any fixture associated with it. Each valve box shall be centered on the valve it covers. Each valve box shall have 6 inches of clean ¾" minus gravel placed in the bottom underneath the valve and lines to reduce the potential of mud and standing water therein.
   a. All connections made inside the box to connect wires to the valve shall be made inside a 3M-DBY or DBR connector. Each connector shall be completely sealed and water proof with a minimum 24" wire loop in each box for each wire.
   b. All splices in control wire shall also be housed in a valve box, as specified above.

3.8 IRRIGATION HEAD INSTALLATION:

A. General:

2. All heads shall be installed above grade so as to minimize washing of the topsoil and seed during the landscaping establishment period, except those which border paving or flat work of any kind. These heads shall be installed at the finished grade of the adjacent paving or flat work. Prior to final acceptance of the project, all heads shall be raised or lowered to final lawn or planting grade.
3. Heads installed in existing sod shall be set at the grade of the soil.
4. All rotary pop-up heads shall be installed at final grade on double swing joints. See detailed drawings in the section following this one. All swing joints must drain by gravity back to the supply lines.
5. All pop-up, shrub spray, lawn spray, bubbler and strip spray heads shall be installed as shown in the details.

B. Bubblers:

1. Contractor shall install one .25 GPH bubbler per shrub as shown on details.
2. Contractor shall install 3 bubblers per tree (two .25 GPH and one .50 GPH), as shown on details.

3. Contractor shall install Schedule 40 SXT tee on lateral pipe for transition to swing pipe. Each tree shall have 1 dedicated tee, with swing pipe branching off as shown on details to irrigate root ball. Contractor may choose to install 1 dedicated tee per shrub or combine 2 shrubs per tee as shown on details. Contractor may not install more than two shrub bubblers per tee.
4. Contractor shall be responsible to install bubbler lateral pipe such that swing pipe installation from lateral to plant material shall not exceed ten feet of tubing per run.

3.9 CONTROLLER INSTALLATION

A. Controller:
   1. It shall be the Contractor's responsibility to install and supply a plugged outlet, junction box or separate breaker to furnish power to a new controller.
   2. AG2401 surge protection shall also be provided at the incoming power and low voltage power side.
   3. Grounding shall be per the national electrical code and the Grounding Grid detail shown on the plans.
   4. All new controllers shall be installed with a D-SS-TH9B-MIB Radio & a Rain Bird RBRDTRA9023NP antenna, also with EICON remote radio card set to Salt Lake County frequency 151.955.
   5. All Rain Bird Maxicom equipment shall be inspected and approved by a Rain Bird approved Maxicom Specialist, such as Mt. States Supply, Contact Tim Brandt 801 484-8885 or Sprinkler Supply Co., Joe Jackson, 801 566-8102.
   6. Contractor shall be responsible for obtaining inspection approval and shall have any rejected installation repaired and re-inspected at no cost to the Owner.
   7. The Contractor shall be required to provide conduit, wiring, and all materials along with the labor necessary to make the controller operational and in compliance with local electrical codes.
   8. When an existing controller is used for part of a new sprinkler irrigation system, the Contractor shall coordinate the setting, wiring, use, and all maintenance operations pertaining thereto, with the County Park's Maintenance personnel.

3.10 WIRING

A. Where more than one controller is required, a different color hot wire shall be used for each controller.
B. Minimum two spare wires shall be run from each controller.
   1. 24 or more valves 4 spare wires are required for each controller.
C. Minimum <u>two spare wires shall be run from each controller to the farthest valve under its control in all directions and any valve which is on a dead-end line.</u>
   1. The spares shall also be a different color from the regular wires and shall be labeled at both ends.
   2. <u>Each spare wire shall be brought up to the surface in each valve box it passes through and coiled with 24 inches for use in future connections.</u>
   3. Each spare wire shall be tested for continuity prior to final acceptance of the project and guaranteed by the Contractor to be functional. Should the County Maintenance Personnel discover a defect within 1 year afterwards, the Contractor shall locate the problem and cause it to be repaired at his cost.
   4. <u>All control wires shall be installed in trenches 6 inches to either side of or under the pipes so that the wire is protected from damage during backfilling and maintenance operations.</u> See detailed drawing showing the wire located in those positions.

5. Control wires not placed in the trenches by the sides or under the pipes, shall be buried 18 inches or deeper and marked on the "as built" drawings.

3.11 FINISHING AND TESTING

A. When installation of all equipment is complete and backfilling, and grading operations are complete, the Contractor shall call for an operational test and major inspection of the sprinkler irrigation system. Notice by the Contractor shall be given, in writing, 3 days in advance to the Project Manager so that proper scheduling can be done for those who are to attend.
B. At the appointed time, an inspection of all valve boxes, controllers, gate valves, and heads shall be made. The entire system will be tested to check for pressure, operation, water coverage, and head adjustment. A list of discrepancies (punch list), shall be written within 3 days and distributed as needed. Each item on the list shall be corrected before the system will be approved by the Inspector who will notify the Project Manager before payment will be made. The Contractor will be back charged for time spent by County offices and consultants who have been brought to the site for a final inspection when the project is not ready for a final inspection.

3.12 GUARANTEE AND MAINTENANCE

A. Upon inspection and acceptance of the sprinkler irrigation system as being operational and properly installed, the Contractor shall guarantee the workmanship, materials, fixtures, and equipment to be free from defects for 1 year after Substantial Completion has been granted.
B. In the Fall of the year during the installation and guarantee period, the Contractor shall meet with the County maintenance personnel on the site. The Contractor shall winterize the system by draining all of the water and doing everything necessary to insure protection of the system until Spring. Blowing out the lines by compressor shall be permitted during the 1 year guarantee. The individuals involved from both parties shall exchange all information necessary for the eventual take-over of the system by the County.
C. The Contractor shall insure and guarantee complete drainage of the system. In working with or connecting to an existing system, he shall guarantee compatibility in operation and drainage between the two systems.
D. The Contractor with the County maintenance personnel, inspector or Project Manager in attendance shall energize the sprinkler irrigation system again the following Spring and shall repair all defects found as a result of Winter damage, improper installation, improper maintenance, defective materials or inadequate sprinkler drainage.
E. The Contractor shall coordinate with the landscaping sub-contractor during the entire landscaping and lawn establishment period on the use, scheduling, and maintenance of the sprinkler system.

3.13 FINAL INSPECTION

A. At the end of the guarantee period, when the lawn and landscaping have been approved, the Contractor shall call for a final inspection of the sprinkler irrigation system. There shall be 5 days notice given, in writing, to the Project Manager, prior so that the appropriate people may attend.
B. Prior to that time, all heads shall have been adjusted to their proper pattern, radii, and height. The system shall have been flushed out, checked for operation, and any defects corrected. The entire system will be inspected and checked to determine if everything is

in working order to be turned over to the County. A final list of items found in need or correction (if any), will be made and the Contractor shall correct them.

1. The Project Manager will notify the Owner when they have verified that every item is acceptable.
2. Upon final acceptance of the project by the Project Manager, the County shall assume all responsibility for the system.

Backfill

A. No backfilling of trenches shall be done until the system has been inspected for proper trench depths, installation of equipment, control wire, and location of heads by the Landscape Architect.

B. The system shall be tested under pressure for leaks, and general operation of the equipment. It must maintain a minimum pressure of 60 P.S.I. from the main connection to the farthest head. this may be tested and certified by the Landscape Architect. All defects disclosed by the pressurization and operation test shall be corrected before proceeding with further work.

C. BACKFILL under and around the lines to the center line of the pipe shall be placed in maximum layers of 6 inches and thoroughly compacted.

D. Special care shall be taken to assure complete compaction under the haunches of the pipe. Backfill compaction under the haunches of the pipe shall be compacted to the original density. Compaction requirements above the pipe shall be the same as for surrounding areas.

E. No rocks larger than 1/2 inches in diameter nor any other debris shall be backfilled into the trenches. All trenches shall be backfilled then saturated with water sufficiently to insure no settling of the surface after lawn is planted or sod is replaced.

Maintenance and Guarantee

A. As Built Drawings or Plans

1. The Contractor shall keep, as his work is installed, an accurate record of exact dimensioned locations, grades, elevations, and the size of all exterior and interior underground piping, valves, and drains. Dimensions shall be indicated distances from columns, buildings, curbs, and similar permanent features on the site. A zoning chart showing each irrigation zone and its control valve is required. Chart shall indicate the timer settings for each automatic controller zone.

B. Guarantee and Maintenance:

1. Upon inspection and acceptance of the sprinkler irrigation system as being operational and properly installed, the Contractor shall guarantee the

workmanship, materials, fixtures, and equipment to be free from defects for 1 year after Substantial Completion has been granted.

2. In the Fall of the year during the installation and guarantee period, the Contractor shall meet with the County maintenance personnel on the site. The Contractor shall winterize the system by draining all of the water and doing everything necessary to insure protection of the system until Spring. Blowing out the lines by compressor shall be permitted during the 1 year guarantee. The individuals involved from both parties shall exchange all information necessary for the eventual take-over of the system by the County.
3. The Contractor shall insure and guarantee complete drainage of the system. In working with or connecting to an existing system, he shall guarantee compatibility in operation and drainage between the two systems.
4. The Contractor with the County maintenance personnel, inspector or Project Manager in attendance shall energize the sprinkler irrigation system again the following Spring and shall repair all defects found as a result of Winter damage, improper installation, improper maintenance, defective materials or inadequate sprinkler drainage.
5. The Contractor shall coordinate with the landscaping sub-contractor during the entire landscaping and lawn establishment period on the use, scheduling, and maintenance of the sprinkler system.

C. Final Inspection

1. At the end of the guarantee period, when the lawn and landscaping have been approved, the Contractor shall call for a final inspection of the sprinkler irrigation system. There shall be 5 days notice given, in writing, to the Project Manager, prior so that the appropriate people may attend.
2. Prior to that time, all heads shall have been adjusted to their proper pattern, radii, and height. The system shall have been flushed out, checked for operation, and any defects corrected. The entire system will be inspected and checked to determine if everything is in working order to be turned over to the County. A final list of items found in need or correction (if any), will be made and the Contractor shall correct them.
3. The Project Manager will notify the Owner when they have verified that every item is acceptable.
4. Upon final acceptance of the project by the Project Manager, the County shall assume all responsibility for the system.

TURF AND GRASSES (SECTION 329200)

Performance Standard Criteria (PSC)

Baseline Performance Standard: Requirements listed within this section.

High Performance Standard:

Alternative turf species and grasses considered regional and drought-tolerant shall be proposed by the Design Team, and approved by the County shall be required for all high performance projects.

Exemption. The Salt Lake County Facilities Management Project Manager may determine exemption from this standard on a case by case basis. Exemption shall be based on unique site, project, or existing conditions. Proposed exemptions shall be reviewed by the Project Manager on each project. The County project manager will present the proposed exemption to the PDT for review and comment.

Materials

A. Seed

1. Seed: The grass seed shall consist of a mixture of the current year's Kentucky Blue Grass of the following varieties:

   a. Baron 20%, Fylking 20%, Glade 10%, Merret or Nasa 30%, and Perennial Turf Type 20%.

   b. Rad, Pennfine, Manhatten, Derby, Dasher, or Blaser may be substituted for the above varieties upon approval of the Landscape Architect.

2. The seed mixture shall meet the minimum tested requirements of A.N.A. The seed shall be the current year's crop, guaranteed by the supplier as follows:

   a. 80% Germination Rate

   b. 72% Purity

   c. No more than 2% inert matter

   d. No noxious weeds

   e. No more than 1 / 10% weed seed

   f. 28 pounds per bushel or equiv

   g. 80% pure live seed

3. The seed mixture shall be applied at a rate of 6 pounds per 1,000 square foot. Prior to seeding the Contractor shall arrange for the inspector to check the seed in storage. Labels shall be obtained for the project Landscape Architect's file.

B. Fertilizer

1. The first application of fertilizer shall be a 16-1 6-8 mixture incorporated with soil during tillage not more than 30 days prior to planting. A light application of 4-4-3 shall be applied every six weeks as per manufacturer's recommendations during the establishment and maintenance periods at a rate of 3 lbs. per 1,000 square foot. Approximately 1 pound of actual nitrogen per 1,000 square feet shall be used 60 days after seeding. Similarly 1 pound o factual phosphorous and 1 pound of actual potassium per 1,000 square feet shall be used.

C. Mulch (wood fiber)

1. Wood Fiber Mulch shall be a wood material which has been shredded, pulverized, or dissolved into small fibers. The mulch shall have been processed so that it will have no germination and so that it forms a blotter-like ground cover. The material shall be air dry and contain no more than 15% moisture by weight.

D. Mulch (peat moss)

1. Peat moss shall be pure sphagium moss and shall have an organic content of not less than 95 percent. The moss shall be weed free and have a PH of not more than 6.0.

E. Mulch (straw)

1. Straw mulch shall be clean straw free from noxious weeds or other elements harmful to lawn. All slopes greater than 5 percent or having washing problems shall be mulched with straw (does not apply to hydro-seeding).

Planting

A. Preparing the Seed Bed

1. The area to be seeded shall be rough graded and fine graded with all rocks over 1 inch in diameter and debris removed from the area as per other specifications. The topsoil shall have been spread in all areas to be planted which do not have 3 or 4 inches of topsoil naturally. The topsoil shall be the quality specified in other related sections.
2. The topsoil shall be wet enough to permit it to be worked properly. It shall not be so dry it is powdery nor so wet that it will puddle, or become hard when it dries.
3. The topsoil shall be applied and graded smooth so that when settled the surface is free from ridges and depressions which will puddle or hold water. Any areas containing new topsoil shall be rolled by a hand roller on shall areas. After rolling at a weight of 150-200 pounds per linear foot of roller, the bed shall again be graded to the specified grade with a smooth surface. Large areas shall be final graded by passing a land plane in three different directions over the entire area to be planted. The finished grade of the seed bed ready for seeding shall be 1 inch below the top surface of any concrete, or paved area, or finished grades of areas adjoining existing lawn shall match the existing grade in every spot.

B. Fertilizing

1. The fertilizer specified above shall be spread evenly over the prepared seed bed in the amount specified above and at those times.

C. Seeding and Mulching

1. Salt Lake County prefers the drilling method of seeding lawn. This method shall consist of (1) preparing the seed bed as specified in paragraph 2.0, (2) combining the special seed mixture specified in paragraph 1.0 with the fertilizer specified in paragraph 1.1 at the rates per thousand square feet as specified, (3) drilling the seed and fertilizer into the earth with a mechanical seeder such as a brilliant lawn seeder and making two complete passes at 30 degrees apart from one another over the entire area to be seeded as indicated on the plans. All slopes over 30 percent shall be seeded by hydro-mulching. Any slopes having a washing problem shall be mulched with straw, jute, fibre mating, enkamat, curlex blanket, or other erosion control materials as per the manufacturer's specifications. The material to be used shall be submitted by the Contractor for the Project Landscape Architect to be reviewed and approved.

D. One Step Hydro-Seeding

1. The second seeding method recommended by the County for general area seeding shall be the one step hydro mulching method. This method shall consist of (1) preparing the seed bed as specified in paragraph 2.0, (2) combining the seed mixture as specified in paragraph 1.0 at a rate of 100 pounds per acre with Silva Fibre Mulch as specified in paragraph 1.2 at a rate of 2,000 pounds per acre, filling the tanks with water, agitating of these materials into a well-mixed slurry suspension, and spraying the mixture under pressure onto the prepared seed bed.
2. This seeding method shall be utilized only during May 1 through September 25.

E. Two Step Hydro-Seeding

1. A variation of the one step hydro-mulching method which may be used from March 1 through October 30 is the two step method. This method shall consist of (1) preparing the seed bed as specified above, (2) sowing the seed mixture at a rate of 44 pounds per acre in two directions with an approved mechanical seeder, (3) and spraying a mixture of water and Silva Fibre under pressure at a rate of 1,400 pounds per acre onto the prepared seed bed.

F. Small Area Lawn Repair and Seeding

1. Small area lawn repair and seeding shall consist of (1) preparing the seed bed as specified in paragraph 2.0, (2) applying the fertilizer as specified in paragraph 1.1, (3) sowing the lawn seed mixture as specified in section 1.0 a uniformly over the area, and (4) ranking the seed and fertilizer into the soil.

a. Any area less than 2,000 square feet, but larger than 1 square foot shall be seeded by this method unless sod is specified.

b. Lawn areas to be reseeded shall also be done by this method also.

2. Lawn area of established grass or turf shall be repaired with new first grade sod as specified in the sod planting specifications.

a. All areas seeded by this method shall be covered with sphagrum peat moss applied uniformly at a rate of two pony bales per thousand square feet.

b. All slopes greater than 30 percent of any having a washing problem shall be mulched with straw at a rate of one and one half bales per thousand square feet. Jute, fibre matting, enkemat curlex blank or other erosion control materials may be used upon approval of the project Landscape Architect.

G. Watering of Seeded Areas

1. The entire seeded area shall be watered with a completely operational sprinkler irrigation system as soon as possible after seeding. The seeded areas shall be watered 5 times per day at 10 minutes per time. The contractor shall submit a watering schedule to the Project Landscape Architect. After germination and when the grass has stooled-out, the watering schedule may be adjusted to meet the needs of the grass and weather conditions.

Guarantee Period

A. Maintenance and Guarantee

1. The Contractor shall maintain and guarantee the new lawn by including any and all operations to establish a close stand of grass free from weeds and undesirable course or native grasses. Such operations shall include but not be limited to watering, weeding, re-seeding, mowing, spraying, fertilizing, and trimming.

B. First Mowing

1. The new lawn shall be first mowed as soon as the grass has reached a height of 3 inches and subsequent mowings shall be as often as is necessary to maintain the lawn at a uniform height of 2 inches while the lawns are under the Contractor's care.

C. Reseeding

1. The Contractor shall re-seed all spots more than 12 inches in any dimension which have not produced a movable lawn. The maintenance and guarantee period shall be the same for re-seeded areas as for new lawn areas.

SOD LIFTING AND LAYING

General Materials

A. Sod

1. Sod supplied by the Contractor shall be well established Kentucky Blue Grass, grown by a local sod grower, first grade, pest and weed free, one (1) to one and one quarter (1 1/4) inches thick supplied in rolls or sheets of the industry's standard size or alternate approved by County Project Manager in writing.

B. Fertilizer

1. Fertilizer shall be a complete mixture, analyzing sixteen percent (16%) nitrogen; sixteen percent (16%) phosphoric acid; and eight percent (8%) potash, of commercial type and applied at a rate of six (6) pounds per thousand (1000) square feet of area.

C. Top Dressing

1. Top dressing shall be a fertile, friable, natural, loam of fine texture. It shall be free of subsoil, stones, lumps, clods, sticks, weeds, roots, or other extraneous materials. It shall not be used for top dressing operations while frozen or muddy nor on frozen or muddy ground.

Sod Preparation

A. Sod Storage on the Site

1. Sod that has been lifted and is to be used by the County shall be stored spread-out, grass side up on a flat surface other than existing lawn and maintained in a healthy living condition until re-used. Sod maintenance shall include but not be limited to watering as often as necessary to keep it in a moist condition. No sod shall be stored on the site for longer than two (2) days. Sod that becomes yellow, dry or broken shall be removed from the site by the contractor at his expense.

B. Sod Bed Preparation

1. All areas of fill i.e. trenches, mounds, etc. shall be compacted and settled.

2. Before topsoil is spread the sub-grade shall be scarified to a depth of four (4) inches to insure proper bonding with applied topsoil if it has been compacted due to weather or equipment. The area shall be leveled and raked free of stones larger than one (1) inch in diameter and other debris.
3. Topsoil shall be spread to a depth of four (4) inches or as directed by the Landscape Architect.
4. The existing topsoil in all other areas to be sodded shall be loosened and pulverized to a depth of four (4) inches and all stones over one (1) inch in any dimension, sticks, roots, rubbish or other extraneous matter shall be removed from the premises. The surface will be fine graded so that when settled the surface is free from depressions or ridges and will conform to the required grades indicated. The surface shall be smooth, loose, and of uniformly fine texture at the time of sodding.
5. The Contractor shall prepare no more ground than can be sodded in a twenty-four (24) hour period.
6. No sodding shall be done immediately after a rain storm or if a prepared surface has been compacted without first, loosening the surface to a smooth, loose, uniformly fine texture just prior to sodding.

C. Fertilizer Application

1. The specified fertilizer shall be applied and incorporated into the upper four (4) inches of topsoil at a rate of six (6) pounds per thousand (1,000) square feet.

D. Grade

1. The new sod shall be laid on the topsoil so that the finished grade shall be one-half (1/2) inch below the top of adjacent paving or meeting exactly the grade of existing lawn.

Installation

A. Sod Laying

1. The sod shall be placed upon the prepared surface so that joints between courses are matched against the last line laid.
2. All work shall be done from boards laid on top of the prepared surface or on already laid sod. Care shall be taken to prevent foot prints or other disturbances to the prepared bed other than absolutely necessary. Any such disturbances shall be promptly repaired so that the sod will be laid on a proper bed to insure the necessary bonding between it and the sod.
3. Sod shall be tamped lightly as each piece is set to insure that good contact is made between edges and also with the ground. Sod laid on any sloped areas shall be anchored with wooden dowels or other materials which are accepted by the sodding industry.

B. Top Dressing

1. All areas which are sodded shall be top dressed with the top dressing specified above. The dressing shall be applied by the completion of each day's work. The top dressing shall be first applied by spreading it over the sod and then carefully working it into the joints with a stiff brush or mat.
2. All sodded areas shall be thoroughly watered after the top dressing is applied. Watering must be done carefully so as to avoid puddling or washing. Further work shall be curtailed until the area is dried sufficiently to allow sodding continuance without damage to already laid sod or the prepared bed.

C. Maintenance

1. The sod shall be maintained immediately after any section of the lawn is sodded, top dressed, and watered and shall continue until acceptance at the end of the guarantee period.
2. Maintenance shall include any and all operations necessary to establish a close stand of grass, of the varieties specified, free of weeds and undesirable coarse native grasses. Such operations shall include but not be limited to watering, weeding, application of additional top dressings, mowing, and trimming.

D. Sod Establishment Period

1. The Contractor shall be responsible for the sodded area during the period when the lawn is becoming established. The period shall begin at the time any individual phase of the sodding is completed and continue for a minimum of sixty (60) days. This shall be considered the establishment period.
2. All areas designated for sod shall be covered with a reasonable stand of grass and acceptable to the Landscape Architect. All spots twelve inches or larger and any areas found not acceptable shall be re-sodded as specified herein. Those areas which are re-sodded shall be maintained and guaranteed the same as the initial lawn sodding.

PLANTING – (SECTION 329300)

HIGH PERFORMANCE DESIGN

A. Provide shade (within 5 years of occupancy) for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots).

B. Restore and/or protect a minimum of 50% of the site area with plants that are indigenous and/or cultivars of native plants that are adapted to the local climate and are not considered invasive species or noxious weeds.

C. Use appropriate plant material and design landscape with native or adapted plants to reduce or eliminate irrigation requirements.

Landscape Design Standards and Guidelines

A. Deciduous Trees

1. All deciduous trees shall have a minimum trunk size of two inches in caliper, unless otherwise specified.

B. Evergreen Trees

1. All evergreen trees shall have a minimum size of five feet in height, unless otherwise specified.

C. Ornamental Trees

1. All ornamental trees shall have a minimum trunk size of one and one-half inches in caliper, unless otherwise specified.

D. Shrubs

1. All shrubs shall have a minimum height or spread of eighteen inches depending on the plant's natural growth habit, unless otherwise specified. Plants in five-gallon containers will generally comply with this standard.

E. Drought-Tolerant Species

1. Plants shall be selected for form, texture, color, pattern of growth and adaptability to local conditions. Site conditions in the County are generally arid, and the selection of plant species suited to dry conditions is appropriate.

   a. Baseline Performance Criteria: To promote water conservation, not less than eighty percent of the trees and eighty percent of the shrubs used on a site shall be drought-tolerant species that can withstand dry conditions once established.

   b. High Performance Criteria: All trees, shrubs, turf, and plantings used on a site shall be drought-tolerant species that can withstand dry conditions once established.

2. The Jordan Valley Water Conservation District's "Slow the Flow" website has lists and a searchable database of native, adapted, and drought-tolerant plant species. www.slowtheflow.org

F. Limits On Turf

1. To help promote the intent of this district by minimizing the impact on the natural landscape, the area of domestic turf grasses shall not exceed thirty percent (30%) of the area to be landscaped

2. Exceptions such as public parks and other projects which necessitate large areas of turf shall be approved by the County project manager.

G. Scale and Nature of Landscaping Material

1. The scale and nature of landscaping materials shall be appropriate to the size of the structures. Large scaled buildings, for example, should generally be complemented by larger scaled plants.

H. Planting Beds

1. Planting beds may be mulched with bark chips, decorative stone and/or gravel, or similar materials. Mulch shall not be used as a substitute for plants.

I. Water Conservation

1. Landscape design must recognize the climatic limitations of the Salt Lake County area and the need for water conservation. While irrigation systems are required for certain landscape areas, and may be desirable for other applications, all irrigation systems shall be designed for efficient use of water.

2. Drip and/or other conservation-based irrigation systems shall be used except in areas of domestic turf and ornamental landscaping. Drip irrigation shall be installed to provide needed water for the first two (2) years of growth to establish plantings.

J. Energy Conservation

1. As a general guideline, plant placement shall be designed to reduce the energy consumption needs of the project.

a. Deciduous trees should be placed on the south and west sides of buildings to provide shade from the summer sun.

b. Evergreens and other plant materials should be concentrated on the north side of buildings to dissipate the effect of winter winds

K. Slope Renegotiation

1. All slopes graded or otherwise disturbed shall be restored/replanted. Restored vegetation shall consist of native or adapted grasses, herbaceous perennials, or woody trees and shrubs as appropriate for slope, soil and microclimate conditions.

L. Erosion Protection

1. As a condition of site plan approval, a plan for erosion protection shall be submitted with the landscape plan. **REFER TO PREVIOUS SECTION.**

General Materials

A. Topsoil

1. Topsoil shall be a natural friable, fertile, fine sandy loam soil possessing the characteristics of representative topsoils in the vicinity which produce a heavy growth of grass, and it shall be obtained from naturally well drained areas from which the topsoil has never been stripped. The topsoil shall be free from subsoil, objectionable weeds, sods, stiff clay, stones larger than one (1) inch maximum in diameter, or any other material of substance which might be harmful to plant growths or a hindrance to planting operations.

B. Backfill

1. Backfill soil mixture shall be the following materials well mixed in the specified proportions which are by volume.

   a. 1 Part Peatmoss
   b. 4 Parts Topsoil

C. Peat

1. Peat shall be goof quality baled peat free from injurious materials.

D. Rubber Hose

1. Rubber hose shall be new two (2) ply fabric bearing rubber hose - inside diameter not less than five-eighths (5/8) inch.

E. Guy Wire

1. Guy wire shall be galvanized iron malleable wire No. 10 gauge.

F. Mulch

1. Mulch shall be clean, medium texture approved materials.
2. 2" of mulch is required in shrub beds and tree planting hole.

   EX: Ferti-Mulch - Medium Size 3/4" - 1 1/2"
   Premier Decorative Bark - Medium Size 3/4" - 1 1/2"
   Far-West Decorative Bark - Medium Size 3/4" - 1 1/2"
   Rock and gravel products as approved by the County
3. Upon completion of the planting operation, all planting beds and saucers around tree planting shall be mulched with a two (2) inch layer of approved material.

G. Tree Stakes

1. Tree stakes shall be two (2) inch by two (2) inch by eight (8) foot common pine stakes used as indicated on the plans. Steel stakes may be used if approved by the Landscape Architect and reclaimed after one year.

H. Weed-Control Barriers

1. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a non-woven polypropylene fabric, minimum 4.8 oz./sq. yd. (162 g/sq. m).

Plant Materials

A. Inspection and Samples

1. All plants shall comply with Federal and State Laws requiring inspection for plant disease and infestations.
2. Any inspection certificates required by law shall accompany each delivery of plans and such certificate will be filed with the Landscape Architect. All plants shall be subject to inspection and approval at the place of growth or upon delivery to the site for their quality, size, species, and variety. Such approval shall not impair the right of inspection and rejection at the site or during progress or work for size and condition of the plants, latent defects, or injuries. Any and all rejected plants shall be removed immediately from the premises by the Contractor. The Contractor shall make all replacements at his expense should he fail to comply in full with any of the specifications.

B. Names and Grades

1. Plant names shall conform to the nomenclature of "standardized plant names" as adopted by the American Joint Commission on Horticultural Nomenclature, 1942 Edition. The names and varieties included therein are generally in conformity with the names accepted in the nursery trade.
2. Size and grading standards shall conform to those of the American Association of Nurserymen, Inc., as published in "American Standard for Nursery Stock", 1959 Edition, with all current revisions unless otherwise specified.
3. The caliper of trees shall be measured six (6) inches above the surface of the ground.
4. Measurements on all trees and shrubs shall be taken with the branches in a normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch or root tip to tip. No trees which have had their leaders cut or so damaged that cutting is necessary, will be accepted

C. Plant Schedules

1. Each bidder shall investigate sources of supply and satisfy himself that he can supply all of the plants mentioned in the planting lists in size, variety, and quantity noted and specified before submitting his bid. Failure to take this precaution will not relieve the successful bidder from his responsibility as Contractor to furnish and install all plant material in strict accordance with the contract requirements without additional expense to the County.

D. Quality

1. All plants shall be fresh and vigorous, and of normal habit and growth, free of disease, insects, or insect eggs, and larvae, weeds or weed seed. No heeled-in plants from cold storage shall be accepted except on approval by the Landscape Architect prior to planting.

Handling/Protection

A. All precautions customary in good trade practice shall be taken in preparing plants for planting and workmanship that fails to meet the highest standards will be rejected. All balled and burlapped plants shall have firm and natural balls of earth. No plant shall be planted if the ball is cracked or broken either before or during the process of planting. Loose, broken or manufactured balls will be rejected.

B. All plant materials in cans shall have been established in that can for a period of time not less than one (1) year, and shall be shown to be in a sound, healthy and vigorous state of growth. Plants not in such condition shall be rejected.

C. All plant material shall be planted immediately upon arrival on the premises if possible. If planting cannot be done immediately, the roots of bare root stock shall be protected from the sun and kept in a moist condition until the time of planting. Such protection may be provided by laying the plants on the north side of the building and covering the roots with wet straw.

D. If it is anticipated that planting will not be done for more than twenty-four (24) hours after the arrival of plants upon the premises, the bare root and ball and burlap stock shall be heeled-in on the north side of a building and all roots completely covered with dirt which shall be wetted down frequently. Care will be take in the handling of all ball and burlap materials so that the earth around the roots is disturbed as little as possible.

Planting

A. Plants shall be generally located as indicated by the drawing. The contractor shall stake out the location of all plants and planting areas with identified plant stakes, and no excavation shall commence until such locations have been approved by the Landscape Architect. In the event that underground construction work or obstructions are encountered during excavation of the holes, alternate locations will be assigned and approved by the Landscape Architect.

B. No planting shall be done in frozen soil or during unfavorable weather conditions subject to the approval of the Landscape Architect or his representative.

C. All concrete work, sprinkling systems, finished grading, are to be completed and approved by the Landscape Architect or his representative before any planting of the specified plant materials is begun. No planting will be done without direct supervision of the Landscape Architect, or his representative.

D. All trees and shrubs shall be planted in pits as detailed in the planting details contained herein or as noted on the drawings. Tree and shrub pits in lawn areas shall be circular in outline, with a diameter at least two (2) feet greater than the diameter of the ball of each plant to be planted.

E. Plants in cans shall be planted in pits having a diameter at least two (2) feet greater than the diameter of the can from which the plant is taken. Bare root trees and shrubs shall be planted in pits having a diameter at least two (2) feet greater than the root system. All plant pits shall be at least one (1) foot deeper than the root system or root ball.

F. All subsoil excavated from tree and shrub pits shall be removed from the site, and the ground for one (1) foot below the bottom of the hole for trees and large evergreens will be broken up with a pick or other similar tool to facilitate penetration of the new roots.

G. The plant shall be set vertically upon a twelve (12") inch mound of backfill soil mixture, backfilled carefully and firmly worked and tamped under and around the root system or ball to fill all voids. When partially backfilled and compacted the burlap shall be removed from the sides of the balls and the tops cut or adjusted to prevent the formation of air pockets, no burlap shall be pulled from under the root balls of the plants. The plants shall then be watered with a hose to completely soak the roots and backfilled with soil mixture.

H. The holes will then be completely backfilled and tamped well. A shallow basin or rain cup will be left around each plant. This basin will be equal in diameter to that of the original planting hole. Each plant will be placed in an individual hole. Holes which settle will be promptly filled with additional soil mixture at no additional expense to the County.

I. A minimum of six (6) inches of topsoil is required in all planting beds. The contractor will first use topsoil stockpiled on the site and then furnish all topsoil as needed. Any topsoil furnished must meet the specifications stated in "General Materials" as topsoil, specifications.

J. No trees will be planted closer than six (6) feet from any concrete walk or other paved surface.

Staking

A. All trees including evergreen trees shall be either staked or guyed.

B. Trees in containers shall be staked as follows:

1. Two (2), two (2) inch by two (2) inch stakes eight (8) feet in length will be used to support each tree planted under this contract unless otherwise indicated. Tree ties shall be made of five-eighths (5/8) inch rubber hose with a number ten (10) gauge wire inserted through the hose and nailed to the stakes by eight-penny nails, see the detailed sheet accompanying these specifications. Each stake will be located six (6) to eight (8) inches away from the trunk and each opposing the other to provide maximum support to the trunk. The stakes will be driven into the hole after the tree has been set-in, but before backfilling begins so as to avoid damage to the roots.

C. Balled and burlapped trees and all evergreen trees shall be guyed as follows:

1. All trees shall be guyed at points of branching with three (3) guy wires spaced equally around and outside the perimeter of the ball. Buy wires shall be covered with rubber hose or the bark otherwise protected by approved materials at points of contact. Each guy shall be positioned below crotches and fastened to a 2"x4"x 20" deadman, 12" below grade. One 6" turnbuckle shall be provided for each guy.

Watering

A. All plants shall be thoroughly watered immediately after planting; this shall mean full and thorough saturation of all backfill in the pits and beds during the same day of planting. Water shall be applied only by open end hose at very low pressure to avoid air pockets, injury or washing. When planted, watered, and fully settled the plants shall be vertical and the stand shall be slightly below the stand in the nursery.

1. The Contractor shall hand water newly planted trees, twice a week for eight weeks.
2. A minimum of five (5) gallons per tree per watering required. Amount may vary pending seasonal rainfall.

Pruning

A. All plants shall be neatly pruned, after planting and inspection by the Landscape Architect, in accordance with the best horticultural practice. Broken or badly bruised branches shall be removed with a clean cut. Each plant shall be pruned to preserve its natural form and character and in a manner appropriate to its particular requirements. In general, at least one fourth (114) of the wood of deciduous shrubs shall be removed by thinning or shortening branches. Trees shall not be end pruned, but laterally thinned out to preserve the natural character of the tree. All pruning shall be done by skilled workers and with sharp tools. Pruning cuts over one-half (1/2) inch in diameter shall be painted with the tree pain approved by the Landscape Architect.

Guarantee Period

A. At the conclusion of the guarantee period and prior to final inspection by the Landscape Architect, of all planting, the Contractor shall be responsible for the removal of all tree stakes, and tree guys.

1. Stakes and guys shall be removed by first cutting the ties securing the tree to stakes or guys and secondly pulling stakes or guys out of the ground.
2. Stakes shall not be broken off above, at, or below ground levels but removed completely.

B. Plants which die or become unhealthy from any cause or appear to be in a badly impaired condition at any time during the guarantee period shall be removed promptly and replaced, and any plants that settle below or rise above the desired finished grades shall be reset at the proper grades.

1. All replacements shall be plants of the same kind, s size, and quality as originally specified in the "plant list" and they shall be furnished, planted, guyed and maintained as specified herein at no additional cost.

C. The Contractor will not be responsible for plants destroyed or lost due to occupancy of the project or vandalism on the part of others.

D. At the conclusion of the guarantee period a final inspection of all planting included in this contract will be made by the Landscape Architect. At that time any plant found to be not in a healthy growing condition, broken, damaged, or otherwise in such condition as to impair or destroy the symmetrical or other desired appearance as determined by the Landscape Architect shall be noted. Plants so noted shall be removed immediately from the site by the Contractor and replaced by him, as specified under this section with plants or like kind and size in the manner previously specified for the original planting without extra compensation.

COMMON WORK RESULTS FOR UTILITIES – (SECTION 330500)

SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Dielectric fittings.
3. Sleeves.
4. Identification devices.
5. Grout.
6. Piping system common requirements.
7. Equipment installation common requirements.
8. Concrete bases.
9. Metal supports and anchorages.

HIGH PERFORMANCE DESIGN

Stormwater Treatment Structure: Refer to "HIGH PERFORMANCE DESIGN REQUIREMENTS – (SECTION 018113)" for High Performance Design Criteria.

DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

B. Welding certificates.

QUALITY ASSURANCE

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

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Hart Industries, International, Inc.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Wilkins Div.

3. Description: Factory fabricated, union, NPS 2 and smaller.

   a. Pressure Rating: **150 psig minimum** at 180 deg F .
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Water Technologies, Inc.

3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

   a. Pressure Rating: **175 psig minimum**
   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Couplings:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Calpico, Inc.
    b. Lochinvar Corporation.

3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.

    a. Pressure Rating: 300 psig at 225 deg F .
    b. End Connections: Threaded.

E. Dielectric Nipples:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Perfection Corporation.
    b. Precision Plumbing Products, Inc.
    c. Victaulic Company.

3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

    a. Pressure Rating: 300 psig at 225 deg F .
    b. End Connections: Threaded or grooved.

SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 22 Section "Common Work Results for Plumbing."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

B. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

D. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

F. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

H. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick, polished brass or aluminum.
2. Material: 0.0375-inch- thick stainless steel.
3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.

5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

I. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

J. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness**:** 1/8 inch, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

K. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 and Larger: Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 and Larger: Dielectric nipples.

PIPING INSTALLATION

A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

    a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
    b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference

with other installations, while still maintaining an efficient and compact installation. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
2. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete.

ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

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

GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

STORM UTILITY DRAINAGE PIPING – (SECTION 334100)

SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Cleanouts.
2. Precast concrete manholes.

PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water

SUBMITTALS

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

B. Shop Drawings: For manholes and catch basins. Include plans, elevations, sections, details, and manhole frames and covers and catch basin frames and grates.

C. Coordination Drawings: Show pipe sizes, locations, and elevations.

D. Field quality-control test reports. Product Data: For each type of product indicated.

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.

PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, **Service and Extra-Heavy classes**

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
2. Corrugated PE Pipe and Fittings NPS 12 and Larger: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
3. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM F 949, PVC with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T- **1** wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Company; a division of MCP Industries, Inc.
e. NDS Inc.
f. Plastic Oddities, Inc.

D. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg.
b. Dallas Specialty & Mfg. Co.
c. Mission Rubber Company; a division of MCP Industries, Inc.

E. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

1. Manufacturers:

a. Fernco Inc.
b. Logan Clay Products Company (The).
c. Mission Rubber Company; a division of MCP Industries, Inc.

CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

a. Josam Company.
b. MIFAB Manufacturing Inc.
c. Smith, Jay R. Mfg. Co.
d. Wade Div.; Tyler Pipe.
e. Watts Industries, Inc.
f. Watts Industries, Inc.; Enpoco, Inc. Div.
g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): **Heavy** duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated or required by Authority having jurisdiction..

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps or FRP ladder wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches**.**
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48, Class 35 gray iron, unless otherwise indicated.

CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch- diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. **Unshielded** flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Gravity-Flow, Nonpressure Sewer Piping: Use **any of** the following pipe materials for each size range:

1. NPS 3 to NPS 6 : Hub-and-spigot, E**xtra-Heavy** class, cast-iron soil pipe and fittings; **gaskets; and gasketed** joints.
2. NPS 3 to NPS 6: Corrugated PE drainage pipe and fittings, soiltight couplings, and coupled joints.
3. NPS 3 to NPS 6 : PVC sewer pipe and fittings, gaskets, and gasketed joints.
4. NPS 8 to NPS 15: Hub-and-spigot, **Extra-Heavy** class, cast-iron soil pipe and fittings; **gaskets; and gasketed** joints.
5. NPS 8 to NPS 15: Corrugated PE drainage pipe and fittings, soiltight couplings, and coupled joints.
6. NPS 8 to NPS 15: PVC sewer pipe and fittings, gaskets, and gasketed joints.
7. NPS 18 to NPS 30: Corrugated PE pipe and fittings, soiltight couplings, and coupled joints.

8. NPS 18 to NPS 30: PVC sewer pipe and fittings, gaskets, and gasketed joints.

PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 24-inch minimum cover.
4. Install piping below frost line.
5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, **18 by 18 by 12 inches** deep. Set with tops **1 inch** above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops **3 inches** above finished surface elsewhere, unless otherwise indicated.

CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:

      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.

   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

      a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

APPENDIX

ARCHITECTS AND ENGINEERS

DESIGN AND CONSTRUCTION

STANDARDS AND PROCEDURES

DRAWINGS • SPECIFICAIONS • CONTRACT DOCUMENTS

SALT LAKE COUNTY

FACILITIES MANAGEMENT DIVISION
2001 South State Street S3100
Salt Lake City, UT 84190-3300
(385) 468-2875
fax (385) 468-3466

APPENDIX

FINAL DOCUMENT • FEBRUARY 10, 2015

APPENDIX Cx

(01.31.07)

PROJECT COMMISSIONING REQUIREMENTS

These sections are to be added by the owner on the form provided in the appendix for "Project" This form is to be included in the design team's programming documents, noted as to which sections are required for subject project, by the County project manager.

Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections. First five and last four subparagraphs are not yet available in MASTERSPEC but should be written and included if total building commissioning is implemented.

- Division 01 Section "Facilities Exterior Enclosure Commissioning" for commissioning process activities for building exterior enclosure, roof, and foundation systems, assemblies, equipment, and components.

- Division 01 Section "Interiors Commissioning" for commissioning process activities for building interiors construction, stairways, and finish systems and assemblies.

- Division 14 Section "Commissioning of Conveying Equipment" for commissioning process activities for conveying systems, assemblies, equipment, and components.

- Division 21 Section "Commissioning of Fire Suppression" for commissioning process activities for fire-suppression systems, assemblies, equipment, and components.

- Division 22 Section "Commissioning of Plumbing" for commissioning process activities for plumbing systems, assemblies, equipment, and components.

- Division 23 Section "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.

- Division 25 Section "Commissioning of Integrated Automation" for commissioning process activities for integrated automation systems, assemblies, equipment, and components.

- Division 26 Section "Commissioning of Electrical Systems" for commissioning process activities for electrical systems, assemblies, equipment, and components.

- Division 27 Section "Commissioning of Communications" for commissioning process activities for communications systems, assemblies, equipment, and components.

- Division 28 Section "Commissioning of Electronic Safety and Security" for commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.

Salt Lake County

INVITATION FOR BIDS

Quote:

Project:

Location:

Pre-bid meeting, date and time:

Pre-bid meeting, location:

Bid due date and time:

Bid Delivery Address: Salt Lake County Office of Contracts and Procurement
2001 South State Street, Room N4500
Salt Lake City, UT 84190

Plan holder list: (801)

Design/technical questions: **A**

Project Manager:

Contract questions: Sherry Craig (801) 468-2300 or Pat Iverson (801) 468-2322

Calendar days to complete project: **0**

Liquidated damages: $__ per calendar day

Bonding limits: $,000 to $,000

MINIMUM License Classifications: __ **Contractor**

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INSTRUCTIONS TO BIDDERS

1.1.00 General Information

01. Sealed bids for the award of a contract for furnishing the materials and labor described below shall be delivered to the Office of Salt Lake County Contracts & Procurement, 2001 South State, Room #N4500, Salt Lake City, Utah 84190-3100, on or before _____ (a.m.) (p.m.) on the _____ day of _____, 200____, at which time they will be publicly opened and read.

. 02 The Project covered by this invitation to Bid is identified as _____ _____ and is located at _____ _____.

.03 A general description of the labor and material to be furnished is described in the attached specifications.

.04 All bids are subject to the following Project documents:

(a) Instruction to Bidders, including all forms mentioned therein.
(b) Agreement Form.
(c) General Conditions.
(d) Plans and Specifications now on file at the offices of ___ and identified as __.
(e) Such other provisions, representations, certifications, and specifications as are attached hereto or incorporated in any of the documents identified above.
(f) VENDOR OATH.

.05 Any explanation desired by a Bidder regarding the meaning or interpretation of the Project documents must be requested in writing and with sufficient time available for a reply to reach all bidders before the date and time of bid opening. Oral explanations or instructions concerning the Project documents given before bid opening or the date of the award of the contract will not be binding upon Salt Lake County. Any information given to a prospective bidder concerning the Project which is the subject of this Invitation for Bids will be furnished to all prospective bidders as an addendum or addenda to the Invitation for Bids, if such information is deemed necessary by County in the preparation of bids or if the lack of such information is deemed by County to be prejudicial to uninformed bidders.

.06 Bidders requesting a copy of the plans and specifications will be asked to identify their company on a plan holder list. County will notify all identified prospective bidders of any addenda to the Project documents. All bidders must verify in their bid that all addenda were received from the plans holder. Failure to so verify shall render the bid non-responsive, unless the addendum(a) for which receipt is not verified concerns work that is not included as part of the awarded contract.

.07 Bidders are invited to be present at the bid opening.

END OF PARAGRAPH 1.1

1.1.00 General Information

01. Sealed bids for the award of a contract for furnishing the materials and labor described below shall be delivered to the Office of Salt Lake County Contracts & Procurement, 2001 South State, Room #N4500, Salt Lake City, Utah 84190-3100, on or before _____ (a.m.) (p.m.) on the _____ day of _____, 200____, at which time they will be publicly opened and read.

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(c) General Conditions.
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.07 Bidders are invited to be present at the bid opening.

END OF PARAGRAPH 1.1

1.2.00 PREPARATION OF BID

.01 Attached herewith are copies of forms identified as OFFER, BIDDING SCHEDULE, BID BOND, CERTIFICATE OF NON-COLLUSION, and CERTIFICATE OF NON-DISCRIMINATION, and NOTICE – POLITICAL CONTRIBUTION.

.02 Each of the forms identified in paragraph .01 above are included in the bid package. However, bidders may substitute a cashiers check as set out herein in place of the Bid Bond. These forms must be removed from the bid book and placed in a separate sealed envelope. Do not include the bid book in the envelope.

.03 All blank spaces on the bid schedule must be filled in correctly, with required signatures and notarized where designated

.04 On the bidding schedule, the prices shall be written in ink or typed, both in words and numerals. In cases of discrepancy, the amount written or typed in words shall be deemed to be the correct amount of the bid.

.05 Each bid must be accompanied by a bid security bond issued by a surety company authorized to do business in Utah or a cashiers check drawn on a bank, or branch thereof, located in Utah. Penal sum of the bond, or the amount of the cashiers check shall be 5% of the amount bid for the work of the Project. Bidder agrees that said amount shall be forfeited to County as liquidated damages if Bidder shall fail to execute a contract and furnish the required payment and performance bonds within ten days after County accepts Bidder's bid and awards the contract to Bidder. Failure to include bid bond or cashiers check as security for acceptance of award of the contract shall render a bid non-responsive. Cashiers checks must name Salt Lake County as payee.

.06 If the bid is submitted by a joint venture, the bid must be signed by an authorized representative of each joint venture. When a bid will be submitted by a joint venture, the proposed joint venture must be pre-approved by Salt Lake County. A letter requesting permission to bid as a joint venture must be submitted to Salt Lake County at least two (2) working days prior to bid opening. The letter shall be signed by an authorized representative of each joint venture designating one of the joint venturers as a contact. Permission to submit a bid as a joint venture must be issued prior to bid opening in order for any bid from a joint venture to be considered by Salt Lake County. The performance bond and payment bond will name the joint venture AND each of the joint venturers.

.07 The place of business of every bidder must be given after his signature, and must be written in full.

.08 Anyone signing a bid as the agent of another must file with the bid legal evidence of his/her authority to do so.

.09 The bid submitted must not contain any erasures, interlineations or other corrections unless each such correction is suitably authenticated, by affixing in the margin immediately opposite the correction the hand-written initials or surnames of the person or persons signing the bid, or the person authorized to submit the bid.

.10 All blank spaces in the bid form must be filled in, but no change shall be made in the phraseology of the bid form, nor shall any additions be made to the language of the bid form.

.11 Bids must be enclosed in a sealed envelope, with the project name and date and time of bid opening on the front of the envelope, addressed to Salt Lake County Contracts and Procurement, 2001 South State Street, Room #N4500, Salt Lake City, Utah 84190-3100, and delivered or mailed early enough to be at the bid opening as set out herein. Salt Lake County is not obligated to open any bids delivered after the time set for the bid opening regardless of the reason for the late delivery.

.12 Bidders are advised that sales tax is a part of bidder's responsibility, and should be taken into account while preparing their bids. The fact that the County is a governmental entity does not exempt contractors from sales tax upon the project which is the subject of this request for bids.

END OF PARAGRAPH 1.2

1.3.00 RULES GOVERNING BID

.01 Any bid received after the schedule closing time for receipt of bids will be kept on file, unopened.

.02 Bidders are advised that they must inform themselves of the character of work to be performed under this contract. Each bidder shall visit the site of the proposed work and fully acquaint him/herself with the conditions relating to the construction and labor so that he may fully understand the facilities, difficulties, and restrictions attending the execution of the work under the Agreement. Bidders shall thoroughly examine and be familiar with the contract terms, plans and the specifications. The failure or omission of any bidder to receive or examine any form, instrument, addendum or other document or to visit the site and acquaint him/herself with the conditions there existing shall in no wise relieve any bidder from the obligations with respect to his/her bid or to the Agreement. The submission of a bid shall be taken as prima facie evidence of compliance with this section.

.03 Changes in or additions to the bid form, recapitulations of the work bid upon, alternative bids, or any other modification of the bid form which is not specifically called for in the Project documents may result in the County's rejection of the bid as not being responsive to the invitation. After Bidder has submitted its bid to County, no oral or telephonic modifications to the bid will be considered. A telegraphic modification will be considered only if the postmark evidences that the telegram was sent early enough to arrive prior to the opening of bids. Submitted bids will be returned in person to bidders who so request prior to the time for bid opening. A substitute bid or telegraphic modification to a previously submitted bid will be accepted in all cases where the substitute bid, or telegraphic modification, is actually received by the Office of Contracts and Procurement prior to the time for bid opening.

.04 The County reserves the right to reject all bids, any non-responsive bid, and to waive any minor informality in any bid received.

.05 Assignment of an awarded contract, or of interests in said contract, are prohibited.

.06 If a bidder to whom an award of contract is made fails or refuses to execute said contract as herein provided, or to conform to any of the stipulated requirements in connection therewith, liquidated damages in the form of the bid bond shall be paid to Salt Lake County. The County will assume ownership of a bid bond in the form of a cashiers check, or will exercise its right to the penal sum of a bid bond written upon a surety. The award will be annulled, and at the discretion of the County, an award may be made to another bidder. The check or bid bond of a bidder to whom a contract has been awarded will be returned to said bidder after all the acts, for the performance of which said bid bond or check is required, have been fully performed by the successful bidder. The bid bonds/cashiers checks of all bidders will be held until the contract is finally executed or all bids are rejected. The liability of Salt Lake County in connection with cashiers checks which are submitted as the bid security shall be limited to the return of the checks to the submitter thereof.

.07 Bidders' offers shall remain open for 60 calendar days after bid opening. A bid which shortens this time will be rejected as non-responsive.

.08 Plans and specifications are available to bidders without a deposit or plan fee. However, unsuccessful bidders must return the specifications and drawings to the plan holder's office within five working days after award of the contract to the successful bidder.

.09 Reasonable accommodations (including auxiliary communicative aids and services) for individuals with disabilities may be provided upon receipt of a request with~~in~~ three working days notice. For assistance, please call V/468-2351; TDD/468-3600.

.10 Conflict of Interest: If applicable, disclosures must be made as required by the Utah Public Officers' and Employees' Ethics Act, Title 67, Chapter 16, Utah Code Annotated (1953), as amended; the County Officers and Employees Disclosure Act, Title 17, Chapter 16a, Utah Code Annotated (1953), as amended; and Sections 2.80.100 and 3.16.120, Salt Lake County Code of Ordinances, 1986. If required disclosures are not included in bid documents, County shall have the right to reject the bid as non-responsive; or, if an award of contract is made to a bidder who failed to make disclosures as required by said laws, County shall have the right to cancel said contract without recourse by the bidder who failed to make the required disclosures.

END OF PARAGRAPH 1.3

1.4.00 LICENSE REQUIREMENTS

.01 All bidders shall be properly licensed by the Utah State Department of Commerce, Occupational and Professional License Division, to do the type of work specified by the plans and specifications for the Project for which bids are being sought by this Invitation for Bids in accordance with current Utah State Law. Upon County's request, bidders shall present satisfactory evidence that they are fully prepared with the necessary finances, equipment, materials and personnel and that they have been regularly engaged in the type of work so specified, to the full satisfaction of the County. Bids received from those not qualified, at the time of bid opening, to submit bids under Utah law shall be rejected.

.02 By submitting a bid pursuant to this Invitation to Bid, bidders shall be presumed to know the requirements for licensing for the work of the Project under Utah law, and by said submission expressly represents to County that said bidder is in compliance with all licensing requirements.

.03 Bidders must hold, at a minimum, a _____ license. All subcontractors must hold the proper license for the portion of the work of the Project they are performing, and at the request of the COUNTY, provide any and all information required to substantiate their proper licensure.

END OF PARAGRAPH 1.4

1.5.00 FORMS TO BE SUBMITTED WITH BID

The following forms are included in this Invitation for Bids. Bids must be submitted on said forms and included with bids. Failure to use and include said forms will render bids non-responsive.

(a) Offer

(b) Bidding Schedule

(c) Bid Bond

(d) Certificate of Non-Collusion

(e) Certificate of Non-Discrimination.

(f) NOTICE – POLITICAL CONTRIBUTION

END OF PARAGRAPH 1.5

1.6.00 DOCUMENTS INCLUDED IN INVITATION FOR BIDS WHICH WILL BECOME A PART OF THE CONTRACT

The following documents will be included as part of the contract between the successful bidder and the County: Modification of, or refusal to accept the Agreement ((a), below), Bidding Schedule ((b), below), and General Conditions ((e), below) will result in bid being rejected as non-responsive, or trigger forfeiture of the low, responsive bidder's bid bond. Bidders may submit payment and performance bonds on forms adopted by the American Institute of Architects (AIA), or on forms provided by surety(s); however, such bonds must be written on a surety company authorized to do business in the State of Utah, and be acceptable to County after review by the Office of the District Attorney.

(a) Agreement

(b) Bidding Schedule

(c) Performance Bond

(d) Payment Bond

(e) General Conditions.

END OF PARAGRAPH 1.6

1.7.00 OFFER FORM

_____, as a Contractor

authorized to do business in the State of Utah, proposes to perform the work identified as:

_____

_____ PROJECT NUMBER _____

The undersigned hereby declares, as bidder, that bidder has personally examined the site of the proposed Project, that the only persons or parties interested in this bid are those named herein, and that this bid is made without any connection with any other person or business entity making a bid for construction of the same Project. Bidder has read the Invitation for Bids, including Instructions to Bidders, General Conditions, Agreement Form, Payment and Performance Bond Forms, Specifications, Plans and Drawings, and any Addendum or Addenda thereto. Bidder agrees to all of the terms and conditions contained in said documents. The undersigned also proposes and agrees that if its bid, as submitted in the attached schedule, is accepted by County, bidder will contract in the form specified in the Invitation for Bids, perform all the work specified in the Project documents and complete the same within the time specified in the Invitation for Bids. Bidder will furnish the required payment and performance bonds within ten days after the County has awarded and signed the Agreement. Bidder will accept in full payment for its satisfactory completion of the Project, the prices named in the Bid Schedule. Said prices are to include and cover the furnishing of all material, labor, tools, equipment and all other factors necessary to complete the entire work in a proper and workmanlike manner according to the plans identified in the Invitation for Bids and upon the terms and conditions and in the manner set forth in the Invitation for Bids, and under penalty of the bonds required by the Invitation for Bids, and to the full satisfaction and acceptance by the County.

The following is the name and place of the surety company, which will sign the payment and performance bonds, each in the amount of one hundred percent (100%) of the bid, as surety if the work is awarded to the undersigned:

_____

Of _____

Local Agent _____

Address _____

Phone number _____

It is hereby agreed that the County has the right to reject this bid, or to award the above-described work to the undersigned at the prices set forth in the Bid Schedule. If the bid is rejected then the cashiers check for five percent (5%) of the total bid amount, if a bid bond is not included, which is made payable to the Treasurer of Salt Lake County, shall be returned to the undersigned as provided in Instruction to Bidders. If the bid is accepted and a contract is awarded to the undersigned, and the undersigned shall fail to enter into said contract in the form and terms set out in the Invitation for Bids within ten days after the award shall have been made, then the said cashiers check shall be cashed and the amount thereof paid into the Treasury of Salt Lake County as liquidated damages for the failure of the undersigned to comply with the terms of this Invitation for bids.

Name of Corporation Submitting Bid _____

State of Registration

_____

Date of Registration in Utah _____

Utah Entity Number_____

Name of President_____

Name of Secretary_____

Name of Partnership Submitting Bid _____

Names of Partners _____

Date of Registration in Utah _____

Utah Entity Number _____

Name of Other Type of Entity Submitting Bid_____

Owner'sName_____

Date of Registration in Utah _____

Utah Entity Number_____

Federal Tax Identification Number (Required of each type of business entity)_____

CERTIFICATION OF REGISTRATION

This is to certify that I or we _____, the undersigned, am/are a Registered Contractor(s) in the State of Utah, and that I / We hold License No. _____, as issued by the Utah State Department of Commerce, Occupational and Profession License Division on _____ (date), licensing me or us to practice as a _____ (type of work) Contractor(s) in said State.

Contractor_____

By_____

Title_____

END OF PARAGRAPH 1.7 (OFFER FORM)

1.8.00 BIDDING SCHEDULE - PAGE 1 AGENCY TO REPLACE PAGE

QUOTE #_____

A. PROJECT: _____

BASE BID $_____(Items 1- _____)

Amount in words_____

_____

ALTERNATE NO. 1 $_____

Amount in words _____

ALTERNATE NO. 2 $_____

Amount in words _____

ALTERNATE NO. 3 $_____

Amount in words _____

BID AWARD COMPLIANCE INFORMATION:

CONTRACT WILL BE AWARDED TO THE LOWEST RESPONSIVE, RESPONSIBLE BIDDER ON THE BASE BID, PLUS ALTERNATES. (THE COUNTY RESERVES THE RIGHT TO AWARD ANY OR ALL ALTERNATES, HOWEVER, THE COMBINED TOTAL MUST STILL BE THE LOWEST COMPARATIVE TOTAL BID.)

I (we) have received, if any, addenda_____

B. UNIT PRICE BREAKDOWN (SEE PAGE 2)

Signature _____

Print name _____

Title _____

Company Name_____

Address _____

City_____State_____ Zip Code_____

Phone ( )_____ Fax ( )_____

END OF PARAGRAPH 1.8 (BIDDING SCHEDULE)

1.9.00 BID BOND FORM, OR ACCEPTABLE FORM IN LIEU THEREOF

1.9.01 Procedure:

A. The Bid Bond may be submitted on AIA Document A310, as published by the American Institute of Architects, 1736 N.Y. Ave. N.W., Washington, D.C. 20006. If said form is not reasonably available, bid security may be submitted on another form, provided the same is acceptable to the County, and approval of said form is obtained by Bidder prior to submitting Bid.

B. The Bid Bond may also be submitted utilizing the form set forth below:

KNOW ALL MEN BY THESE PRESENTS, that we, _____ (Bidder) _____, as Principal, and _____ _____, as Surety, are held and firmly bound unto Salt Lake County, State of Utah, hereinafter called the COUNTY, in the penal sum of _____ _____ dollars, lawful money of the United States, for the payment of which sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that:

Whereas, the Principal has submitted its bid, dated _____, 200_____, for the construction of that certain Project identified as Project Number _____, and described as "_____ _____"; and,

Whereas, the penal sum set forth above is _____ percent (_____ %) [NOTE: Must be at least five (5) percent] of the total amount of the bid of Principal submitted to COUNTY;

NOW, THEREFORE, if the Principal shall not withdraw said bid within the period specified in said bid after the opening of the same, or, if no period be specified, within sixty (60) days after said opening, and shall within the period specified therefore, or if no period be specified, within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with COUNTY in accordance with Principal's bid, as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract, or in the event of Principal's withdrawal of said bid within the period specified, or Principal's failure to enter into such contract and give such bond within the time specified, or if the Principal shall pay COUNTY the difference between the amount specified in Principal's bid and the amount for which COUNTY may procure the required work and/or supplies if the latter

amount be in excess of the former, then the Principal's and Surety's obligation hereunder shall be void and of no effect; otherwise said obligation to remain in full force and effect.

IN WITNESS WHEREOF, the above-bounded parties execute this instrument under their respective seals this _____ day of _____, 200_____ .

_____
Principal's Signature

_____
Witness (if an individual)

_____
Witness (If an individual)

CERTIFICATE AS TO CORPORATE PRINCIPAL

STATE OF _____)
: ss.
COUNTY OF _____)

I certify that I am the _____of the corporation named as Principal in the within bond; that _____ is the _____ _____ of said corporation and signed the said bond on behalf of the Principal, and that said bond was duly signed, sealed and attested for and in behalf of said corporation by authority of its governing body.

Corporate Seal

_____
Signature of Secretary

Subscribed and sworn to before me, a notary public authorized to administer oaths, this _____ day of _____, 200___.

_____
NOTARY PUBLIC

Residing at:
Commission expires:

_____
Surety Company Name

_____
Address

_____

_____

_____
Surety Telephone Number

_____
Signature of Surety

_____
Title

CERTIFICATE AS TO SURETY

STATE OF _____)
: ss.
COUNTY OF _____)

I certify that I am the _____of the corporation named as Surety in the within bond; that _____ is the _____ of said corporation and signed the said bond on behalf of the Surety, and that said bond was duly signed, sealed and attested for and in behalf of said corporation by authority of its governing body.

Corporate Seal

_____
Signature of Secretary

Subscribed and sworn to before me, a notary public authorized to administer oaths, this _____ day of _____, 200___.

_____
NOTARY PUBLIC

Residing at:
Commission expires:

END OF PARAGRAPH 1.09 (BID BOND FORM)

1.10.00 CERTIFICATE OF NON-COLLUSION

PROJECT NAME _____

QUOTE NO. _____

A F F I D A V I T

STATE OF UTAH)
: ss.
COUNTY OF _____)

The undersigned, being of lawful age and being first duly sworn, deposes and says:

As a condition precedent to receipt of the award of the contract for construction of the Salt Lake County Project identified above, I,

_____
(owner – partner – officer or agent)

of _____
(firm)

do solemnly swear that neither I, nor to the best of my knowledge, any member or members of my firm or company have either directly or indirectly restrained free and competitive bidding on this project by entering into any agreement, participating in any collusion, scheme, or otherwise taking any action in violation of law or regulation, or doing any act otherwise unauthorized by Salt Lake County.

Contractor_____

By _____

Title_____

Subscribed and sworn to before me this _____ day of _____, 200____.

Seal:

_____
Notary Public

Residing at:
My Commission expires:

END OF PARAGRAPH 1.10 (CERTIFICATE OF NON-COLLUSION)

1.11.00 CERTIFICATE OF NON-DISCRIMINATION

PROJECT NAME _____

QUOTE NO. _____

AFFIDAVIT

STATE OF UTAH)
: ss.
COUNTY OF _____)

The Undersigned, being of lawful age and being first duly sworn, deposes and says:

That as a condition precedent to the award of the Salt lake County Project as above captioned, I

_____ , of _____
(owner – partner – officer or delegate) (firm)

do solemnly swear that neither I, nor to the best of my knowledge any member or members of my firm or company will discriminate against any employee of the above-named firm or applicant for employment by said firm because of race, religion, color, sex, ancestry, age, handicap or national origin. I will take affirmative action to assure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, ancestry, age, handicap or national origin. Such action shall include, but not be limited to the following: hiring, upgrading, demotion, transfer, recruitment or recruitment advertising, layoffs or terminations, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

Further, I will, in all solicitations or advertisements for employment placed by or on behalf of myself and my company, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, ancestry, age, handicap or national origin.

Further, I will send to each labor union or representative of workers with which I have a collective bargaining agreement or other contract or understanding, a notice, if provided by the County, advising the labor union or workers representative of my commitments under paragraph 3.9.01 of the General Conditions and shall post copies of said notice in conspicuous places available to employees and applicants for employment by me or by my company.

In the event of my noncompliance with the non-discrimination requirements of this Certificate, the contract may be terminated as set forth in the clause entitled Termination for Default.

Contractor_____

By

_____

Title

_____

Subscribed and sworn to before me this _____ day of _____, 200___.

_____
Notary Public

Residing at:
My Commission Expires:

END OF PARAGRAPH 1.11 (CERTIFICATEOF NON-DISCRIMINATION)

SALT LAKE COUNTY

Political Contribution

NOTICE TO ALL BIDDERS, VENDORS, CONSULTANTS, AND CONTRACTORS REGARDING CAMPAIGN CONTRIBUTIONS:

Campaign Contributions Ordinance - Salt Lake County campaign contributions ordinance limits a "contractor" from making campaign contributions to county candidates. For purposes of the campaign finance disclosure ordinance, a "contractor" is defined as "any person, business, corporation, or other entity that executes a written agreement with the County for the acquisition or management of goods, services, or property, or the disposal of surplus goods, whether personal, real, or intangible, including all amendments, extensions, or addendums to the existing contract."

Limitation on Contributions by Contractors - Any person, business, corporation or other entity that is a contractor with the County is prohibited from making a total of contributions that exceed $100.00 to any candidate for county office during the term of the contract and during a single election cycle as defined in the ordinance. For purposes of the ordinance, a person or entity shall be considered a contractor and doing business with the County if it is engaged in any contract with the County on the date of the contribution or it has contracted with the County at any time during a one-year period prior to the date of the contribution. Any person, business, corporation or other entity making contributions of $100.00 or more to any county candidate shall be prohibited from entering into a contract for at least one year after the date the contribution was made. This limitation on campaign contributions applies only to contracts in excess of $10,000 and does not apply to contracts entered into by the County pursuant to existing statewide contracts, small cost purchases, and expedited contracts when the County Council waives the requirements of the campaign finance disclosure ordinance as to that particular expedited contract.

Penalties – (1) If a contribution or contributions are received from a "contractor" and without a candidate's knowledge of a violation of the County's campaign finance disclosure ordinance, the candidate may return the contribution without penalty if the contribution is returned within ten (10) days after the candidate knows of the violation, by way of notification from the County Clerk.

(2) If any contribution is made in violation of the prohibition on contributions by contractors, any existing county contract with the contractor may be voided, at the discretion of the county mayor or council. Any contractor who knowingly makes a contribution or contributions in violation of this provision shall be guilty of a class B misdemeanor.

(3) If any contribution is made in violation of the prohibition on contributions by contractors, the official to whom that contribution is made must return the contribution. Any elected official who knowingly takes a contribution or contributions in violation of the campaign finance disclosure ordinance and does not return the contribution will be guilty of a class B misdemeanor.

ACKNOWLEDGEMENT_____

SIGNATURE BY CONTRACTOR
INCLUDE IN BID PACKET

CONTRACTOR'S RELEASE AND WAIVER OF LIEN

OWNER: **DATE:**

PROJECT: **PROJECT NO:**

CONTRACTOR: **CONTRACT NO:**

CONTRACT VALUE: **$**

TOTAL PAYMENTS RECEIVED: **$**

TOTAL AMOUNT DUE:

Contractor, in consideration of receipt of payment in the above stated amount, does hereby remise, release and forever discharge Owner, Indemnities and its Sureties to the extent covered by partial payments from any and all actions, causes of action, debts, dues, accounts, covenants, agreements, judgements, claims and demands of whatsoever nature of character which said Contractor now has or ever has had against Owner, Indemnities and its Sureties, their successors and assigns, which shall have arisen out of or be incidental to work undertaken or done under or in connection with the above referenced contract and related extra work or change orders thereto.

Contractor hereby certifies and warrants that all known charges for labor, materials, supplies, equipment, lands, licenses and other expenses for which Owner might be sued or for which a lien might be filed, have been fully satisfied and paid, or contractor assumes liability for negotiating final payment, and in consideration of payment hereunder, hereby waives, for itself, its subcontractors, materialmen, successors and assigns, all lien rights arising out of the performance of the construction contract work to the extent covered by partial payments and will defend and save harmless the Owner, Indemnities and its Sureties from and against all suits, actions, claims, liens, or demands of laborers, mechanics, materialmen or others, filed against Owner or the building's structures, additions or improvements constructed under the contract and arising out of the performance of the above contract work.

IN WITNESS WHEREOF, Contractor has executed this Release and Waiver of Lien on this _____ day of _____.

WITNESS OR ATTEST: CONTRACTOR:

_____ _____

NOTARY SEAL

County Contract No.

AGREEMENT

2.1.00 THIS AGREEMENT, made on the _____ day of _____, 200___, by and between Salt Lake County, a body corporate and politic, of the State of Utah, party of the first part, hereinafter called the COUNTY, and _____, party of the second part, hereinafter called the CONTRACTOR.

WITNESSETH, that the CONTRACTOR and the COUNTY, for the considerations hereinafter named, agree as follows:

2.2.00 SCOPE OF THE WORK.

The CONTRACTOR hereby agrees to furnish all of the materials and all of the equipment and labor necessary, and to perform all of the work shown on the drawings and described in the specifications for the project entitled all in accordance with the requirements and provisions of the following Documents which are hereby made a part of this Agreement:

(a) Plans and specifications prepared by _

(b) Addenda, if any.

(c) General conditions.

(d) Performance and Payments Bond Form.

2.3.00 TIME OF COMPLETION.

.01 The work shall be completed within **calendar days** after the Notice to Proceed has been sent, with an extension of time for completion equal to any time lost due to causes which could not have been foreseen or which were beyond the control of the CONTRACTOR and which were not the result of his/her fault or negligence. Extension of "Time for Completion" shall also be allowed in calendar days for any delays in the progress of the work caused by any act or neglect of the COUNTY or of its Employees or by other Contractors employed by the COUNTY, or delay due to an act of Government, or by any delay in the furnishing of plans and necessary information by the COUNTY, or by any other cause which in the opinion of the COUNTY entitles the CONTRACTOR to an extension of time. Strikes and other labor disputes shall be cause for an extension of time for completion.

.02 The work shall be completed on all punch list items within _ **calendar days** after COUNTY accepts CONTRACTOR's Notice of Substantial Completion or liquidated damages will be assessed.

2.4.00 LIQUIDATED DAMAGES.

.01 Should the CONTRACTOR fail to complete the work within the time stated above or within such additional or reduced time as may have been established by the COUNTY, there shall be deducted from any monies due, or that may become due the CONTRACTOR, the sum of ___ **($__)** per calendar day, for each and every calendar day beyond the agreed completion day, that the work remains uncompleted. Such sum is fixed and agreed upon by the COUNTY and the CONTRACTOR as liquidated damages due the COUNTY by reason of the inconvenience, increased costs of

administration and supervision, loss of use, and architectural costs resulting from the CONTRACTOR's default, and not as a penalty.

.02 Permitting the CONTRACTOR to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the COUNTY or any of his/her rights under the Contract.

.03 Said liquidated damage provision shall remain in effect and continue until substantial completion, punch list completion, and acceptance of the project by the COUNTY. The CONTRACTOR hereby authorizes the COUNTY to retain sufficient amounts of moneys due it and remaining in the hands of the COUNTY to pay the damages caused by any such default or defaults.

2.5.00 CONSIDERATION.

.01 (a) The COUNTY shall pay to the CONTRACTOR for the performance of the contract the amounts determined for the lump sum price offered by the bidder in the bidding schedule submitted by CONTRACTOR pursuant to COUNTY's Request for Proposals. If unit prices are called for, any change order(s) to this contract will be priced according to the unit prices. If the bidding schedule calls for unit prices and includes a specified number of units, bidder acknowledges the number of units contained in this schedule are approximate only, and the final payment shall be made for the actual number of units that are incorporated in or made necessary by the work covered by the contract.

(b) Should the number of units of completed work of any individual item of the schedule vary 25% from the number of units stated in such schedule of units, either the COUNTY or the CONTRACTOR may request a revision of the unit price for the item so affected, and both parties agree that under such conditions an equitable revision of the price shall be made.

(c) Extra work not included in scope of work but authorized after the date of the contract, that cannot be classified as coming under any of the units, may be done at mutually agreed upon unit prices, or on a lump sum basis, or under the provisions of paragraph No. 3.18.00 of the General Conditions entitled CHANGES IN THE WORK.

.02 The COUNTY shall pay to the CONTRACTOR for the performance of all the obligations set forth herein the sum of _____ ($_____) for the work of Bid Package A.

.03 The COUNTY shall further pay to the CONTRACTOR for the performance of all the obligations set forth herein an amount not to exceed _____ ($_____), which represents the CONTRACTOR's Guaranteed Maximum Price (GMP) for work of GMP Bid Package

2.6.0 ACCEPTANCE AND FINAL PAYMENT.

.01 Upon receipt of written notice that the work is ready for final inspection and acceptance, the COUNTY will promptly make such inspection, and when it finds the work acceptable under the Contract and the Contract fully performed it will promptly issue a certificate of final payment, over its signature, stating that the work required by this Contract has been completed including all punch list items and is accepted by it under the terms and conditions thereof, and the entire balance found to be due the CONTRACTOR, including the retained percentage, shall be paid to the CONTRACTOR by the COUNTY within thirty (30) days after the date of said certificate.

.02 Before issuance of certificate of final payment the CONTRACTOR shall submit evidence satisfactory to the COUNTY that all payrolls, materials bills, and other indebtedness connected with the work have been paid, except that in case of disputed indebtedness or liens the CONTRACTOR may submit in lieu of evidence of payment a surety bond satisfactory to the COUNTY guaranteeing payment of all such disputed amounts when adjudicated.

.03 The making and acceptance of the final payment shall constitute a waiver of all claims by the COUNTY, other than those arising from unsettled liens, from faulty work appearing within twelve months after final payment, or from manufacturer's guarantees. It shall also constitute a waiver of all claims by the CONTRACTOR.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, the day and year first above written.

SALT LAKE COUNTY

_____
Mayor or Designee

STATE OF UTAH)
: ss.
COUNTY OF SALT LAKE)

On this _____ day of _____, 200____, personally appeared before me _____, who being duly sworn, did say that s/he is the _____ of Salt Lake County, Office of Mayor, and that the foregoing instrument was signed on behalf of Salt Lake County, by authority of law.

_____
NOTARY PUBLIC
Residing in Salt Lake County

CONTRACTOR

_____
(Printed name)_____
(Title) _____

STATE OF UTAH)
: ss
COUNTY OF SALT LAKE)

The foregoing instrument was acknowledged before me on the _____ day of _____, 200__, by (name of acknowledgor and his/her title or representative capacity) _____.

NOTARY PUBLIC
Residing in Salt Lake County

GENERAL CONDITIONS

FIXED-PRICE CONSTRUCTION CONTRACT
SALT LAKE COUNTY, STATE OF UTAH

3.1.00 **DEFINITIONS.** As used throughout this contract, the following terms shall have the meaning set forth below:

.01 The COUNTY shall mean Salt Lake County, a body corporate and politic of the State of Utah.

.02 CONTRACTOR shall mean the individual, firm, partnership, corporation or association contracting to perform the work outlined herein.

.03 SUBCONTRACTOR shall mean those having a direct contract with the CONTRACTOR for the performance of work called for hereunder, including one who furnishes material worked to a special design according to the plans and/or specifications of this work but shall not include one who merely furnishes material not so worked. A subcontractor shall not have any contractual relationship with the COUNTY.

.04 The CONTRACT shall mean all of the following documents but not limited thereto:

(1) Agreement

(2) General Conditions

(3) Performance Bond

(4) Payment Bond

(5) Specifications including Addenda

(6) Plans and Drawings

(7) Change Orders

.05 The SITE shall mean the property as described in the Contract upon which the project will be constructed.

.06 The PROJECT shall mean the complete construction and related activities required to accomplish the intent and meaning of the Contract.

3.2.00 COUNTY REPRESENTATIVE.

.01 The parties agree that the Salt Lake County Office of Contracts and Procurement shall act as the COUNTY's representative with respect to the work to be performed under the agreement. The said Office of Contracts and Procurement shall have complete authority to transmit instruction, receive information, interpret and define COUNTY policy and decisions, with respect to materials, equipment, elements and systems pertinent to the work covered by this agreement.

Electric Power	3.3.01
Emergency Situation	3.24.04
Equal To	3.5.01
Federal Laws, Ordinances and Regulations	3.3.03
General Conditions	3.4.02
Ground	3.3.01
Hold Harmless	3.3.03, 3.24.01, 3.25.01
Inspection	3.21.00
Insurance	3.27.00
Interpretation of Specifications and Drawings	3.4.00
Investigation	3.3.01
Invitation to Bid	3.4.02
Job Site	3.1.05, 3.6.01
Labor	3.3.01, 3.4.06
Labor Disputes	3.16.01
Labor Regulations and Requirements	3.09.00
Latent Physical Conditions	3.15.00
Liability of Contractor	3.26.00
Local Laws, Ordinances and Regulations	3.3.03
Materials	3.4.06, 3.5.01, 3.19.03
Notices	3.3.03, 3.16.00
Notification of Changed Conditions	3.15.01
Notification of Delays	3.10.01
Notification of Labor Disputes	3.16.01
Office of Contracts and Procurement	3.2.01
Omissions	3.4.09
Operations and Storage Areas	3.25.00
Patents	3.8.01
Payments	3.19.00
Permits and Fees	3.36.00
Photographic Site Survey	3.3.00
Possession	3.11.00
Pre-Construction Conference	3.35.00
Prevent Injury to Life, Property, and Project	3.18.02
Prior Approvals	3.39.00
Private Property	3.24.01
Project Manager (Contractor)	3.41.00
Property Protection	3.24.00
Prosecution of Work	3.14.00
Protection of County and Public Property	3.24.00
Reports	3.13.00
Representations	3.3.02
Road, Condition Of	3.3.01, 3.25.05
Roadways, Use Of	3.25.03
Royalties	3.8.00
Schedule of Values	3.40.00
Schedule Report	3.13.00
Site Investigations	3.3.00
Specifications	3.4.00, 3.5.00, 3.14.01
State Laws, Ordinances and Regulations	3.3.03
Storage of Materials	3.3.01, 3.25.00
Subcontractors Bound	3.33.00
Subcontractors List	3.40.00
Superintendent	3.41.00
Surface and Subsurface	3.3.01

Testing	3.21.00, 3.22.00
Termination for Convenience	3.30.00
Termination for Default	3.14.03, 3.29.00
Transportation	3.3.01
Warranty	3.23.00
Water	3.3.01
Weather	3.3.01, 3.42.00
Work Sequence	3.38.00
Work Under Other Contracts	3.37.00
Workmanship	3.5.01

3.3.00 SITE INVESTIGATIONS, REPRESENTATIONS, AND PHOTOGRAPHIC SURVEY.

.01 The CONTRACTOR acknowledges that s/he has satisfied him/herself as to the nature and location of the work, the general and local conditions particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, road, uncertainties of weather, the conformation and condition of the ground, the character, quality and quantity of surface and subsurface materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this contract. Any failure by the CONTRACTOR to have acquainted him/herself with all the available information concerning these conditions will not relieve him from responsibility for performing the work.

.02 The COUNTY assumes no responsibility for any understanding or representations made by any of its officers or agents during or prior to the execution of this contract, unless such understandings and representations by the COUNTY are expressly stated in the contract. Representations made, but not so expressly stated and for which liability is not expressly assumed by the COUNTY in the contract, shall be deemed to be for the information of the CONTRACTOR and the COUNTY will not be liable or responsible therefore.

.03 The CONTRACTOR shall give all notices and comply with all federal, state, and local laws, ordinances and regulations in any manner effecting the conduct of the work, and all such orders and decrees as exist or may be enacted by bodies or tribunals having any jurisdiction or authority over the work, and shall indemnify and save harmless the COUNTY against any claim or liability arising from or based on, the violation of any such law, ordinance, regulation, order, or decree, whether by him/herself or his/her employees.

.04 Prior to beginning work, photograph existing site, walks, curbs, roadways, etc. in area of project. Purpose of these photographs is to establish existing conditions prior to construction.

a. Photographs shall be by a photographer experienced in construction photography.

b. Photographs shall show existing conditions, details and close-ups at each level.

.05 One copy of all photographs shall be labeled and correlated to plan views on contract drawings. Deliver to COUNTY prior to commencing work under the contract.

a. Format shall be as follows: Digital color prints clearly marked to identify exact location and view of each print, and date photo was taken.

b. Failure to comply with this requirement may result in the CONTRACTOR being responsible for all damage to surface or structure in the work area, whether new or existing.

3.4.00 INTERPRETATION OF SPECIFICATIONS AND DRAWINGS.

.01 The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all.

.02 In the event of an inconsistency between provisions of this Invitation for Bids, the inconsistency shall be resolved by giving precedence in the following order: (a) Bidding Instructions, (b) General Conditions, (c) Specifications, and (d) Drawings.

.03 Within the working drawings, the larger scale takes precedence over smaller; figured dimensions over scaled; and noted materials over graphic indications.

.04 Within the working drawings, the architectural drawings shall take precedence over the other drawings and shall govern in all cases where discrepancies occur.

.05 For convenience or reference and to facilities letting of subcontracts, the specifications are separated into respective divisions and sections. The forming of these separations shall not operate to make the COUNTY or any of its representatives any arbiter to establish subcontract limits between CONTRACTOR and subcontractors or suppliers.

.06 The intention of the Documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning shall be held to refer to such recognized standards.

.07 In case of discrepancy either in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the COUNTY by the CONTRACTOR or such discrepancy shall be deemed to have been waived. COUNTY shall promptly make a determination in writing. Any adjustment by the CONTRACTOR without this determination shall be at their own risk and expense.

.08 The COUNTY shall furnish from time to time such detail drawings and additional information as it may consider necessary for clarification of contract documents.

.09 Omissions from the drawings or specifications, or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings or specifications, or which are customarily performed, shall not relieve the CONTRACTOR from performing such omitted or misdescribed details or work, but they shall be performed as if duly and clearly set forth and described in the drawings and specifications.

3.5.00 MATERIALS AND WORKMANSHIP.

.01 Unless otherwise specifically provided for in the specifications, all equipment, materials and articles incorporated in the work covered by this contract are to be new and of the most suitable grade of their respective kinds for the purpose and all workmanship shall be first class. Where equipment, materials, or articles are referred to in the specifications as "equal to" any particular standard, the COUNTY shall decide the question of equality. The CONTRACTOR shall furnish to the COUNTY for approval the name of the manufacturer of machinery, mechanical and other equipment which s/he contemplates incorporating in the work, together with their performance capacities and other pertinent information. When required by the specifications or when called for by the COUNTY, the CONTRACTOR shall furnish to the COUNTY for approval full information concerning the materials or articles which s/he contemplates incorporating in the work. Samples of materials shall be submitted for approval when so directed. Machinery, equipment, materials and articles installed or used without such approval shall be at the risk of subsequent rejections by the COUNTY.

.02 Specific reference in the specifications or drawings to any article, device, product, material, fixture, form or type of construction, etc. by name, make or catalogue number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The CONTRACTOR may at his/her option use any articles, device, product, material, fixture, form or type of construction, etc., but only after approval by the COUNTY of CONTRACTOR use. When three or more names are mentioned in the specifications and the CONTRACTOR desires to use a product of another manufacturer s/he shall state the name of the substituted manufacturer or supplier in a request for approval and shall also state the addition or deduction from the contract amount if the product submitted is accepted.

3.6.00 DELIVERY OF MATERIALS.

.01 Unless otherwise provided in this contract, all materials to be furnished by the CONTRACTOR shall be delivered to the project's job site.

3.7.00 OTHER CONTRACTS.

.01 The COUNTY may undertake or award other contracts for additional work upon the project, and the CONTRACTOR shall fully cooperate with such other Contractors and the COUNTY employees and carefully fit his/her own work to such additional work as may be directed by the COUNTY. The CONTRACTOR shall not commit or permit any act which will interfere with the performance of work by any other contractor or by the COUNTY employees.

3.8.00 ROYALTIES AND PATENTS.

.01 If any design, device, material or process covered by letters patent or copyright, or for which letters patent or copyright have been applied, is used by the CONTRACTOR, s/he shall provide for such use by legal agreement with the COUNTY of the patent or proposed patent or copyrights or a duly authorized licensee of such COUNTY, and shall save harmless Salt Lake County from any and all loss or expense or account thereof including its use by Salt Lake County.

3.9.00 LABOR REGULATIONS AND REQUIREMENTS.

.01 The CONTRACTOR will comply with provisions set forth in the Labor Laws of the State of Utah, Title 34, Utah Code Annotated, 1953 amended and comply with current existing federal and state laws applicable to contracts on public construction.

.02 The COUNTY may in writing require the CONTRACTOR to remove from the work such employee as the COUNTY deems incompetent, careless, insubordinate, or otherwise objectionable, or whose continued employment on the work is deemed by the COUNTY to be contrary to the public interest.

3.10.00 DELAYS CAUSED BY COUNTY.

.01 It is anticipated that there shall be no delays due to operations of the COUNTY. However, should such delays occur, CONTRACTOR shall immediately notify the COUNTY in writing as to the cause of the delay.

.02 If COUNTY accepts CONTRACTOR claim, and such delay causes an increase or decrease in the time required for the performance of this contract, an equitable adjustment of time shall be made by the COUNTY and the contract modified in writing accordingly.

.03 The equitable adjustment shall be deemed acceptable to the CONTRACTOR unless s/he submits a written protest, with supporting documentation, within 15 calendar days of the notice of equitable adjustment.

3.11.0 POSSESSION PRIOR TO COMPLETION.

.01 The COUNTY shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be deemed an acceptance of any work not completed in accordance with the contract. If such prior possession or use by the COUNTY delays the progress of the work or causes additional expense to the CONTRACTOR, an equitable adjustment in the contract price and/or the time of completion will be made and the contract will be modified in writing accordingly.

3.12.00 COUNTY-FURNISHED PROPERTY.

.01 The COUNTY will deliver to the CONTRACTOR for use in connection with and under the terms of the contract only such COUNTY property as may be specified in the schedule or specifications, together with such related data and information as may reasonably be required for the intended use of such property. The delivery or performance dates for supplies or services to be furnished by the CONTRACTOR under this contract are based upon the expectation that the COUNTY furnished property suitable for use will be delivered to the CONTRACTOR to meet such delivery or performance dates. In the event that the COUNTY-furnished property is not delivered to the CONTRACTOR by such time or times, the COUNTY shall, upon timely written request made by the CONTRACTOR make a determination of the delay occasioned the CONTRACTOR and shall equitably adjust the contract price, or delivery or performance dates, or all of them, and any other contractual provisions affected by such delay. In the event that the COUNTY-furnished property is received by the CONTRACTOR in a condition not suitable for the intended use, the CONTRACTOR shall, upon request thereof, notify the COUNTY of such fact and, as directed by the COUNTY either (1) return such property at the County's expense or otherwise dispose of the property, or (2) effect repairs or modifications. Upon completion of (1) or (2) above, the COUNTY shall, upon written request of the CONTRACTOR, equitably adjust the contract price, or delivery or performance dates, or all of them, and any other contractual provisions affected by the return or disposition, or the repair or modification. The foregoing provisions for adjustment are exclusive and the COUNTY shall not be liable to suit for breach of contract by reason of any delays in delivery of COUNTY furnished property or delivery of such property in a condition not suitable for its intended use.

3.13.00 SCHEDULE REPORT.

.01 The CONTRACTOR shall within five (5) working days after receiving the Notice To Proceed, prepare and submit to the COUNTY for approval, a critical path schedule to include all work required by the contract. The schedule shall be prepared in the form prescribed by the COUNTY and of suitable scale to indicate appropriately the percentage of the actual progress at each weekly meeting or at such intervals as directed by the COUNTY, and shall immediately deliver to the COUNTY six (6) copies thereof. The COUNTY reserves the right to accept or reject the critical path schedule, which right will be exercised in a reasonable manner. A CONTRACTOR who fails to submit its critical path schedule as required herein may be subject to a work stoppage by the COUNTY, until such schedule is provided. The COUNTY shall not be liable for a delay claim as a result of such a stoppage.

3.14.00 PROSECUTION OF WORK.

.01 The CONTRACTOR shall keep on the site a copy of the drawings and specifications and shall at all times give the COUNTY access thereto.

.02 The CONTRACTOR shall furnish sufficient forces, construction plant, and equipment, and shall work such hours, including night shifts, overtime operations, weekend, and holiday work, as may be necessary to insure the prosecution of the work in accordance with the approved progress schedule. If, in the opinion of the COUNTY, the CONTRACTOR falls behind the progress schedule, the CONTRACTOR shall take such steps as may be necessary to improve his/her progress, and the COUNTY may require him to increase the number of shifts, and/or overtime operation days of work, and/or the amount of construction plant, all without additional cost to the COUNTY.

.03 Failure of the CONTRACTOR to comply with the requirements of the COUNTY under these provisions shall be grounds for determination by the COUNTY that the CONTRACTOR is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination, the COUNTY may terminate the CONTRACTOR rights to proceed with the work, or any separable part, thereof, in accordance with the clause herein entitled "Termination for Default."

3.15.00 CHANGED CONDITIONS.

.01 The CONTRACTOR shall promptly, and before such conditions are disturbed, notify the COUNTY in writing of: (a) subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (b) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this contract. The COUNTY shall promptly investigate the conditions, and if they find that such conditions do so materially differ and cause an increase or decrease in the cost of, or the time required for, performance of this contract, an equitable adjustment shall be made and the contract modified in writing accordingly. Any claim of the CONTRACTOR for adjustment hereunder shall not be allowed unless s/he has given notice as above required.

3.16.00 NOTICE OF LABOR DISPUTES.

.01 Whenever the CONTRACTOR has knowledge that any actual or potential labor dispute is delaying or threatens to delay the time of performance of this contract, the CONTRACTOR shall immediately give notice thereof, including all relevant information with respect thereto, to the COUNTY.

3.17.00 CERTIFICATION.

.01 The CONTRACTOR shall furnish written certification in the form required by the COUNTY, that the work was completed in compliance with the plans and specifications.

3.18.00 CHANGES IN THE WORK.

.01 Minor Changes: The COUNTY will issue supplemental instructions authorizing minor changes in the work, which the parties agree do not involve adjustment to the Contract Sum or Contract Time.

.02 Types of Changes in the Work: Changes in the work that will require an adjustment to the contract sum or contract time will be initiated in one of the following manners:

a. COUNTY Initiated Changes: When the COUNTY requests a change to the work, the COUNTY will issue a numbered Proposal Request to the CONTRACTOR. It will include a detailed description of proposed changes in the work and may include supplemental or revised drawings and specifications.

1. Requests issued by the COUNTY may be either a directive to perform the work described therein (this request shall only be issued if COUNTY in its sole discretion deems the work thereof to be required by an exigency situation or otherwise not suitable to the delay inherent in requesting contractor's response) or, the request by the COUNTY may be designated as one for information only. In such a case, the CONTRACTOR should not consider a request an instruction either to stop work in progress or to execute the proposed change. However, the CONTRACTOR should inform the COUNTY of any impact to work or schedule.
2. CONTRACTOR will respond to the latter type of request with a written, itemized proposal within 14 calendar days of receipt of a Proposal Request.

b. CONTRACTOR Initiated Changes: When latent or unforeseeable conditions require modifications to the contract or CONTRACTOR initiates changes through a value

engineering proposal, the CONTRACTOR must propose said changes by submitting a request to the County.

1. Include a statement outlining the reason for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

2. Provide all information about the change as outlined below for "Contractor's Proposal."

3. Changes requiring immediate action to prevent injury or loss of property shall be completed by the CONTRACTOR immediately. The CONTRACTOR shall notify the COUNTY of the change as soon as possible.

.03 CONTRACTOR Proposal-required elements: Submit a written proposal of changes and costs to the County for review.

a. The Proposal shall identify specific material and labor required to complete the change in the work. The Proposal shall completely itemize all material quantities, unit cost, labor estimates, hourly rates, delivery charges, taxes and mark-up factors calculated in the overall costs. Material costs shall not exceed those listed at established market levels and labor costs shall not exceed those listed at Journeyman schedules as established for this region by R.S. Means.

b. Sub-Contractor and CONTRACTOR mark-up for profit, if any, and for overhead and administrative costs shall not exceed a combined figure of 15% of the itemized costs for material supplied and labor directly performed. CONTRACTOR mark-up on Sub-Contractor's work shall not exceed 5% of the sub-contract amount for time and materials. A maximum additional performance bond mark-up of 1%, or the actual bond cost rate as verified by the bonding company, will also be allowed as a valid mark-up as part of the CONTRACTOR submittal.

c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time. If no request for additional time is made, no additional time will be allowed to complete the changed work.

d. No other mark-ups are allowed for project management, supervision, general conditions, on any extension of time allowed by the County for changes.

.04 Change Authorization Proposals: When it has been determined that a change to the Contract is necessary, but exact terms and conditions and/or plans and specifications are impossible to ascertain due to time constraints, the County may issue a Change Authorization.

a. The COUNTY will issue a Proposal Request to the CONTRACTOR. This request will include a detailed description of proposed changes in the work.

b. CONTRACTOR will respond to the Proposal similar to that outlined above, but rather than a fixed price, the proposal may include any of the following: estimated price, unit costs, equipment costs, hourly rates or a not to exceed amount.

c. After review of the Proposal, the COUNTY may issue a Change Authorization which will authorize the CONTRACTOR to begin work on the proposed changes. This will allow full compensation of properly documented work performed by the CONTRACTOR.

d. At completion of the changed work or at times allowed by COUNTY, costs will be totaled, documented, reviewed and executed as a Change Order.

.05 Execution of Change Orders. No application for payment on a change order item may be made until the Change Order has been fully executed by the COUNTY. Any work performed prior to the issuance of a Change Authorization or Change Order signed by an authorized agent of the COUNTY is at CONTRACTOR risk.

3.19.00 PAYMENTS.

.01 The COUNTY shall make monthly progress payments to the CONTRACTOR in an amount of money equal to ninety-five (95) percent of incurred costs for labor expended and materials, including overhead on such labor and materials supplied to the job site during the month next proceeding. However, in no event shall the cumulative total of progress payments exceed the COUNTY estimate of the percentage of work completed. Said payments will be made upon submission of a progress payment report in the form prescribed by the COUNTY. The CONTRACTOR shall keep and maintain books and records available to audit by the COUNTY or its representatives at all reasonable hours.

.02 In making any progress payments as provided in .01 above, the COUNTY may retain five (5) percent of the payment amount until final completion and acceptance of all work covered by the contract; provided, however, that the COUNTY, at any time after fifty (50) percent of the work has been completed, if it finds that satisfactory progress is being made on the project, may make any of the remaining partial payments in full. All funds retained by the COUNTY under this paragraph 3.19.00 shall be placed in an interest-bearing account, as required by the provisions of 13.8.5, enacted by the Utah Legislature in its 1983 General Session (amending Section 17-15-3 and other sections of U.C.A., 1953, as amended), and the interest on the account shall accrue to the benefit of the CONTRACTOR and its subcontractors, to be paid after the project is satisfactorily completed and accepted by the Salt Lake County Mayor. The Salt Lake County Treasurer will establish the interest-bearing retainage account and accrue interest on all retained amounts in the account at an interest rate that is 1% less than the monthly average interest rate earned by the COUNTY on its pooled investments of COUNTY funds in general. The accrued interest amount in the account will be paid to the CONTRACTOR at the time the contract is completed and the principal of the retained amount is paid to the CONTRACTOR as provided in this paragraph 3.19.00. As provided in the Act, it shall be the responsibility of the CONTRACTOR to distribute and pay to any and all of its SUBCONTRACTORS any portion of the interest received by the CONTRACTOR on the retainage amount to which the SUBCONTRACTOR may be entitled pursuant to its subcontract with the CONTRACTOR. It is expressly agreed by the CONTRACTOR that all funds withheld or retained from payment by the COUNTY because of faulty work, materials, or equipment or for contract items not provided or installed by the CONTRACTOR in accordance with the plans, specifications, drawings, and other contract documents or any amount in dispute shall not be considered as retained amounts and shall not be subject to the provisions of this subparagraph 3.19.02. It is also agreed that this paragraph shall not be construed so as to prevent the COUNTY from waiving the requirement for retainage under the contract or to prevent the CONTRACTOR from waiving the requirement that any retained amounts be placed in an interest-bearing account. Any waiver by the CONTRACTOR, however, must be in writing and furnished to the COUNTY prior to being given the notice to proceed under the contract.

.03 All rights, title and interest in and to material and work covered by partial payments made shall thereupon become the sole property of the COUNTY, but this provision shall not be construed as relieving the CONTRACTOR from the sole responsibility for all materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the COUNTY to require the fulfillment of all of the terms of the contract.

.04 Upon completion and acceptance of all work required hereunder, the amount due the CONTRACTOR under this contract will be paid upon the presentation of a properly executed final payment application and a Claim Release and Waiver. After the CONTRACTOR shall have furnished the COUNTY with a release, if required, of all claims against the COUNTY arising under and by virtue of this contract, other than such claims, if any, as may be specifically excepted by

the CONTRACTOR from the operation of the release in stated amount to be set forth therein. If the CONTRACTOR's claim to amounts payable under the contract has been assigned, a release may also be required of the assignee at the option of the COUNTY.

3.20.00 ACCEPTANCE FOR PAYMENT.

.01 Upon substantial completion of all work under this contract, the work will be given a punch-list walk through by the COUNTY. When all of the work including punch list items is found to be satisfactorily completed in accordance with the contract, and the entire work is accepted by the COUNTY, final payment will be made to the CONTRACTOR.

.02 For purposes of this clause, final acceptance refers only to final acceptance which will allow the CONTRACTOR to be paid and does not release CONTRACTOR of warranty requirements.

3.21.00 INSPECTION.

.01 When special inspections or testing are required, the COUNTY will employ an independent, qualified testing agency for all special inspections and testing required. The CONTRACTOR will be responsible for coordinating and scheduling all inspections with a minimum advance notice of 24 hours. The testing agency will be responsible for disseminating all required reports to the proper parties.

.02 The CONTRACTOR will be responsible for setting up a meeting which the CONTRACTOR, COUNTY, and the testing agency will attend before construction begins. The purpose of this meeting will be to establish the testing requirements and frequency of testing including, but not limited to, the testing and inspection specified in the contract documents.

.03 Except as otherwise provided herein all material and workmanship, if not otherwise designated by the specification, shall be subject to inspection, examination, and test by the COUNTY at any and all times during manufacture and/or construction at any and all places where such manufacture and/or construction are carried on. The COUNTY shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material shall be satisfactorily replaced with proper material without charge therefore, and the CONTRACTOR shall promptly segregate and remove the rejected material from the premises. If the CONTRACTOR fails to proceed at once with the replacement of rejected material and/or the correction of defective workmanship the COUNTY may, by contract or otherwise, replace such material and/or correct such workmanship and charge the cost thereof to the CONTRACTOR, or may terminate the right of the CONTRACTOR to proceed as provided in this contract, the CONTRACTOR and surety being liable for any damage to the same extent as provided in said Clause.

.04 The CONTRACTOR shall furnish promptly without additional charge, all reasonable facilities, labor, and materials necessary for the safe and convenient inspection and tests that may be required by the COUNTY shall be performed in such manner as not necessarily to delay the work. The CONTRACTOR shall be charged with cost of inspection when material and workmanship are not ready at the time inspection is requested by the CONTRACTOR. All costs of re-testing for previously failed tests shall be paid by the CONTRACTOR.

.05 Should it be considered necessary or advisable by the COUNTY at any time before the final acceptance of the entire work to make an examination of work already completed, by removing or tearing out same, the CONTRACTOR shall, upon request, promptly furnish all necessary facilities, labor, and material. If such work is found to be defective or nonconforming in any material respect, due to the fault of the CONTRACTOR or his/her subcontractors, s/he shall pay all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, the actual direct cost of labor and material necessarily involved in the examination and replacement, plus 10%, shall be allowed the CONTRACTOR and

s/he shall, in addition, if completion of the work has been delayed thereby, be granted a suitable extension of time due to the additional work involved.

3.22.00 TESTING OF ASSEMBLY AND FABRICATED SYSTEMS.

.01 Tests or trials to determine effectiveness of performance of completed assembly or fabricated system as may be required by the plans and specifications shall be made by the CONTRACTOR, without cost to the COUNTY.

3.23.00 WARRANTY.

.01 The CONTRACTOR expressly warrants the workmanship, materials and manner of construction provided for and contemplated by this contract and the plans, profiles and specifications accompanying and forming part of the same and agrees that if the improvement contemplated therein does not remain in good condition for a period of **one year** from the date of final acceptance by the COUNTY of the entire property, ordinary wear and tear excepted, because of defects in the workmanship, materials or manner of construction, then and in that event CONTRACTOR agrees that any and all repairs necessary to maintain said improvement and each and every part thereof in such good condition shall be made by said CONTRACTOR without additional charge or cost to the property owners or to the COUNTY.

.02 During the warranty period, the CONTRACTOR shall make reasonable efforts to correct deficient work. Unless the specifications call for a shorter time, when the deficiency involves safety of the building occupants or patrons; the loss of or damage to property; or renders the building unusable for its intended purpose; the CONTRACTOR shall respond and begin to correct the work no later than 24 hours after having received notice.

.03 In the event the CONTRACTOR does not respond as indicated herein, the COUNTY may elect to complete the work and contact the CONTRACTOR surety for payment of completed work. Failure to respond to warranty work may be grounds to deny future work for the CONTRACTOR.

3.24.00 PROTECTION OF PROPERTY; INDEMNIFICATION OF COUNTY.

.01 The CONTRACTOR shall not enter upon private property for any purpose without obtaining permission, and s/he shall be responsible for the preservation of all public property, trees, monuments, etc. along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage or injury thereto. S/he shall use suitable precautions to prevent damage to the pipes, conduits, and other underground structures including public utilities, and shall protect carefully from disturbance or damage all monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed. The CONTRACTOR shall indemnify and save harmless the COUNTY from and against all losses and all claims, demands, payments, suits, actions, recoveries, and judgments of every nature and description brought or recovered against COUNTY by reason of any omission or act of the CONTRACTOR, his/her agents or employees in the execution of the work or in the guarding of it. The CONTRACTOR shall obtain and shall maintain and pay the premiums of such insurance in such amount and with such provisions as will protect the COUNTY from contingent liability under this contract and a copy of such insurance policy or policies shall be available to the COUNTY upon request with the COUNTY listed as an additional insured.

.02 Care will be taken by the CONTRACTOR in felling trees authorized for removal to avoid any unnecessary damage to vegetation that is to remain in place. Any limbs or branches or trees broken during such operation shall be trimmed with a clean cut and painted with an approved tree-pruning compound if required by the COUNTY. The CONTRACTOR will be liable for or may be required to replace or restore at his/her own expense all vegetation not protected and preserved as required herein.

.03 The CONTRACTOR shall provide and maintain all necessary watchmen, barricades, red lights and warning signs and take all necessary precautions for the protection and safety of the public. S/he shall continuously maintain adequate protection of all work from damage, and shall take all reasonable precautions to protect the COUNTY's property from injury or loss arising in connection with this contract. S/he shall make good any damage, injury or loss to his/her work and to the property of the COUNTY resulting from lack of reasonable protective precautions, except such as may be due to errors in the contract documents, or caused by agents or employees of the COUNTY. S/he shall adequately protect adjacent private and public property, as provided by law and the contract documents.

.04 In an emergency affecting the safety of life or of the work or of adjoining property, the CONTRACTOR is, without special instructions or authorization from the COUNTY, hereby permitted to act at his/her discretion to prevent such threatened loss or injury. The CONTRACTOR shall be entitled to reasonable compensation for emergency work.

3.25.00 OPERATION AND STORAGE AREAS.

.01 All operations of the CONTRACTOR (including storage of materials) upon the COUNTY's premises shall be confined to areas authorized or approved by the COUNTY. No unauthorized or unwarranted entry upon, passage through, or storage or disposal of materials shall be made upon the COUNTY premises. The COUNTY premises adjacent to the construction will be made available for use by the CONTRACTOR without cost whenever such use will not interfere with the COUNTY other uses or purposes. The CONTRACTOR shall hold and save the COUNTY, its officers and agents, free and harmless from liability of any kind arising from the use, trespass or damage occasioned by his/her operations on COUNTY owned property or premises of a third person.

.02 Temporary buildings (storage sheds, shops, office, etc.) shall be erected by the CONTRACTOR upon the COUNTY premises only with approval of the COUNTY, and shall be built with labor and materials furnished by the CONTRACTOR without expense to the COUNTY, and will be removed by the CONTRACTOR at the CONTRACTOR expense upon the completion of the work. With written consent of the COUNTY, such buildings and/or utilities may be abandoned and need not be removed.

.03 The CONTRACTOR shall, under regulations prescribed by the COUNTY, use only established roadways or construct and use such temporary roadways as may be authorized by the COUNTY. Where materials are transported in the prosecution of work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state or local law or regulation. When it is necessary to cross curbs or sidewalks, protection against damage shall be provided by the CONTRACTOR, and any damaged roads, curbing, or sidewalks shall be repaired by, and at the expense of the CONTRACTOR.

.04 The CONTRACTOR shall at all times keep the construction area, including storage areas used by him, free from accumulations of waste material or rubbish and prior to completion of the work, remove any rubbish from and about the premises, and all tools, scaffolding, equipment, and materials not the property of the COUNTY. Upon completion of the construction, the CONTRACTOR shall leave the work and premises in a clean, neat and workmanlike condition satisfactory to the COUNTY.

.05 The CONTRACTOR shall at all times insure that public streets utilized during construction shall be mud and debris free and constantly maintained in that condition.

3.26.00 LIABILITY OF CONTRACTOR.

.01 The CONTRACTOR shall be responsible for all damages to persons or property that occur as a result of the negligence or fault of the CONTRACTOR in connection with the prosecution of the

work. The CONTRACTOR shall also be responsible for all materials delivered and work performed until completion and final acceptance.

3.27.00 INSURANCE.

.01 The CONTRACTOR shall secure and maintain such insurance from an insurance company authorized to write casualty insurance in the State of Utah as will protect him/herself, his/her subcontractors, and the COUNTY from fire and extended coverage losses and from claims for bodily injury, death or property damage which may arise from operations under this contract. All such insurance policies must be approved and accepted by the COUNTY. The CONTRACTOR shall not commence work under this contract until s/he has obtained all insurance required under this paragraph and shall have filed the certificate of insurance or the certified copy of the insurance policy with the COUNTY. The certificate of insurance must name Salt Lake County as an additional named insured. Each insurance policy shall contain a clause providing that it shall not be canceled by the insurance company without ten (10) days written notice to the COUNTY of intention to cancel. The amounts of such insurance shall be not less than the following:

a. Workmen's Compensation and Employer's Liability Insurance shall be secured and maintained as required by the State of Utah.

b. Public Liability, Bodily Injury, Death, and Property Damage:

1.	Injury or death of one person	$1,000,000
2.	Injury to more than one in single accident	$3,000,000
3.	Property damage	$1,000,000

c. Automobile and Truck Liability, Bodily Injury and Property Damages:

1.	Injury or death of one person	$1,000,000
2.	Injury to more than one in single accident	$3,000,000
3.	Property damage	$1,000,000

.02 In addition to such fire insurance as the CONTRACTOR elects to carry for his/her protection, s/he shall secure and maintain in the name of Salt Lake County policies upon such structures and materials in such amounts as shall be designated by Salt Lake County. The policies shall be secured from a Utah company which is satisfactory to Salt Lake County and shall be delivered to the COUNTY.

.03 CONTRACTOR shall secure and pay for an acceptable all-perils type Builder's Risk Insurance Policy for the full amount of the contract price including any change orders and will include the interests of the CONTRACTOR, subcontractors and suppliers. The policy should also include transit coverage insuring materials being moved to the job site. The policy should clearly state that Salt Lake COUNTY, the project manager and the architect are named insureds.

a. The maximum allowable deductible shall be $1,000.00 per occurrence.
b. Insurance carrier shall have an A.M. Best rating of A-.

3.28.00 BONDS.

.01 The CONTRACTOR shall furnish a payment bond with good and sufficient surety or sureties in a form acceptable to the COUNTY for the protection of persons furnishing material or labor in connection with the performance of the work under this agreement. The penal sum of such payment bond shall be 100% of the contract price.

.02 The CONTRACTOR shall furnish a performance bond with good and sufficient surety or sureties in a form acceptable to the COUNTY in connection with the performance of the contract work. The penal sum of the performance bond shall be 100% of the contract price.

.03 Bonds required hereunder shall be dated as of the same date as the contract and shall be furnished by the CONTRACTOR to the COUNTY at the time of execution of this contract and before Notice To Proceed is issued by the COUNTY. Bonds shall bind the Surety for performance of all of the work of the Contract through substantial completion and continuing thereafter to bind the Surety's obligation through any applicable warranty periods.

.04 If any surety upon any bond furnished in connection with this contract becomes unacceptable to the COUNTY, or if the surety fails to furnish reports as to his/her financial condition as requested by the COUNTY, the CONTRACTOR shall promptly furnish additional surety as shall be required to protect the interests of the COUNTY and of persons supplying labor or materials in the prosecution of the work contemplated by the contract.

.05 In the event any changes, alterations, modifications or amendments are made from time to time to this contract, or plans or specifications, subsequent to the date of bonds furnished hereunder, the CONTRACTOR shall secure from the Surety, a Bond Rider to the effect that the Surety waives Right of Discharge by reason of such action.

.06 The bonds furnished hereunder shall be in a form acceptable to the COUNTY and shall contain words to the effect Surety waives notice of any modifications or amendments to this contract, or plans or specifications hereunder.

.07 Bonds will also contain a provision to the effect that, if the CONTRACTOR fails to give the Surety notice of changes, alterations, modifications, or amendments to this contract, Surety shall not be released of liability under existing bonds or any riders issued thereto. The COUNTY shall have the right to withhold any payments due the CONTRACTOR hereunder until such time as the CONTRACTOR secures the bonds required or riders thereto and the same has been approved by the COUNTY.

.08 The duty of securing required bonds for this contract and riders thereto shall be upon the CONTRACTOR.

3.29.00 TERMINATION FOR DEFAULT.

.01 If the CONTRACTOR refuses or fails to prosecute the work, or any separable part thereof, with such diligence as will insure its completion within the time specified in this contract or any extension thereof, or fails to complete said work within such time, the COUNTY may, by written notice to the CONTRACTOR, terminate his/her right to proceed with the work or such part of the work as to which there has been delay. In such event the COUNTY may take over the work and prosecute the same to completion, by contract or otherwise and the CONTRACTOR and his/her sureties shall be liable to the COUNTY for any excess cost occasioned the COUNTY thereby, and for liquidated damages for delay, as fixed in the specifications or accompanying papers, until such reasonable time as may be required for final completion of the work, or if liquidated damages are not so fixed, any actual damages occasioned by delay. If the CONTRACTOR's right to proceed is

so terminated, the COUNTY may take possession of and utilize in completing the work such materials, appliances and plant as may be on the site of the work and necessary therefore.

.02 If the COUNTY does not terminate the right of the CONTRACTOR to proceed, as provided in paragraph (.01) hereof, the CONTRACTOR shall continue the work, in which event s/he and his/her sureties shall be liable to the COUNTY, in the amount set forth in the specifications or accompanying papers, for fixed, agreed, and liquidated damages for each calendar day of delay until the work is complete or accepted, or if liquidated damages are not so fixed, any actual damages occasioned by such delay.

.03 The right of the CONTRACTOR to proceed shall not be terminated, as provided in paragraph (.01) hereof, because of any delays in the completion of the work due to unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of the Government, in either its sovereign or contractual capacity, acts of another contractor in the performance of a contract with the COUNTY, fires, floods, epidemics, quarantine restrictions, strikes, freight, embargoes, and unusually severe weather, or delays of subcontractors or suppliers due to such causes provided, that the CONTRACTOR shall within ten (10) calendar days from the beginning of any such delay, unless the COUNTY shall grant a further period of time to the date of final settlement of the contract, notify the COUNTY in writing of the causes of delay. The COUNTY shall ascertain the facts and the extent of the delay and extend the time for completing the work when in the COUNTY judgment the findings of fact justify such an extension, and the COUNTY finding of facts thereon shall be final and conclusive on the parties hereto.

3.30.00 TERMINATION FOR CONVENIENCE.

.01 The performance of work under this contract may be terminated in whole, or from time to time in part, by the COUNTY in accordance with this clause. Termination of work hereunder shall be effected by delivery to the CONTRACTOR of a Notice of Termination specifying the extent to which performance of work under the contract is terminated. If the notice is hand delivered to CONTRACTOR by County, termination becomes effective on date signed for. If the notice is delivered to CONTRACTOR by certified mail, date of signature on return receipt will be the effective date of termination.

.02 After receipt of a Notice of Termination and except as otherwise directed by the COUNTY, the CONTRACTOR shall, (1) stop work under the contract on the date and to the extent specified in the Notice of Termination; (2) place no further orders or subcontracts for materials, services or facilities except as may be necessary for completion of such portions of the work under the contract as may be terminated; (3) terminate all orders and subcontracts to the extent that they are related to the performance of any work terminated by the Notice of Termination; (4) assign to the COUNTY in the manner, at the times, and to the extent directed by the COUNTY, all of the right, title, and interest of the CONTRACTOR under the orders or subcontracts so terminated, in which case the COUNTY shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts; (5) settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts subject to the approval or ratification of the COUNTY to the extent the COUNTY may require, which approval or ratification shall be final for all the purpose of this clause; (6) transfer title and deliver to the COUNTY in the manner, to the extent, at the times directed by the COUNTY (i) the fabricated or non-fabricated parts, work in progress, complete work, supplies and other material produced as a part of, or required in connection with the performance of the work terminated by the Notice of Termination, and (ii) the completed or partially completed plans, drawings, information, and other property which, if the contract has been completed, would be required to be furnished to the COUNTY; (7) use its best efforts to sell in the manner, to the extent, at the time, and at the price or prices directed or authorized by the COUNTY and property of the types referred to in provision (6) of this paragraph, provided, however, that the CONTRACTOR (i) shall not be required to extend credit to any purchaser and (ii) may acquire any such property under the conditions prescribed by and at a price or prices approved by the COUNTY and provided further that the proceeds of any such transfer or disposition shall be applied in deduction of any payments to be made by the COUNTY

to the CONTRACTOR under this contract or shall otherwise be credited to the price or cost of the work covered by this contract or paid in such other manner as the COUNTY may direct; (8) complete performance of such part of the work as shall not have been terminated by the Notice of Termination; and (9) take such action as may be necessary or as the COUNTY may direct for protection and preservation of the property related to this contract, which is in the possession of the CONTRACTOR and in which the COUNTY has or may acquire an interest.

.03 After receipt of a Notice of Termination, the CONTRACTOR shall submit to the COUNTY its termination claim, in the form and with the certification prescribed by the COUNTY. Such claim shall be submitted promptly, but not later than 90 calendar days from the effective date of termination. Upon failure of the CONTRACTOR to submit its termination claim within the time allowed, the COUNTY may determine, on the basis of information available to it, the amount, if any, due to the CONTRACTOR in respect to the termination of such determination under this paragraph, it shall pay the CONTRACTOR the amount so determined.

.04 Subject to the provisions of paragraph (.03) the CONTRACTOR and the COUNTY may agree upon the whole or any part of the amount or amounts to be paid to the CONTRACTOR by reason of the total or partial termination of work pursuant to this clause, which amount or amounts may include a reasonable allowance for profit on work done and the COUNTY shall pay the agreed amount or amounts; provided that such agreed amount or amounts exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of the work not terminated.

.05 The obligation of the COUNTY to make any payments under this clause shall be subject to deductions in respect of (1) all un-liquidated advance or other payments on account theretofore made to the CONTRACTOR, (2) any claim which the COUNTY may have against the CONTRACTOR in connection with this contract, and (3) the agreed price for, or the proceeds of sale of, any materials, supplies, or other things retained by the CONTRACTOR, or sold, and not otherwise recovered by or credited to the COUNTY.

.06 If the termination hereunder be partial, prior to the settlement of the terminated portion of this contract, the CONTRACTOR may file with the COUNTY a request in writing that an equitable adjustment be made in the price or prices specified in the contract for the work in connection with the continued portion not terminated by the Notice of Termination, and the appropriate fair and reasonable adjustment shall be made in such price or prices. However, nothing contained herein shall limit the right of the COUNTY and the CONTRACTOR to agree upon the amount or amounts to be paid to the CONTRACTOR for the completion of the continued portion of the contract when said contract does not contain an established contract price for such continued portion.

.07 The COUNTY may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the CONTRACTOR in respect to the termination portion of the contract, whenever in the opinion of the COUNTY the aggregate of such payments shall be within the amount to which the CONTRACTOR will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed upon or determined to be due under this clause, such excess shall be payable by the CONTRACTOR to the COUNTY upon demand, together with interest thereon computed, for the period from the date on which such excess payment is received by the CONTRACTOR to the date on which such excess is repaid to the COUNTY provided however that no interest shall be charged with respect to any such excess payment attributable to a reduction in the CONTRACTOR claim by reason of retention or other disposition of termination inventory until ten (10) calendar days after the date of such retention or disposition, or such later date as determined by the COUNTY by reason of the circumstances. The Salt Lake County Treasurer will establish the monthly average interest the CONTRACTOR will pay the COUNTY based on the rate earned by the COUNTY on its pooled investments of COUNTY funds in general.

.08 Unless otherwise provided for in the contract, or by applicable statute, the CONTRACTOR, for a period of three (3) years after final settlement under the contract shall make available to the COUNTY at all reasonable times at the office of the CONTRACTOR all its books, records, documents, or other evidence bearing on the costs and expenses of the CONTRACTOR under

the contract and in respect to the termination of work hereunder or, to the extent approved by the COUNTY, photographs, microphotographs, or other authentic reproductions thereof.

.09 For purposes of paragraph (.04) above, the amounts of the payments to be made by the COUNTY to the CONTRACTOR shall be: (a) the cost of work performed prior to the effective date of the Notice of Termination; (b) the cost of settling and paying claims arising out of the termination of work under subcontracts or orders as provided hereinabove exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the subcontractor prior to the effective date of the Notice of Termination of work under this contract; (c) a sum of money, as a profit, equal to a maximum amount that the CONTRACTOR can establish from his/her own records s/he would have received if the agreement had been carried through to completion, provided however, that in no event shall said profit exceed ten percent (10%) of the total sum of incurred costs; (d) the total sum to be paid to the CONTRACTOR under (a), (b), and (c) above shall not exceed the total contract price as reduced by the amount of payments otherwise made and is further reduced by the contract price of work not terminated.

3.31.00 COUNTY EMPLOYEES NOT TO SHARE.

.01 No individual or group of official employee(s) or agent(s) of the COUNTY shall be allowed to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit and said official(s), employee(s), or agent(s) as a group or individually own less than 50% of the outstanding stock of said corporation.

3.32.00 COUNTY EMPLOYEES NOT TO PARTICIPATE.

.01 The CONTRACTOR warrants that no COUNTY employee, official, or agent has been retained by the CONTRACTOR to solicit or secure this contract upon any agreement or understanding for a commission, percentage, brokerage, contingent fee, or any other form of compensation. For breach or violation of this warranty the Government shall have the right to terminate this contract for default as set out herein or in its discretion to deduct from the contract price or otherwise recover the full amount of such enumeration.

3.33.00 SUBCONTRACTORS BOUND.

.01 The CONTRACTOR will include at a minimum the following provisions of this contract in all subcontracts or supplier agreements as applicable: 3.8.00, 3.9.00, 3.26.00, 3.27.00.

3.34.00 ASSIGNMENT OF CONTRACT.

.01 The CONTRACTOR shall not assign, transfer or sublet this contract or any interest therein or any part thereof, without prior written consent of the COUNTY.

3.35.00 PRE-CONSTRUCTION CONFERENCE.

.01 A pre-construction conference will be held before the start of any work with the CONTRACTOR and representatives of the COUNTY to review all project drawings, specifications, methods, schedules, and related application requirements pertaining to the work; and, to establish mutual understanding of all procedures and precautions related to the proper prosecution of the work. The COUNTY shall assure the completion of all required procedures by the CONTRACTOR prior

to the commencement of any work by the CONTRACTOR including, but not limited to, insurance and bonding requirements, schedules, and contract documents.

3.36.00 PERMITS AND FEES.

.01 The following shall be the COUNTY's responsibility unless modified according to terms of paragraph 2 below:

a. The COUNTY will submit the construction documents to the permitting authority for plan review. When permits or fees are required by the permitting authority, the COUNTY will pay the following costs directly to the governing agency and/or entity upon request from the CONTRACTOR:

1. Plan check fees.

2. Building Permits.

3. Impact Fees (i.e. - hydrology).

4. Conditional Use Permit Fees (completed prior to bidding).

5. Utility Connection Fees (i.e. - gas, sewer, water, power, phone).

b. Utility unit labor and material costs for work not included with connection fees and normally performed by the utility company.

.02 The following shall be the CONTRACTORs' responsibility:

a. The COUNTY may require at the pre-construction conference that the CONTRACTOR submit construction documents to the permitting authority for plan review. When fees are required by the permitting authority, the COUNTY will pay the costs directly to the governing agency and/or entity upon request from the CONTRACTOR

b. When permits and fees are required by the permitting authority, the CONTRACTOR will make arrangements to secure the building permit and will notify the COUNTY's project representative, in a timely manner, of the fee amount required to obtain the building permit. The contract will research, coordinate and schedule all work required by the utility companies, special service districts and subcontractors to complete all work shown on the construction documents. The CONTRACTOR will be responsible for all work not normally performed by the utility companies or special service districts (i.e. - trenching and backfilling) even if this work is not indicated in the construction documents, and shall comply with paragraph 3.18 Changes In The Work.

c. The CONTRACTOR will be responsible for all bonding requirements and deposits that might be required by utility or government entities to perform the work.

.03 Reimbursement

a. In the event the contractor pays any of the fees required by the permitting authority or utility fees, said fees will be reimbursed by the COUNTY at actual cost.

3.37.00 WORK UNDER OTHER CONTRACTS.

.01 The COUNTY reserves the right to issue other contracts that might impact this project. CONTRACTOR will be required to schedule and coordinate under this contract with such other contractors.

3.38.00 WORK SEQUENCE.

.01 The CONTRACTOR will be responsible for the work, means, methods, sequence and scheduling of all work to complete the project.

3.39.00 PRIOR APPROVALS.

.01 Where possible, three or more acceptable brands of equipment, manufactured articles or methods of construction have been identified in the contract documents in order to establish a standard and allow competition. The intent of this process is not to exclude the use of other brands, articles or methods which may be acceptable and deserving consideration. However, only explicitly specified or prior approved before the bid opening items are acceptable to the COUNTY. To be considered for a prior approval the bidder must:

a. Submit fully detailed technical data, samples, installation methods, test reports and certification, references and all other supporting documentation as may be requested by the COUNTY.

b. Prove to the COUNTY that items held up as equal to or superior to specified items meet project specification design and intent. Obtaining prior approval does not relieve the CONTRACTOR from meeting the project specifications or any portion thereof.

.02 Prior Approval: Request for prior approval of brands, articles and methods not explicitly specified may be submitted to the COUNTY up to and including the tenth calendar day preceding the day bids are scheduled to be opened to allow time for review and evaluation. Such requests will be evaluated as time allows and, if approved, will be included in an addenda under the heading "Prior Approvals."

3.40.00 SCHEDULE OF VALUES/LIST OF SUBCONTRACTORS.

.01 After the bid opening the apparent low bidder and upon request the apparent second or third low bidders shall submit a schedule of values and list of subcontractors, used in formulating their bids, to the COUNTY project manager within twenty-four hours.

a. If a bidder has any doubt regarding the correctness or acceptability of any subcontract bid, the bidder may submit the names and amount of other competing subcontractors, making sure that the bidder clearly states which one was used in formulating his bid.

.02 No changes to the original Schedule of Values will be allowed except by change order. Changes to the original List of Subcontractors involving major subcontractors will not be allowed except with the approval of the COUNTY project representative.

3.41.00 CONTRACTOR SUPERVISION.

.01 The CONTRACTOR shall designate and keep continuously on the project, during its progress and until the project is finally accepted, an experienced and competent project manager and superintendent and any necessary assistants, all satisfactory to the COUNTY. The project manager and superintendent shall not be changed except with the consent of the COUNTY unless the project manager or superintendent proves to be unsatisfactory to the CONTRACTOR and ceases to be in his/her employ.

.02 The superintendent shall represent the CONTRACTOR project manager in his/her absence and all notices, requests and instructions given to the superintendent shall be considered as having been given to the CONTRACTOR project manager.

.03 The CONTRACTOR shall give efficient supervision to the work, using his/her best skill and attention. The CONTRACTOR shall carefully study and compare all drawings, specifications and other instructions giving prompt notice to the COUNTY of any errors, inconsistency, or omission which CONTRACTOR should have reasonably discovered.

3.42.00 WEATHER DELAYS.

.01 The COUNTY and the CONTRACTOR agree that adverse weather conditions are normal and expected during the Contract period and that a sufficient number of days have been included in the Contract period that will account for delays caused by normal weather conditions.

.02 If unusually severe and adverse weather conditions are the basis for a claim for additional time, such claim shall be documented by data substantiating that weather conditions were unusually severe for the period of time and could not have been reasonably anticipated. Unusually severe weather is the CONTRACTOR burden to prove and must be reconciled with averages shown for this area by the U.S. Weather Service, and that said weather conditions had an adverse effect on the scheduled construction by impacting critical path activities.

.03 CONTRACTOR will be responsible to notify the County of any weather conditions that affect the progress of critical path items. Notification must be sent on the date of adverse weather. Acceptance by COUNTY of weather impact notice will not guarantee the approval of any extension to the Contract period.

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SALT LAKE COUNTY
CONTRACT PAYMENT APPLICATION

APPLICATION NO. **DATE** **PERIOD:FROM** **TO**

DATE DATE

PROJECT:

CONTRACTOR:

CONTRACT NO.

ORIGINAL CONTRACT AMOUNT

Account Number	
Fund	
Agency	
Dept ID	
Account	
Program	
Fund Source	
PC Bus Unit	
Project ID	
Activity	

CHANGE ORDER SUMMARY			
No.	DATED	$ AMOUNT	DAYS
NET CHANGE ORDER SUMMARY			

-

ADJUSTED TOTAL CONTRACT AMOUNT - A

TOTAL WORK COMPLETED TO DATE $ _____

TOTAL MATERIALS ON SITE TO DATE $ -

TOTAL WORK COMPLETED & MATERIALS ON SITE TO DATE -

LESS: 5 % RETAINAGE $ -

LIQUIDATED DAMAGES $ - P1

PREVIOUS PAYMENT APPLICATIONS $ _____ P2
(Total P2+P3 of prior payment application)

TOTAL DEDUCTIONS < - >

NET AMOUNT OF THIS PAYMENT - P3

ADJUSTED CONTRACT BALANCE AFTER THIS PAYMENT -
(A1-P1-P2-P3)

CONTRACTOR CERTIFICATION:

To the best of my knowledge, information and belief, the work of this contract payment application has been completed in accordance with the contract documents all amounts have been paid for obligations, for which previous payments were received from the county; and, that the current payment shown herein is now due.

CONTRACTOR, BY: TITLE: DATE:

FOR COUNTY USE ONLY:					
Contract Date	Contract Period		Completion Date	% Comp. To Date	Days to Date
	Original	Days	Original	Work	Used
	Current	Days	Current	Time	Left

WE, THE COUNTY'S REPRESENTATIVES, CERTIFY that based on on-site observations and the above listed data, the work of this project has progressed to the point indicated; that to the best of our knowledge, information and belief, the quality of work is in accordance with the contract documents; and that the contractor is entitled to receive the amount indicated for payment.

BY: BY:

DATE DATE

BY: BY:

DATE DIVISION DIRECTOR DATE

SALT LAKE COUNTY

SALT LAKE COUNTY CABLING SPECIFICATION

The purpose of this document is to provide documentation and requirements to cabling professionals interested in bidding design/installation services for communications cable-plant for Salt Lake County projects.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory, direct all queries in regard to current project to Salt Lake County. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supersedes and voids all previous literature, etc.

Document Created 3/22/2013
Creator Network Engineer Dallas Cook

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Installing Contractor shall adhere to all of the following Standards and Codes:

ANSI/TIA

- ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises, or most recent revision at the time of installation

- ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standards, or most recent revision at the time of installation

- ANSI/TIA-568-C.2 - Balance Twisted Pair Communications and Components Standards, or most recent revision at the time of installation

- ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard

- ANSI/TIA –942 -Telecommunications Infrastructure for Data Centers, or most recent revision at the time of installation

- TIA-569-B - Commercial Building Standard for Telecom Pathways and Spaces, or most recent revision at the time of installation

- ANSI/TIA-606-A – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, or most recent revision at the time of installation

- ANSI-J-STD-607-A - Commercial Building Grounding/Bonding Requirements, or most recent revision at the time of installation

- ANSI/TIA 1152 – Testing of Copper Links

National Electric Codes

- National Electrical Safety Code (NESC) (IEEE C 2)

- National Electrical Code (NEC) (NFPA 70)

ISO/IEC

- ISO 11801 - Generic Cabling for Customer Premises

OSHA Standards and Regulations – all applicable

Local Codes and Standards – all applicable

BICSI

- Telecommunications Distribution Methods Manual 12th Ed., or most recent revision at the time of installation

- Information Transport Systems Installation Methods Manual (ITSIMM), 5th Edition, or most recent revision at the time of installation

The Contractor shall design, install, test and document all systems according to methods outlined in above-mentioned Standards and all County recommendations contained within this document. Contractor shall bring any apparent conflicts between Industry Standards and County guidelines to the attention of the County. Resolution of said conflicts must be received in writing to Contractor

from County. It is the responsibility of the Contractor to know all Standards-based installation recommendations and all requirements contained in this document.

Quality Assurance

PANDUIT *System Warranty*

Contractor shall provide upon completion a Panduit *CERTIFICATION PLUS* System Warranty to guarantee installation of end-to-end high performance cabling systems that meet all application requirements associated with the Category of cabling installed. The guarantee shall include all copper cable and connectivity components. The system shall be warranted for a period of at least 25 years.

Transfer manufacturer's Panduit PREMIUM 6 WARRANTY (minimum 25 years) warranties to the owner. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve you of these obligations. A copy of the warranty is to be provided at the completion of the project to Salt Lake County Director of IT Infrastructure.

Product Guarantee

All PANDUIT Pan-Net ™ non-consumable products have a further 25-year component guarantee when installed per TIA or ISO/IEC standards, this guarantee assures the PANDUIT Pan-Net Network Cabling System will operate successfully with all application(s) for which the Category of system was designed to support.

In order to qualify for the guarantee, the structured cabling system must be installed in per the following:

- Meet all ANSI/TIA commercial building wiring standards
- Panduit will provide a single source solution for the end-to-end installation
- Panduit Products must be installed per Panduit instructions and methods by a **Panduit certified Installer**
- If any *PANDUIT PAN-NET™* product fails to perform as stated above, *PANDUIT* will provide new components at no charge.

Contractor Qualifications:

Contractor shall have a minimum three years documented experience on similar projects and have available service facilities within 120 miles of project.

A copy of certification documents for each must be submitted with the quote in order for such quote to be valid.

Contractor is responsible for workmanship and installation practices in accordance with the Panduit Certified Installers Program.

At least 30 percent of the technicians on the job must have a current Panduit Certified Copper Technicians certificate, and 20 percent must be certified by Panduit for Fiber Optic installation.

Contractor shall meet the following requirements: NO EXCEPTIONS. If you do not understand any aspect of these specifications, call Corey Hess–Network Manager over IT Infrastructure? For clarification;

1) RCDD on staff, full time, to oversee bid and installation procedures.

2) Panduit certified designer.

3) Panduit certified installation technician.

4) BICSI certified Installer II and Installer I technicians on staff, on project full time.

The vendor shall have Utah County or Salt Lake County based service personnel, factory trained to service the equipment proposed with a normal response to service calls (not to exceed two hours for major systems failures) on the same day.

Upon request made by the electrical engineer/designer/Salt Lake County Director of IT Infrastructure, furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.

Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout.

1.0 HORIZONTAL CABLE INSTALLATION REQUIREMENTS

A minimum of two (2) County approved Category 6A UTP cables shall be run from the telecommunication closets to each jack location. Additional cables called for in a particular Scope of Work may be more Category 6A cables or some combination of the following:

- Two-strand 50/125 micron optical fiber cable minimally rated OM 3 or higher may be requested for some projects.
- 62.5/125 micron, (OM 1) cable is acceptable only as additions to legacy systems where OM 1 cable is already installed.
- Single-mode optical fiber (OS 1) shall be installed only for backbone optical connections unless

otherwise stipulated by the County. Contractor shall refer to the Scope of Work for that project and is responsible for getting clarification from the county whenever the type of cable to be installed is not clear.

- In addition, all installed horizontal cable must meet the following County requirements.

1.1 All horizontal cables and cable pairs must be terminated in numerical order across the wiring patch field with the lowest number station run or pair first.

1.2 Each four-pair cable shall be bundled with like kinds. Velcro wraps or other approved methods for forming bundles shall be utilized telecommunications rooms. **Plastic cable ties shall not be used in County-Telecommunications rooms**.

County approved hook and loop ties for cable bundling in telecom rooms are as follows:

Panduit	HLS-75RO	.75 inch wide, 75 foot continuous roll hook and loop cable ties.
Panduit	HLS-15RO	.75 inch wide, 15 foot continuous roll hook and loop cable ties.

1.3 Within telecommunications rooms, cables shall be bundled only with like kinds (same Category) and secured to building structure using only methods approved in TIA Standards. Bundling shall be accomplished with velcro or other approved methods. Cable shall be secured to building structures with "D" Rings or J-Hooks or other approved fixtures rated by the manufacturer to accommodate the minimum bend radius requirements of the Category of cable being installed. Delivery systems shall support cable all the way up to the point that the cable is introduced into to the surface raceway system. Contractor shall be responsible to ensure that no cable pathway exceeds a 40% fill at installation and shall size all pathways/delivery systems accordingly using outer diameter measurements for the cable being installed.

1 ¼ - INCH CONDUIT CAN HAVE NO MORE THAN 6 CABLES WITHIN

1 - INCH CONDUIT CAN HAVE NO MORE THAN 3 CABLES WITHIN

¾ - INCH CONDUIT CAN HAVE NO MORE THAN 2 CABLES WITHIN

No zip ties to be used for grouping of wires use Velcro strapping on all.

County approved J-hook horizontal delivery system is:

Panduit	JMJH2-X20	2" J hook with snap lock attachments to use with brackets
Panduit	JMTRB38-1-X	Single-level threaded rod bracket for use with 1/4" to 3/8" threaded rods.
Panduit	JMSBCB87-1-X	Single-level screw-on beam clamp bracket for use with flanges up to 3/4" (19.1mm) thick.
Panduit	JMCB-X	Chaining bracket to extend J-MOD ® capacity one level. Capacity: three levels maximum.

1.4 Contractor shall follow all TIA Standard guidelines for maintaining separation between low-voltage copper communications cable and potential sources of electro-magnetic interference like motors, transformers, electrical lines, lighting ballasts, etc.

1.5 When requested by the County the Contractor shall supply and install all connecting cables, including but not limited to patch cables, work station patch cables, octopus cables or other such assemblies, fiber jumper cables, connectors, baluns and other such impedance or media conversion devices required to provide connectivity of all of County's Data Equipment.

1.6 Contractor shall reference all attachments to assist with jack locations and counts. Contractor is responsible to notify the County with their bid, their recommended horizontal and backbone design. This design shall include, but not be limited to, the number of fibers to each building, the copper cable pairs to each building, and total Structured Cabling System design.

2.0 HORIZONTAL CABLE SPECIFICATIONS

2.1 UNSHIELDED TWISTED PAIR (UTP)

2.1.1 GENERAL REQUIREMENTS

2.1.1.1 A minimum of two (2) blue jacketed four-pair, plenum/non-plenum rated, unshielded twisted-pair cables shall be pulled from the IDF to each telecommunications outlet. Contractor is responsible for using proper fire rated cable for the environment – plenum, riser or non-plenum. All voice and data Horizontal Copper Cable shall be Category 6A, as defined by this specification or the Scope of Work provided by Salt Lake County.

County approved Category 6A UTP cables for horizontal distribution are:

General Cable	7133849	Gen*SPEED*® 10 MTP™ Category 6A Cable, non-plenum (riser rated) – blue jacket
General Cable	7131849	Gen*SPEED*® 10 MTP™ Category 6A Cable, plenum rated – blue jacket
Belden Cable	10GX12 0061000	Non-plenum rated blue jacket
Belden Cable	10GC13 D151000	Plenum rated blue jacket

2.2 FIBER-OPTIC HORIZONTAL CABLING

- 62.5/125 micron, (OM 1) cable is acceptable only as additions to legacy systems where

OM 1 cable is already installed.

- Contractor shall NOT mix different core size multimode cable in the same installation without express written request by the County.
- Single mode fiber optic cable shall be reserved for backbone connections unless otherwise indicated by the County.

3.0 HORIZONTAL CABLE TERMINATION EQUIPMENT:

3.1 The Telecommunications Outlet: Unless otherwise indicated in a particular Scope of Work, Work Area appliances shall be an angled four-hole single gang faceplate. Color coding for Category 6A modular jacks shall be Blue for data, Yellow for voice (if required). Contractor is responsible for filling all unused faceplate holes with blank inserts. Work Areas that include including fiber optic cable shall NOT be terminated in a flush-mount plate, but rather be installed in a County approved 4-hole multi-media surface boxes as indicated below.

County approved faceplates:

Panduit	CFPSE4IWY	Executive Series Faceplate. Accepts Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes. Plate may be loaded from the front and includes label field.
Panduit	CFPSE2IWY	2 ports are accepted where they are approved
Panduit	CMBIWY-X	Blank insert.

3.1.1 PATCH PANELS: Telecommunications Room UTP cable shall be terminated on 24 or 48 port modular patch panels consisting of flush-mounted frames with rear loading faceplates to accommodate the same Category 6A 8-position modular jacks as used in the work area.

County approved modular panels are:

Panduit	CPP24FMWBLY	24 port modular panel. Requires 6A jacks.
Panduit	CPP48FMWBLY	48 port modular panel. Requires 6A jacks.

3.1.2 Patch Cords: All Patch Cords shall be green colored Category 6A.

County approved patch cables are as follows:

Panduit	TX6AxUTP	Green Category 6A patch cords with Matrix Technology,(no booted patch cords) where "x" designates length in feet. Available in lengths being 3 ft. to 20 ft. in one foot increments. Also available in 25, 30 and 40 foot lengths.

3.1.3 Modular Jacks: All 100 Ohm UTP shall be wired to 8 position Category 6A modular jacks using the T568B pin-out unless otherwise specified, consistent with Salt Lake County's existing facility standard. These jacks are to be used in the Work Area and in the modular patch panels in the telecommunications rooms as described above.

County approved modular jacks:

Panduit	TG6X88TGBU	Category 6A, RJ45, 10 Gb/s, 8-position, 8-wire universal jack module – blue.
Panduit	TG6X88TGYL	Category 6A, RJ45, 10 Gb/s, 8-position, 8-wire universal jack module – yellow.

Work Area Installations shall follow these requirements:

568 B WIRING STANDARDS WILL BE FOLLOWED FOR ALL CABLING TERMINATIONS INSTALLED

****NO CABLE RUN SHALL EXCEED 90 METERS/280 FEET FROM STATION LOCATION TO NEAREST IDF, INCLUDING SERVICE LOOP AS PER SPECS AND PATCH CABLES ON TERMINATION END AND MDF/IDF UPLINK, AND SHOULD NOT EXCEED A TOTAL OF 180 DEGREE BEND RADIUS (Except as approved in ANSI/TIA/EIA 569 standards) IN THE ENTIRE SPAN OF THE RUN.**

3.1.4 All face-plates, surface-mount boxes, and blank covers shall be the same color as indicated by the agency and match any existing telecommunications, data, and electrical face-plates.

3.1.5 Jacks mounted on drywall shall be flush mounted and at the same level as the electrical outlets and shall be ADA compliant. Jacks mounted in modular furniture shall be mounted in a surface mount receptacle box at desktop level unless otherwise indicated. The Contractor must supply all face-plates, boxes, brackets and jacks.

3.1.6 Contractor shall supply and install an adequate number of solid (no cutouts) face-plate covers to conceal all outlet boxes, which go unused (i.e., no jack is installed). These outlet covers shall be the same color as station face-plate covers. Blanks will be used to cover cutouts in face-plate where no jack is installed.

3.1.7 Contractors shall work closely with the County to determine the final telecommunications outlet locations and requirements. Exact faceplate locations shall be determined just prior to installation. Contractor is required to seek final approval from the County on final locations of jacks prior to the installation of cables or jacks. Floor plans will be provided for the Contractor's reference, when available.

3.1.8 When it is necessary to run cable on wall surfaces this cable must be enclosed in Panduit surface raceway of size and style appropriate to the cables contained therein (see "County Approved Raceway" in the HORZONTAL PATHWAYS section of this document). This raceway must

be securely attached to the wall using screws in the wall joists in drywall installation and using wall anchors on block walls. Raceway must be the same color as the surface mounted outlet box. The County will not accept any surface raceway systems mounted with adhesive only.

3.1.9 All floor outlets shall be of a size and type compatible with the floor box provided. Jacks shall be as specified in this section.

Telecommunications Room Mounting and Cable Management Hardware:

All cable termination and routing/management appliances in the Telecom Room shall be designed and dressed out in a professional, workmanlike manner. Contractor shall select mounting and management appliances such that the installed cross-sectional fill shall not exceed 40%.

County approved racks and wire managers:

Great Lakes	GC24WM	24J X 21.25W x 24.5 D Wall mount Cabinet
Great Lakes	GL600E-2432P	60 H x 24 W X 32 D
Great Lakes	GL720E2432	72 H x 24W x 32 D
Panduit	PRV10*	Front and back vertical cable manager, includes four PRSP7 slack spools. Dimensions: 83.9"H x 10.0"W x 16.4"D (2131mm x 254mm x 417mm)
Panduit	PRV8*	Front and back vertical cable manager, includes four PRSP7 slack spools. Dimensions: 83.9"H x 8.0"W x 16.4"D (2131mm x 203mm x 417mm)
Panduit	PRV6*	Front and back vertical cable manager, spools are not included. Dimensions: 84"H x 6"W x 16.4"D (2133.6mm x 152.4mm x 416.6mm)

3.2 Fiber Termination Equipment:

All multimode and single-mode fiber optic cable shall be terminated using appropriate cam-type LC connectors.

Fiber distribution in the telecommunications room shall be accomplished using fiber enclosures as specified below.

County approved fiber connectors and appliances are as follows:

Panduit	FLCDMCXAQY	LC OPTICAM ® 10GIG™ 50/125μm Multimode Duplex Fiber Optic Connector for 900μm tight-buffered fiber installation.
Panduit	FLCDSCBUY	LC OPTICAM ® Single mode Duplex Fiber Optic Connector for 900μm tight-buffered fiber installation.
Panduit	FCE1U	Holds up to four QUICKNET ™ Cassettes, FAP adapter panels, or FOSM splice modules.

		Dimensions: 1.73"H x 17.60"W x 16.30"D (43.9mm x 447.0mm x 414.0mm)
Panduit	FCE2U	Holds up to eight QUICKNET ™ Cassettes, FAP adapter panels, or FOSM splice modules. Dimensions: 3.48"H x 17.60"W x 16.30"D (88.4mm x 447.0mm x 414.0mm)
Panduit	FAPXWAQDLCZ	LC 10GIG™ FAP – Fiber adapter panel - LC 10GIG™ Duplex Multimode Fiber Optic Adapters (Aqua) with zirconia ceramic split sleeves where X is the number of duplex adapters. Number of duplex adapters available is 6, 8 and 12.
Panduit	FAPxWBUDLCZ	LC FAP loaded with LC duplex single mode fiber optic Adapters (Blue) with zirconia ceramic split sleeves where "x" represents the number of duplex adapters. Number of duplex adapters available is 6, 8 and 12.
Panduit	FXE10-10MxY	LC to LC multimode duplex patch cord, 1.6mm jacketed cable (one Duplex LC connector on each end) – 10GIG™ 50/125μm where "x" is the length in meters. Available lengths are 1 – 10 meters in 1 meter increments. Also come in 15, 20, 25 and 30 meter lengths.
Panduit	F9E10-10MxY	LC to LC single mode duplex patch cord, 1.6mm jacketed Cable (one duplex LC connector on each end) – 9/125μm where "x" is the length in meters. Available lengths are 1 – 10 meters in 1 meter increments. Also come in 15, 20, 25 and 30 meter lengths.

3.3 Testing and Acceptance

General

3.3.1 All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C series of Standards and TIA copper test document 1152. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

3.3.2 All cables shall be tested in accordance with this document, the ANSI/TIA Standards, the PANDUIT® CERTIFICATION PLUS℠ System Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the Salt Lake County project team for clarification and resolution.

3.4 Copper Channel Testing

All twisted-pair copper cable links shall be tested for compliance to the requirements in ANSI/TIA-568-C series of Standards and requirements in TIA-1152 for the appropriate Category of cabling installed.

A representative of the County's Inspection Team will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test

these randomly selected links and the results are to be stored in accordance with the prescriptions in this Section. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing and the cost shall be borne by the installation contractor.

3.5 Fiber Channel Testing

All fiber links shall be tested for insertion loss. Insertion loss budgets being calculated based on the recommendations contained in ANSI/TIA 568 C.0 and ANSI/TIA 568 C.3. Contractor shall provide written documentation to Salt Lake County for every fiber link tested showing all link components and how acceptable loss limits were calculated.

Contractor shall troubleshoot and correct any failing links with an OTDR if necessary to bring them within Standard acceptable loss limits.

4.0 SYSTEM DOCUMENTATION

Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to Salt Lake County for approval. Documentation shall include the items detailed in the sub-sections below.

Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. Contractor shall provide as part of this documentation copies of the original test results.

Salt Lake County may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by Salt Lake County, including a 100% re-test. Contractor shall assume all costs for retesting.

Test Results documentation shall be provided in electronic format within three weeks after the completion of the project. The media shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

The field test equipment shall meet the requirements of ANSI/TIA-568-C series of Standards and TIA 1152. Contractor is responsible to use the most current and appropriate level tester and most current software to verify all copper and fiber links.

Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form. The reports submitted shall contain the electronic test results as defined by this specification along with any software necessary to view and evaluate the test reports.

When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

The As-Built drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD) formats on which as-built construction information can be added. These documents will be modified accordingly by the Contractor to denote as-built information as defined above and returned to the Owner.

Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD) form.

4.1 Identification and Labeling

4.1.1 The contractor shall develop and submit for approval a labeling system for the cable installation designed in accordance with recommendations from the ANSI/TIA-606-A and ANSI/TIA-942 Standards. The County will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination with a unique encoded identifier for the cable within the system as per Standards. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

4.1.2 All label printing will be machine generated by Panduit EasyMark software and desktop printers and Panduit hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device. Hand-written labels will not be accepted.

5.0 HORIZONTAL PATHWAYS:

The Horizontal Pathway consists of a series of conduits, cable trays, cable hangers, chases, surface raceway, and power poles that connect the IDF to office work station area. It generally houses the horizontal system.

5.1 CONDUIT:

5.1.1 Metallic raceways or conduits shall be used to run cables point to point when intermediate splices or terminations are not required. This includes dedicated fiber to a specific point or a high degree of security. The applicable guidelines for the building entrance conduit apply along with the following:

5.1.2 They shall be used when it is not possible to conceal horizontal wire in the ceilings or floors, and when there is a security issue.

5.1.3 Conduits not being used must be threaded and capped at both ends. The bend radius and tensile strength rating shall not exceed the manufacturer's specifications at any time. The maximum specification for conduit shall contain no more than two 90 degrees bends. The inside radius of the bend not less than 10 times the normal diameter of the conduit and not less than 24 inches. All inside building conduit runs exceeding two 90 degree bends must contain accessible pull boxes. Conduit runs must not contain square or oval conduit fittings. Installation of the Structured Wiring System will only begin after it is approved by the COUNTY.

5.1.4 The Contractor must provide 3/32 inch O.D., 200 pound strength, polyethylene pull lines in all conduits.

5.1.5 Parallel cable runs, pulled through conduit raceway, shall be placed in as few conduits as space will allow. Active conduits shall be fully utilized before parallel empty conduits are used.

5.1.6 Contractor shall size all conduit and similar pathways so as not to exceed a 40% cross-sectional fill. Pathway sizing shall be based on the outer diameters (OD) of the cable being installed.

5.1.7 Conduit shall not be connected to audio or electronics ground except at equipment cabinet.

5.1.8 The Contractor must provide pull boxes in accessible positions with screw covers located as per recommendations in ANSI/TIA 569-B Standard.

5.1.9 Contractor will provide 2 4" conduits for entrance to the building to the telecommunications room for Century link

5.2 UTILITY POWER POLES

The utility power poles must meet the following specifications:

5.2.1 The power pole must be constructed specifically for use with the systems furniture installed at the site and shall be equivalent in size, structure, materials, and color as those poles provided by the County.

5.2.2 Provide a dual compartment with a metallic barrier separating telecommunications cables from electrical cables, per the latest National Electrical Code standards.

5.2.3 Provide knockouts for a minimum of two (2) duplex, eight-position, surface-mount jacks

5.2.4 Provide knockouts for a minimum of two standard duplex AC electrical outlets.

5.2.5 Surface mount boxes mounted to power poles are not acceptable, except when using existing power poles that do not have knockouts for faceplates.

5.2.6 The contractor is required to seek final approval from the County on the selection of a utility power pole type and color.

County approved utility poles are:

Panduit	PCPA11R20IW	11 foot dual channel aluminum pole equipped with pre-terminated electrical outlets and providing channel separation for the installation of communication cabling and modules.

Panduit	PCPA13R20IW	1c foot dual channel aluminum pole equipped with pre-terminated electrical outlets and providing channel separation for the installation of communication cabling and modules.

5.3 SURFACE RACEWAY

5.3.1 No cabling shall be exposed. All cabling shall be enclosed in conduit or in surface raceway. Surface raceway shall be used to route, protect and conceal cabling in offices and classrooms. Conduit shall be used to route, protect and conceal cabling in walls, warehouses, tunnels, outside and in the backbone (when required). Please refer to the project Scope of Work to determine if metallic conduit, metallic surface raceway, or plastic raceway will be required.

5.3.2 All surface raceway shall be of a single channel design or dual channel when electrical wiring is run in the raceway. Raceway shall be manufactured from impact-resistant material, or metallic, with a flammability rating of U.L. 94V-0.

5.3.3 Surface Raceway shall be available in multiple sizes and multiple colors. Contractor is to match color as close as possible the aesthetics of the office environment of the installation site. Raceway finish shall be pure color and will resist scratches and dents and will not peel or corrode. Contractor must receive approval from Salt Lake County prior to installation of surface raceway.

5.3.4 All surface raceway shall have a full complement of bend radius control and standard fittings including, but not limited to: elbows (internal & external), couplings for joining raceway sections, blank end fittings for closing open ends of the raceway, and tee fittings.

5.3.6 All surface raceway shall incorporate a minimum bend radius as recommended for Category 6S UTP & fiber optic cables.

5.3.6 All surface raceway shall consist of an adhesive backed base and cover in sections. Securely install all surface raceway by using proper installation screws into walls. Screws shall be within 2" of the top and bottom of each end and shall have mounting screws at 6" intervals.

5.3.7 Standard of Quality is Panduit Pan-Way Surface raceway, or equivalent for plastic raceway. Metallic Surface Raceway's standard of quality will be Panduit Metallic Raceway, or equivalent.

5.3.8 Contractor shall ensure that all components such as surface boxes, faceplates, etc. are of the same manufacturer and compatible with the surface raceway provided.

5.3.8.1 Surface Mount Boxes shall be single gang low profile box allowing the utilization of up to 6 ports, or a double gang low profile box with up to 10 ports. The box shall be 1.06" in height and must match the color of the surface raceway installed. The box shall mount with adhesive and screws onto the mounting surface.

5.3.8.2 Faceplate shall be an angled 4-port single gang faceplate with screw cover, labels, and a curved designer appearance as specified earlier in this document, unless otherwise indicated by the County. Each faceplate shall accept individual connector modules. The faceplate must match the color of the surface mount box and/or surface raceway and Contractor is responsible for providing blank inserts for any faceplate holes not populated.

5.3.8.3 All outlets shall utilize interchangeable connector modules that mount

side by side to facilitate moves, adds and changes. Connector modules shall be available to support high performance copper and fiber cabling systems.

5.3.9 When security is an issue, and only when requested by the County, the Contractor shall supply metallic raceway metallic faceplates.

County approved raceway systems are:

Panduit	Latching Duct single channel plastic raceway	Available in sizes LD3, LD5 and LD10 in colors Office White, Electric Ivory, International Gray and White in lengths 6, 8 and 10 feet.
Panduit	T-70 raceway – plastic dual channel	Dual channel raceway for running power and communications cabling in same raceway.
Panduit	PMR5/PMR7 Metallic Raceway	Metal raceway in areas where security is an issue.
Panduit	PMR40 dual channel metallic raceway	Dual channel metallic raceway for running power and communications in the same raceway.

5.4 SYSTEMS (MODULAR) FURNITURE

Office furniture will be the responsibility of the Agency. The Agency will provide the Contractor with the contact name and telephone number of the office furniture installing company and the office furniture manufacturer. The Contractor will be responsible for obtaining the proper mounting hardware and for planning the installation of cables through office furniture troughs. The material and installation cost will be included in the contractor's bid response. NOTE: CATEGORY 6A CABLE (OR ANY CABLE RUNNING AT SPEEDS AT 100 MEGABITS OR HIGHER), SHALL NOT BE PLACED IN THE BOTTOM CHANNEL OF MODULAR FURNITURE WITH ELECTRICAL CABLE. ALL CATEGORY 6A CABLE SHALL BE PULLED IN THE TOP CHANNEL OF THE MODULAR FURNITURE OR IN MODULAR FURNITURE RACEWAY DESIGNED TO THAT PURPOSE.

6.5.1 The Contractor is responsible for and required to provision and install all necessary materials to effect the cabling of the systems furniture.

6.5.2 Flexible conduit, elbows, wall face-plates, and connection hardware must be supplied and installed by the Contractor and must be compatible with the Modular Furniture.

6.5.3 The Contractor is required to put in place all systems furniture top or base plates, which have been left open for the installation of communications cabling.

6.5.4 Standard of quality for Category 6A Cable pathway for modular furniture will be

Panduit Pan-Way Office Furniture Raceway System.

6.5.4.1 Must be UL listed in accordance with UL-5C requirements for Class 2 Communication Cable Management Systems

6.5.4.2 Must maintain bend radius control throughout the entire Office Furniture Raceway System as required by TIA Standards.

6.5.4.3 Faceplates must be compliant with labeling requirements of TIA/EIA-606-A standards.

6.5.4.4 Must be designed for tamper resistant closure.

6.5.4.5 Must be supplied with adhesive backing for fast and easy installation.

6.5.4.6 Top cap width must be between 1.88" and 2.30" and must be compatible with all common manufacturers of modular furniture.

6.5.4.7 Must be designed for jack placement at the desktop.

6.5.4.8 Must have all raceway fittings necessary for a complete modular furniture installation.

County approved modular furniture raceway systems:

Panduit	Pan-Way	Office furniture raceway system. Mount along top of modular furniture placing drops on desk level. Available in colors Office Beige, Office Slate, Office Gray and Medium Tome.

5.5 OPEN OFFICE CABLING

Zone cabling strategies, where necessary, shall be of the type "MUTOA" – (Multiple User Termination Outlet) or "CP" (Consolidation Point). Whichever strategy employed shall adhere to all recommendations contained in ANSI/TIA 568 C.1 – "Building Telecommunications Cabling Standards".

5.6 INNERDUCT SPECIFICATIONS

Innerduct shall be U.L. Listed, non-metallic corrugated flexible raceway used to route fiber-optic cables in the horizontal cable routes from the IDF to the work area jack locations. All Innerduct shall have the following specifications:

6.7.1 Innerduct shall be available in ¾" through 2" sizes for indoor use.

6.7.2 Innerduct shall be "orange" in color.

6.7.3 All Innerduct will be plenum rated in accordance with the NEC 1999 (Article 770-53).

6.7.4 All Innerduct installed will include pre-installed pull tape.

6.7.5 All couplers and adapters shall be of the same manufacturer as the Innerduct and shall be installed in accordance with manufacturer's specifications.

6.7.6 Standard of quality for Innerduct is Carlon Plenum-Gard / Riser-Gard, or equivalent.

6.0 BUILDING AUTOMATION SYSTEMS (BAS):

- Building Automation Systems include the following type of systems:
- Fire Alarm Systems (FA)
- Security & Access Control Systems (SAC)

- Heating, Ventilating, and Air Conditioning Systems (HVAC)
- Energy Management System (EMS)
- Lighting Control Systems (LC)
- Future Automation Systems
- Most BASs operate using low-speed data networks or local area networks (LAN) typically transmitting at rates less than 1 Mbps in the horizontal and up to 10 Mbps in the backbone (riser). By providing a common cabling distribution system for voice, data, video, and BAS it is possible to reduce construction cost by as much as 25% to 50%. This is because the various systems can use the same pathways, equipment rooms, and most importantly one-project team to engineer, install, and project manage the installation of all cabling. This creates an Intelligent Building that also can reduce the cost of operation of these systems by integrating the cabling infrastructure.

6.1 APPLICABLE STANDARDS ALLOWING THE USE OF COMMUNICATION CABLES

NEC Article 725-61(g) permits communications cables to be substituted for traditional Class 2 or Class 3 cable types (i.e. CL2, CL3, CL2R, CL3R, CL2P, CL3P)

NEC Article 760-8 addresses installation of fire alarm cables and references ANSI/TIA/EIA-568-B as nationally recognizes standards that determine acceptable industry practices.

NEC Article 760-54(b) allows conductors of power-limited fire alarm circuits, Class 2, Class 3, and communications circuits to share the same cable, enclosure, or raceway.

NEC Article 760-61(d) permits communications cables to be substituted for traditional power-limited fire alarm cables types (i.e. FPL, FPR, and FPLP).

NEC Article 820-53(d) permits communications cables to be substituted for traditional coaxial cable types (i.e. CATV, CATVR, CATVP, and CCTV).

6.2 FIRE ALARM SYSTEM RESTRICTIONS

In the installation of FA structured Cabling it is important to consult and comply with the local Fire Codes for the installation site. Please note that only Power-Limited Fire Alarm (PLFA) can be integrated into the structured cabling system using communications-type cables. Non-Power-Limited Fire Alarm (NPLFA) use high voltage electrical cable and can only be installed by a certified electrician.

6.3 COVERAGE AREA (CA)

The coverage area is served by a BAS device. The BAS device can be connected to the horizontal cabling using:

Unshielded twisted-pair (UTP) cable from the Horizontal Cross-connect.
UTP cable or cordage from an outlet or control panel (CP).

Note, when hardwiring twisted-pair communications cabling to a BAS device, it may be necessary to use spade-tip or sleeve connectors to interface the cable connectors to the terminal strip. Always follow the manufacturer's specifications for terminating the cable. Always use an approved connector that properly fits the terminal strip connection of the device.

6.4 HORIZONTAL CABLING REQUIREMENTS

6.4.1 A minimum of Category 5e cable will be used to connect BAS devices to a horizontal channel with copper cable. A minimum of 50/125 micron Fiber-Optic cable can also be used when fiber is preferred over copper by the

manufacturer of the BAS equipment.

6.4.2 When connecting BAS devices to a horizontal channel, design and methods shall adhere to all Standards and codes referenced in the beginning of this document, including the distance limitations.

6.4.3 Follow the BAS vendor's guidelines, or the manufacturer's guidelines (if available) to determine the distance limitations and number of devices that can be connected to a horizontal cable run.

6.4.4 Although it is allowed by the NEC, BAS signals should not share the same horizontal cable as the telecommunications signal.

6.4.5 Each different BAS function (i.e. fire alarm, security, HVCA, and EMS) should us a separate 4-pair UTP cable with a minimum of four (4) 4-pair UTP cables for applications that include all four functions.

6.4.6 Signals from systems such as audio circuits (i.e. speakers and emergency sound) and some analog input/output circuits have sheath-sharing restrictions and may require separate cables for each audio, digital, or analog circuit. Consult the manufacturer's recommendations or requirements.

6.4.7 Horizontal cables should be limited to one device per cable run in order to provide maximum flexibility for future changes, but may contain as many as five devices per run in order to reduce cabling costs and still provide for some future flexibility.

6.4.8 Multiple horizontal cables can also be bridged or chained at the Horizontal Cross-connect located at the Telecommunications Room (TR) or CP,

in order to extend a coverage area
in order to connect multiple horizontal cable runs to one BAS controller point
in order to create a fault-tolerance circuit
or to connect multiple devices to one horizontal cable.

Grounding and Bonding

The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB and associated earthing system shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/J-STD-607-A Telecommunications Bonding and Grounding Standard, ANSI/TIA-942 Data Center Standard and all grounding recommendations contained in the TIA 568-C series of Standards.

The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective

TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

All conductors used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the requirements outlined in ANSI/TIA-606-A, ANSI-J-STD-607-A, ANSI/TIA-942 and the ANSI/TIA-568-C series of Standards. All labels shall be machine-generated. Hand-written labels shall be removed and replaces with printed labels at Contractor's cost.

All racks shall be outfitted with a vertical grounding busbar. Any equipment provided with grounding terminals shall be bonded to the rack mounted vertical busbar according to manufacturer's recommendations. Any equipment without built-in grounding terminals shall be bonded to the rack using thread-forming grounding screws. Contractor shall install wall-mount telecommunications grounding busbars (TGB) in any telecom room not having one. All racks shall be bonded to the TGB using rack grounding conductors. Contractor shall install electro-static (ESD) discharge ports on no less than every-other rack. Contractor shall provide one wrist-grounding strap per each ESD port installed.

For illustration proper rack grounding see fig. 1 below.

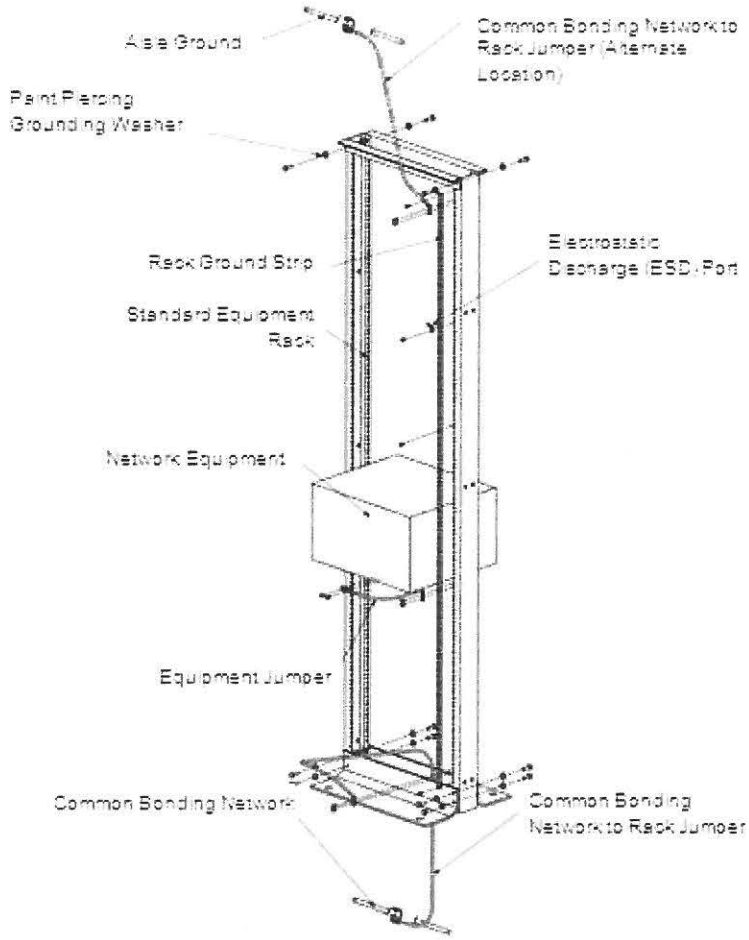

Figure 1 - Properly Grounded/Earthed Rack (Back of Rack Shown)

Contractor as part of design/build bid assumes all responsibility for sizing and length of all grounding products and conductors.

Approved bonding/grounding products for Salt Lake County are as follows:

Panduit	RGS134-1Y	Rack Grounding Strips (vertical grounding bus bars) for threaded rail fasteners. Each piece of active equipment shall be attached to this vertical bus bar.
Panduit	GJ6XXUH	#6 AWG green wire with yellow horizontal stripe to bond rack to wall mounted telecommunications grounding busbar (TGB). Jumper is pre-terminated on one end with LCC6-14JAWH-L and the other end with LCC6-14JAW-L. "XX" in part number is length in inches with available lengths being 72", 96", 120", 144", 168", 192", 216", 240", 264", and 288".
Panduit	GB2B0314TPI-1	Telecom room wall mount telecommunications grounding busbar (TGB) 1/4" x 2" x 24"
Panduit	RGESD2-1	Electrostatic discharge port - should be installed on every-other rack/cabinet.
Panduit	RGESDWS	Electrostatic discharge straps for the ESD ports - should be installed on every-other rack/cabinet.
Panduit	RGTBSG-C	Green thread forming bonding screws with serrated heads to bond panels and equipment not outfitted with grounding terminals to the rack.
Panduit	RGTS-CY	Thread forming screws to attach jumpers to rack/cabinet busbars.
Panduit	RGEJ624PHY	#6 AWG (16mm^2) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws.

Fire stop

A fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped. Fire stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed fire stop system, stamped/embossed by the PE shall be provided to the County Technical Representative prior to installing the fire stop system(s).

Product Substitutions

This is a performance-based specification and substitutions are not allowed.

In the Rare occasion a substitution is required then all Substitutions must follow the same rigid standards for quality and termination style as those products specified herein.

Any Contractor wishing to offer structured cabling products other than those specified shall submit a request for product substitution in writing no less than one week in advance of bid. Written requests for substitution shall be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results where appropriate proving equivalency in transmission performance and mechanical function.

This written documentation shall be accompanied by three each samples of the substitution product being offered for evaluation. Equal product acceptance must be received from Salt Lake County in writing.

Contractor shall be responsible and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs shall include, but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

7.0 COMMUNICATION EQUIPMENT ROOMS

7.1. Definitions

7.1.1 Building Distributor (BD): A room from which intrabuilding backbone cables distribute to floor distributors. May also be a floor distributor if horizontal cables terminate within it. May also be an equipment room if PBX or core network electronics are present.

7.1.2 Building: All structures that include an OPS element that are not defined as spaces. These may include structures not normally occupied, such as storage a shed and athletic fields.

7.1.3 Entrance Facility (EF): A room into which inter-locking backbone cables enter. Cables may or may not terminate in this room. Most often, an EF is the BD.

7.1.4 Equipment Room (ER): A room containing voice and data electronics. Reserved for rooms with enough electronics to impact space and cooling requirements (rooms with PBX hardware or core network electronics).

7.1.5 Floor Distributor (FD): A room into which horizontal cable terminates. May be any of the above rooms as well. An FD with minimal switches to support the horizontal cables only is usually not considered and equipment room.

7.1.6 Network Room (NR): A generic term for any of the above terms. The preferred term, unless a more specific term is needed to better define specific requirements for the room.

7.2 Network Room Provisioning

7.2.1 Network Room sizing shall be based on BICSI "Serving Area" chart. (e.g. 5000 sq ft room will be 10ft X 8ft, 5000sq ft to 8000sq ft room will be 10ft X 9ft, >8000sq ft room will be 10ft X 11ft). In all cases any building >5000sq ft shall have a minimum Network Room size of 10ft X 8 ft. Buildings <5000sq ft can use BICSI specified shallow rooms or cabinets. Use of shallow rooms or cabinets will be considered and approved by Salt Lake County.

7.2.2 Each Network Room shall have two (2) walls covered with ¾" AC grade plywood. Plywood will be installed from finished floor to 96 inches above finished floor. Plywood will have two (2) coats of fire intumescent paint, color white. The plywood shall be anchored every two feet around the perimeter of the board only (no anchors 6 inches from an edge) galvanized or stainless steel anchors.

7.2.3 Each Network Room shall have a minimum of three (3) dedicated 120V-20AMP duplex outlets installed on walls with plywood. It would be preferred that these outlets be split between two or more load centers. One (1) 120V-15AMP convenience outlet shall be installed near entrance to room.

7.2.4 If fire protection is provided sprinkler heads shall have wire cages installed and troughs to prevent accidental discharge and prevent accidental operation.

7.2.5 Equipment not related to the support of the Network Room such as piping, duct work, and power shall not be located in or pass through the Network Room.

7.2.6 In cases where cable runs will exceed 90 meters a second Network Room shall be installed.

7.2.7 Network Rooms shall be entered through common space and not be a pass through to another room.

7.2.8 Shared use of Network Rooms shall be avoided.

7.2.9 Network Rooms shall have independent cooling provided with thermostat located within the room. Cooling calculations (BTUs) will be provided to Designer when cable counts are completed. Cooling units will be installed so that no condensate will drip on equipment or cables.

7.2.10 Network Rooms shall have a minimum ceiling height of 10 feet above finished floor. Under no circumstances shall a drop ceiling be installed.

7.2.11 Light Fixtures shall not be installed Below 8 foot 6 inches. Light must provide 500 lux (50 foot-candles at 3 feet above finished floor. Lighting switch must be located inside Network Room.

7.2.12 Network Room installation of ladder rack, racks, UPSs, patch panels, wire management, cable termination, active equipment, power strips punch down blocks, and grounding shall be completed by Contractor

7.2.13 Installation of zone cabinets shall be done according to manufactures recommendations and be sized for 50% capacity when project is completed.

END OF SECTION

Attachment B

Inter-Building (Campus) Backbone Specifications

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Attachment B
Inter-Building (Campus) Backbone Specifications

1.0 BUILDING ENTRANCE FACILITIES

1.1 UNDERGROUND SERVICE ENTRANCE

1.1.1 General:

Telecommunications facilities must enter and terminate in a location where they can serve the occupants of a building. The entrance facility consists of the path these facilities follow on private property that includes the entrance point through the building wall and the pathway continuing to the entrance room or space. The service entrance path is usually from an underground path through the building wall for connecting the Local Exchange Carrier (LEC) to the building wiring plant, and that is the main topic of this section. Other service entrances, such as aerial, are discussed at the end of this section.

The MDF/Entrance room or space is the component of the entrance facility that provides space for the termination of entrance and vertical riser cable. It may contain network interface devices and telecommunications equipment. When telecommunications equipment is located in the entrance room or space, the entire room or space shall meet the requirements for an equipment room since additional space will be needed.

The size of pathways, between the entrance point and the entrance room or space, shall be the same as the entrance pathways unless the route is through open accessible areas. In such cases, the pathway placed may be only for those cables initially installed with supporting structure adequate to accommodate future pathway requirements.

For new construction Salt Lake County Telecommunications (SLCT) will coordinate with the LEC the installation of local service and the establishment of the DMARC at the MC. For existing facilities where the DMARC will be moved to the MC, SLCT will also coordinate with the LEC. For existing facilities where the DMARC will not be moved to the new MC the Contractor will provide an appropriately sized Tie-Cable to connect the DMARC with the MC as part of their bid.

1.1.2 Entrance Considerations:

Salt Lake County must contract with the LEC or the Contractor to construct various distribution conduit pathways, usually from the main terminal location or building entrance location to the property line, pole, or manhole, to support the cable plant facilities. Included within this scope of work are easements, permits, and right-of-ways for the excavation and placement of new multiple plastic ducts and/or conduit.

It is Salt Lake County's responsibility to contact all Local Exchange Carriers and telecommunications providers that will be involved in providing service to the building. The purpose is to establish their requirements, review any associated engineering documents and explore alternatives for delivering service. Then, Salt Lake County can determine the quantities of materials needed to meet the requirements of the systems

requested. Contractors must notify Salt Lake County of any discrepancies in the documentation or associated drawings. Spare capacity for future growth must be provided and this spare capacity includes "planned" areas where, currently, no buildings or small concentrations of owned buildings presently exist.

The designs of conduit or duct systems are governed by the installation requirements of the NEC, EIA/TIA Standards and the BICSI Telecommunications Distribution Methods Manual. The Contractor must include Outside Plant (OSP) cable for underground, direct buried, submerged or submarine applications; hand holes, man holes, pedestal or cabinets; all installation hardware; poles for aerial cable installations; and all hardware for installation and access.

When a direct buried cable plant is allowed and a rock base is located, sand padding must be provided in the bottom of the trench. All backfill must be free of rock and other debris to avoid damage to the direct buried cable. In addition, the trench must be a minimum of 24 inches deep for copper, 36 inches deep for fiber, and must be tamped with a mechanical impact device. A direct buried cable plant should include a buried "detectable warning tape" 18 inches below grade along the path.

1.1.3 Permits/Easements/Right-of Ways

All trenching within a public right-of-way owned by or under the jurisdiction of the City, the County, or Salt Lake County, must conform to the appropriate codes. Salt Lake County is responsible for obtaining permits and for ensuring that the most current standards are met. New conduit distribution routing will be determined by Salt Lake County and/or the appropriate authority for obtaining right of ways, permits, etc. It will be the agency's responsibility to coordinate with Salt Lake County and all utilities to avoid interrupting their service. Salt Lake County Telecommunications could delegate these tasks to the contractor but will retain responsibility for their completion.

1.1.4 Existing Distribution Facilities:

After the inside wiring from the Local Exchange Carrier (LEC) was deregulated, the end user became responsible for this function. The LEC transferred ownership of all intra-building wiring and equipment that was currently installed to the building owner. County owned buildings except facilities recently rewired with a structured wiring plan have an intra-building telecommunication wiring plant that is now owned by the County. That means that any anticipated wiring changes or additions concluded on the building equipment must be reported by the Contractor to Salt Lake County who will verify that no special circuits will be effected and will document the change to maintain an accurate record of the inside wiring plant within the building. If this procedure is not rigidly adhered to, the Contractor may be liable for the cost to repair any damage or to restore functionality to the building.

Salt Lake County reserves the right to purchase selected portions of the existing Outside Plant and Inside Plant from the local exchange carrier or any other carrier. This will only be done where Salt Lake County and Contractor agree that the selected portions are in good working condition.

Any existing Outside Plant that the Contractor contemplates reusing will require the approval of Salt Lake County. If approved for use, it will be completely tested and guaranteed by the Contractor under the same warranty as new cable plant.

Upon County approval for use of existing conduit, the Contractor must remove any unused existing wire or cable to clear conduits for new placements. County approval is

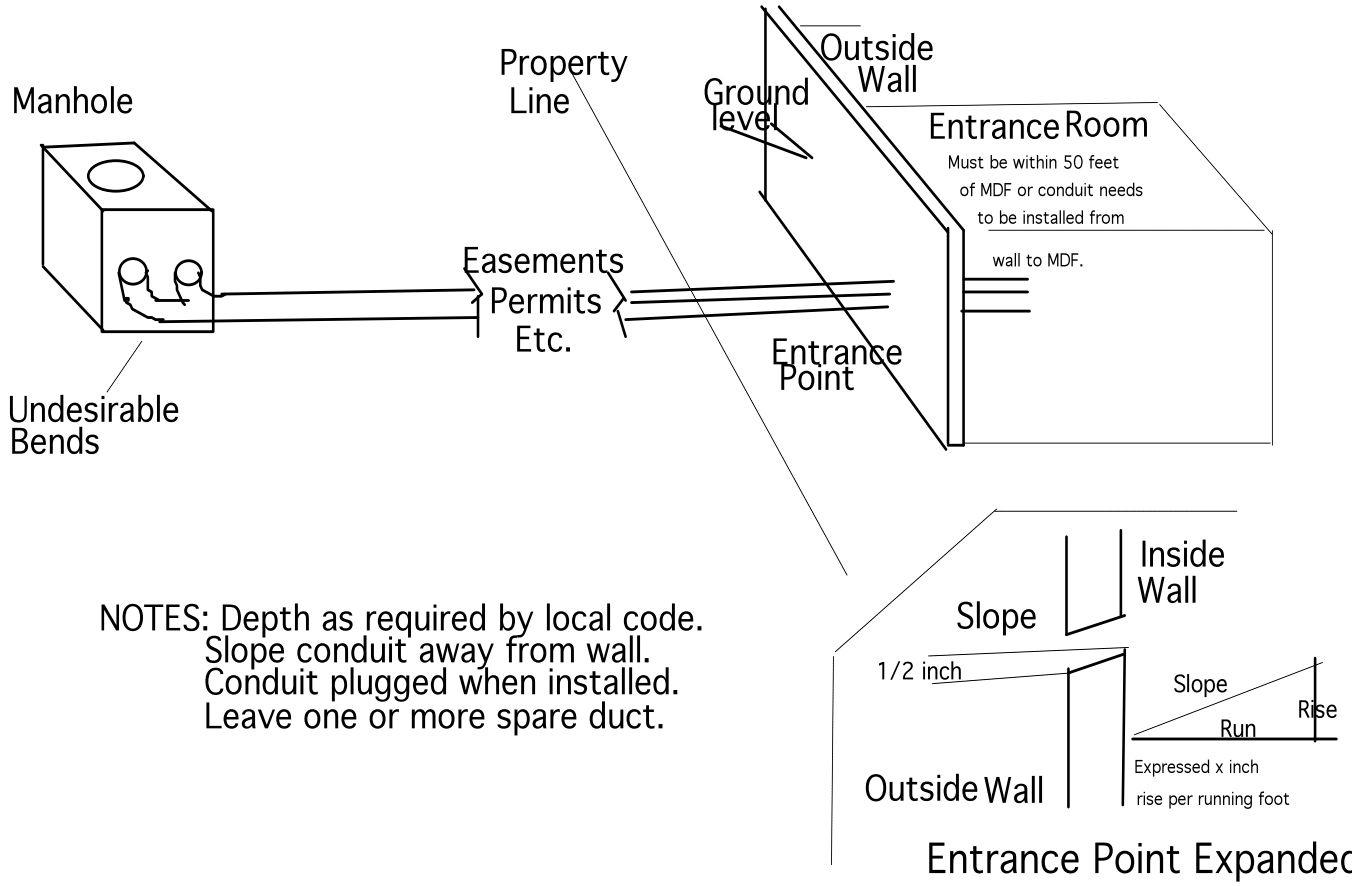
required prior to removal or rearrangement of any existing cable, wiring, or plant facilities. Any additional cost for wire removal will be included in the Contractor's bid.

Used cable and conduit will be inventoried and mapped on the appropriate "as-built" drawings by the Contractor. Re-used cable plant will be free of contaminating circuits, bridges, and taps. All distribution frames scheduled for reuse will be refurbished (physically and electrically), and re-identified to the satisfaction of Salt Lake County. All conduits approved for re-use must be certified by the Contractor to be a clear, sound path for cable pulling before cable installation. Salt Lake County will provide assistance in locating existing cable and conduits and any records that are available.

Salt Lake County requires that only existing conduit previously allocated for telecommunications be used in any distribution design bid. Use of any existing or future electrical distribution conduit in any part of the system for communications cables shall not be permitted. **Salt Lake County prefers the installation of new conduits whenever possible.**

1.1.5 Entrance Conduit:

Conduit should be provided into the building based on the number of wire pairs that will be required to provide telephone service. The local serving telephone company determines the number of pairs that they will install into the building. The Contractor can assume 3 cable pair for each 160 square foot area of office space to determine the amount of entrance conduit required for their installation. All entrance conduit will be continuous, and will be installed from the designated property line to the Main Distribution Frame (MDF). The following are requirements for conduit installation:



1.1.5.1 See NEC, EIA/TIA Standards and the BICSI TDMM for installation requirements.

1.1.5.2 All communication conduits either in a duct bank or within a building shall not exceed two (2) ninety (90) degree bends in a given length. This is different where electrical permits three (3) ninety (90) degree bends.

1.1.5.3 All single four (4) inch conduit lengths must have true circular cross sections providing a clear even raceway.

1.1.5.4 Change to steel conduit must be made with steel to PVC or steel to polypropylene adapters.

1.1.5.5 In making joints, the ends and couplings must be coated with joint adhesive or sealing compound approved by the duct manufacturer and driven into a tight fit. All excess compound must be removed.

1.1.5.6 Plastic or manila rope should be used when and where possible, for pulling in cable. Appropriate construction equipment must be used, and all precautions must be taken to prevent damage to plastic duct.

1.1.5.7 Conduit ending in manholes, building entrances, etc., must be terminated with waterproof bell ends or conduit terminators.

1.1.5.8 Spare ducts terminating outside a manhole must be sealed with waterproof caps.

1.1.5.9 All vacant ducts terminating inside buildings or manholes must be sealed at each end with mechanical duct plugs. Cable filled ducts throughout the conduit distribution system must be sealed with an expandable urethane foam. Vacant ducts will contain a 1/4 inch polyethylene pull rope.

1.1.5.10 Distribution conduit and multiple plastic duct must be sized to allow at least a 20% growth for any type of cable installed.

1.1.5.11 All conduit duct banks must be of uniform construction. Where a connection is made to a manhole or building, the concrete encasement must be well bonded or doweled to the structure and a waterproof seal provided. Multi-cell conduit shall be incorporated in telecommunication pathways to support future applications.

1.1.5.12 Duct spacers or duct tiers must be installed at ten (8) foot intervals to support and secure the conduits of the duct banks while pouring of concrete.

1.1.5.13 All grounding shall be per NEC, EIA/TIA Standards, and BICSI's TDMM.

1.1.6 **Allocation Requirements:** Salt Lake County requires that all differing cable types be installed in separate and distinct conduits, cells or innerducts throughout the distribution conduit system. The exception to this rule is cable installation in County approved direct buried cable routes. Salt Lake County will allow the use of Innerduct installed within the four (4) inch (diameter) conduit or cell for fiber optic or other types of specialized cable. However, in those instances where Innerduct would be installed, a distinct separation between the twisted pair, fiber optic cable and other specialized cable must be maintained. Fiber optic and specialized cable, if installed in Innerduct, must be in separate four (4) inch primary conduits or cells. Additionally, where Innerduct is installed within a four (4) inch conduit for twisted pair cable, the specified fill for that

conduit must not be exceeded. Acceptable distribution conduit for cable allocation follows:

1.1.6.1 Copper conductor twisted pair cable will be installed in the four (4) inch primary conduit or cell only. Innerduct is not acceptable for installing twisted pair cable without prior approval of Salt Lake County.

1.1.6.2 Coaxial and specialized cable must be installed in Innerduct in a separate conduit or cell from that used for twisted pair or fiber optic cables.

1.1.6.3 All necessary steps must be taken to ensure sheath continuity for grounding purposes.

1.1.7 **Cable Splicing:** All cables designed to carry low voltage signals into the building, for the vertical riser systems or the horizontal distribution system, must meet the following rules for cable splicing:

1.1.7.1 Cable must be splice free from the building entrance to the termination point except for a single non-plenum to plenum or transitional splice when the cable enters the building.

1.1.7.2 If a transition splice must be made in a plenum area, the non-plenum cable and the splice must be encased in an approved plenum rated material.

1.1.7.3 All Intra-building splice cases will be rack and hook supported or secured through a County approved method.

1.1.7.4 No splices of any type will be pulled into conduits or innerducts.

1.1.7.5 All cable splicing must give high quality of continuity connections. If pairs are not spliced, they must be cleared, capped and waterproofed.

1.1.7.6 Splicing of station wiring will not be allowed.

1.1.8 **Conduit Testing:** All conduit distribution routes associated with any new system will be "tested" and "verified" after installation activities and all major plant rearrangements have been completed. Each conduit section (between manholes/pullboxes or buildings, etc.) will be fully cleaned with a mandrel before installing additional sections. All conduit trenches will be backfilled with County approved fill and compacted as specified in this document. Compacting will be verified before paving where applicable. The vendor will supply complete testing and correction reports, information, and explanations to Salt Lake County or its designated representative for review prior to acceptance of the conduit distribution system. The vendor and Salt Lake County will develop a mutually acceptable format for recording and reporting test results before the start of resting activities. Salt Lake County reserves the right to witness all testing.

1.1.9 **Entrance Conduit Capacity:**

1.1.9.1 The following schedule will be used for entrance conduit unless additional conduits are required to meet other needs such as a video, tie cables, miscellaneous circuits or dual feeds.

NUMBER OF COPPER PAIRS	CONDUIT REQUIRED
1-1000	one 4" and one spare 4"
1001-2000	two 4" and one spare 4"

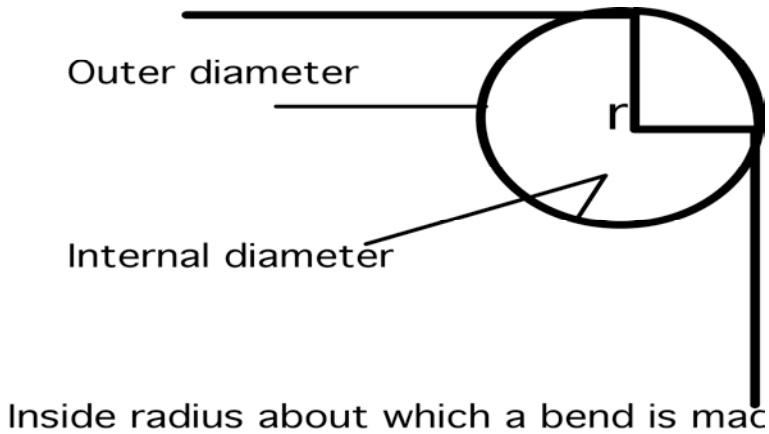
1.1.9.2 In addition to the size, conduit and duct is available in a variety of types and

shapes as follows:

- PVC Type EB - a thin wall plastic requiring concrete encasement.
- PVC Type dB - a heavier walled plastic that can be directly buried.
- PVC Type Schedule 40 - ultraviolet (sunlight) and flame resistant.
- PVC Type Schedule 80
- STEEL - A rigid metal conduit made of galvanized steel: EMT, IMC, in addition to GRC depending on the application.

1.1.9.3 If the entrance cables will include fiber optics, the fiber optic cable shall be placed inside a separate conduit designated for fiber. CATV, or other signal grade service will be placed in separate like entrance conduits or in segmented 4 inch existing conduits.

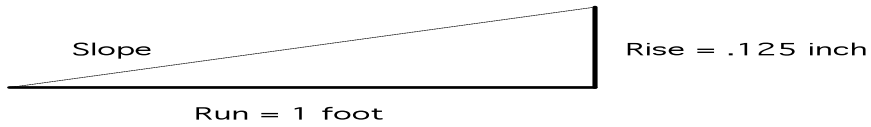
1.1.10 **Conduit Bends:** Bends in underground conduit and duct are undesirable, however, when required up to two 90 degree bends are permitted. They will have a radius not less than six times the internal diameter of conduits 2 inches or smaller, or ten times the internal diameter of conduits larger than 2 inches. These bends are NOT permitted in other than steel conduit or duct and the bend section shall be concrete encased.



1.1.11 **Pull And Junction Boxes**: Pull boxes and junction boxes shall be minimum 4 inch square(100 mm) by 2 1/8th inches(54 mm) deep for use with 1 inch(25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square(117 mm).

For telecommunication and fiber optic cable installations the NEC requirements apply regardless of wire size. All boxes used on telecommunication and fiber optic systems with conduits of 1 1/4" and larger shall be sized per the NEC conduit requirements. For these installations the conduit is the determining factor not the wire size.

1.1.12 **Drain Slope:** Underground conduit should be installed such that a slope exists at all points of the run to allow drainage and prevent the accumulation of water. A drain slope not less than 0.125 inches per foot is desirable. The conduit should slope downwards away from the structure. Where water infiltration is anticipated, an exterior drainage box shall be installed at the entrance point.



Expressed .125 inch rise per running foot.

1.1.13 **Sunlit Areas:** Fiberglass or PVC type D conduit is preferable for any section of conduit exposed to sunlight. When a length of conduit is exposed, the use of an expansion joint should be considered.

1.2 OTHER SERVICE ENTRANCES:

1.2.1 **Aerial Entrances:** Aerial entrances are generally undesirable because of no mechanical protection of the facility, the required clearances, and storm loading requirements, to name a few reasons. Aerial cable construction will be allowed only in special applications.

When aerial construction is necessary, the maximum span from the last pole to the building should not exceed 100 feet. Use slack span construction that will place as little pulling tension as practical on building attachments and support structures. Aerial cables should enter buildings through a raceway equipped with an approved service head.

1.2.2 **Rooftop Entrances:** All rooftop installations must be reported to Salt Lake County. DFD will then perform engineering studies to determine the stress loads and other necessary criteria.

One of the major considerations of an aerial entrance is the proper clearances required. These should be obtained from the local codes, but the following can serve as guidelines:

❑ From power supply at pole	40 inches
❑ From power at mid-span sag	12 inches
❑ From building power conductors	4 inches horizontal, 12 inches vertical
❑ From traffic	15.5 feet vertical
❑ From pedestrian	9.5 feet vertical
❑ From rooftop	8 feet
❑ From roof overhang	18 inches
❑ From railroad tracks	23.5 feet
❑ From vertical roof conduct	6 feet horizontal

1.2.3 **Antenna Entrance:** Antenna field entrance rooms shall be designated per applicable code. The antenna pathway from the antenna field to the entrance room shall provide isolation for the antenna cables from other backbone cables. The antenna entrance room shall be located as close as practicable to the antenna field.

1.3 ENTRANCE POINT:

1.3.1 **General:** An entrance point is a component of the service entrance facility, and is the point of penetration of the foundation wall. The 4 inch metal conduit or sleeve shall be the only pathway used for the entrance point. The conduit entering from below grade shall extend 4 inches above the finished floor. If the conduit enters from a ceiling it will

terminate 4 inches below the finished ceiling.

1.3.2 **Foundation Penetration/Termination:** The conduit shall extend into undisturbed earth (beyond the backfill area next to the wall) and at least 5 feet beyond the foundation's exterior. When terminated at the inside of the building wall, the conduit shall have a smooth bell-shaped finish unless it extends to the entrance room or space. The conduit or sleeve shall be securely fastened to the building and grounded by use of a grounding bushing.

1.3.3 **Conduit Infiltration:** All conduit shall be plugged to restrict infiltration of gas, water, and vermin. An external venting system may need to be installed to ensure that gases do not enter the building.

1.3.4 **Lightning Protectors:** The national electric code requires properly grounded lightning protectors on incoming telephone cable. The lightning protectors are for personnel safety and to some degree protection of telephone equipment. The telephone cable terminates on the lightning protector and a cable leaves the lightning protector and goes to the demarcation point. In some cases the serving telephone company may use a protected terminal that allows customer connections right at the protector. In these cases the terminal where a customer makes connections is the demarcation point. **FACILITY WILL ALWAYS HAVE INSTALLED A SECOND SOLID COUNTY PROTECTOR SYSTEM BEHIND ALL TELCO PROT4ECTION TO PROTECT COMMUNICATIONS SYSTEMS.** All copper entrance will be terminated on properly grounded 2-stage solid-state protection. The protection shall be UL approved protectors for all types of inter-building cabling. These protectors must be installed close as possible to the point where the cabling enters the building, and the installation and grounding must conform to current NEC codes and customer provided equipment vendor's specifications. **CAMPUS COPPER DISTRIBUTION SYSTEMS WILL ALWAYS PROVIDE LIGHTNING PROTECTION ON BOTH SIDES OF THE COPPER CABLES. ALSO NOTE THAT DUE TO DROUGHT LIKE CONDITIONS ALL FACILITIES SHOULD REINSTALL ALL GROUNDING RODS TO A DEPTH OF AT LEAST 30 FEET.**

1.4 NETWORK DEMARCATION POINT (MPOP):

The network demarcation point is the interconnection between the Local Exchange Carrier's telecommunications facilities and the telecommunications wiring of the building's facilities. The demarcation point is sometimes called the Standard Network Interface (SNI). It refers to Part 68.3 of the FCC's Rules and Regulations (Chapter I of Title 47 of the Code of Federal Regulations). It states that the Standard Network Interface demarcation point is "The point of interconnection between telephone company communications facilities and terminal equipment, protective apparatus or wiring at a subscriber's premises. The network interface or demarcation point shall be located on the subscriber's side of the telephone company's protector or the equivalent thereof in cases where a protector is not employed, as provided under the local telephone company's reasonable and nondiscriminatory standard operating practices. While the SNI is located on the subscriber's side of the protector, the SNI is part of the Telephone Company's network facilities. The means of connection for carrier provided services may be a standard registration jack or other means as specified in either the tariffs or the appropriate industry standard. To determine the exact demarcation point requirements, contact the service provider in the local area. A single building generally has one demarcation point only and this would be designated the Minimum Point of Penetration (MPOP). Since a single building can only have one MPOP, another demarcation point would become the alternate demarcation point. In single tenant buildings, the demarcation point is located within twelve inches of the protector

or if no protector is required, it shall be within twelve inches of where the carrier's facilities enter the premise. If the Local Exchange Carrier does not have a minimum point of entry policy, the building owner shall determine the location of the demarcation point."

1.5 ENTRANCE ROOM OR SPACE:

1.5.1 **General:** The entrance room or space is the component of the entrance facility that provides space for the termination of entrance and backbone cable. If the entrance room or space contains telecommunications equipment, the entire room or space must meet the requirements for an equipment room; otherwise, the space must meet the requirements for a telecommunication's Room. The room or space shall be located in a dry area not subject to flooding and as close as practical to the entrance point.

1.5.2 **Entrance Room Size:** The following tables specify space requirements different from Telecommunication's Rooms or Equipment Rooms for all telecommunications equipment and associated cross connections for the building MDF. The distance from rack to work station shall not exceed 250 feet or additional room facilities must be provided. If the MDF is beyond 50 feet from the network demarcation point, then the cable must be in conduit.

Gross Floor Space Sq. Feet	Dimensions Feet
0 - 500,000	12x14
500,000	12x15.6
600,000	12x18.3
800,000	12x22.3
1,000,000	12x27.7

1.5.3 **Campus Environment:** In locations where there will be more than one building on the same continuous property, conduit equal to the amount of entrance conduit described above will be required. It shall be between any newly proposed building and the location of the Minimum Point of Penetration (MPOP). If existing buildings have fiber optic cable installed, a separate conduit of at least 4 inch diameter should be run from the MPOP to any newly proposed building, with innerduct and pull ropes placed inside.

1.5.4 The entrance room or space is the component of the entrance facility that provides space for the termination of the entrance backbone cable. In accordance with NEC Article 800 Section 800-50 exception No.3 the entrance or outside building cable shall be terminated and protected on a listed primary protector within 50 ft. of entering the building. Where telecommunications equipment (e.g. PBX) is located in the entrance room or space, the entire room or space shall meet the requirements for an equipment room as specified in Section 8 of TIA/EIA-569-A. If the network interface devices and telecommunication equipment are required in the entrance room, additional space will be needed.

1.5.5 The decision whether a room or open area is provided shall be based on security, quantity, type of termination and equipment, size of building and physical location within the building. For buildings exceeding (20,000 sq. ft.) usable floor space, an enclosed room should be provided.

1.5.6 In buildings (with up to 100,000 sq. ft.) of usable floor space, wall mounted terminating hardware may be suitable. Buildings of larger floor area may require free standing frames for cable termination. Tables 8.3-1 and 8.3-2 of TIA/EIA-569-A specify the space for all telecommunications equipment and associated cross-connections based on an 8 ft. wall or on free standing racks.

1.5.7 Listed below are some additional provisions:

- A minimum of two walls should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8 ft. high, capable of supporting attached equipment. Plywood should be either fire rated or covered with two coats of fire retardant paint.
- Lighting shall be a minimum of 50 foot candles measured 3 ft. above the finished floor.
- False ceiling shall not be provided.
- The access door shall be a minimum of 36 in. wide and 80 in. high and shall be fitted with a lock.
- Floors, walls and ceiling shall be treated to eliminate dust. Finishes shall be light in color to enhance room lighting.
- Electrical: A minimum of two dedicated 20A, 110V AC duplex electrical outlets, each on separate circuits, shall be provided for equipment power. Consideration should be given to identifying those outlets dedicated to telecommunications equipment. In addition, convenience duplex outlets shall be placed at 6 ft. intervals around the parameter walls, at a height of 6 in. above the floor. If emergency power is available, consideration shall be given to automatic power backup.
- If an emergency power source is available in the building, it is desirable that at least one of the duplex outlets be so supplied.
- Access shall be made available to the independent telecommunications grounding system specified by ANSI/TIA/EIA 607.
- TIA/EIA-569-A contains fire-stopping, sprinkler requirements, miscellaneous pathways, and telecommunications recommendations of separation from less than 480V power lines. Further information of entrance rooms can be found in TIA/EIA-569-A and the BICSI Telecommunications Distribution Methods Manuals.

2.0 UNDERGROUND SPECIFICATIONS

2.1 TRENCH, BORE, DIRECT BURIAL - INSTALLATION GUIDELINES

2.1.1 Minimum depth of a trench for copper cables shall allow **at least 60 cm (24”) of cover from the top of the final grade.**

2.1.2 Minimum depth of a trench for fiber-optic cables should allow at **least 1 m (36”) of cover from the top of the final grade.** Depth of fiber optic cable must be below the frost line to avoid frost heave.

2.1.3 Telecommunication cables shall not be run in the same trench as gas, oil, water, power, sewer, etc.

2.1.4 When crossing another utility facility:

- Maintain 305 mm (12”) of separation.
- Cable system shall be routed so as to allow for safe access for construction, inspection, and maintenance.
- There shall be no transfer of load from one utility to another
- When crossing roads, railroads, and waterways, the cable shall be placed inside either a metal or rigid plastic duct for protection

2.1.5 Trench should be graded true and free from stones and soft spots. Bottom of trench should have 4" of sand from bottom of trench to conduit with a cover of 6" of sand over conduit (not tamped). Backfill should also be free of stones and be firmly tamped around the sides of the conduit, to develop maximum supporting strength. After final backfill is placed, tamping should be used to finish grade. **IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO RESTORE DISTURBED AREA TO ORIGINAL CONDITION.**

2.1.6 A plastic detectable warning tape (containing metallic tracings) shall be installed a minimum of 45 cm (18") above the conduit to provide a means of locating cable. The tape shall be orange in accordance with the Public Works Association requirements.

2.1.7 Boring: Minimum depth of bore for must meet or exceed depths as described in 6.2.1.1 for copper cables and 6.2.1.2 for fiber cables. All bores must include a 4" Conduit. Standard of Quality is Carlon Bore-Gard PVC Trenchless Raceway, or equivalent.

2.1.8 Cables shall be installed in each sites tunnel system wherever possible. Contractor must have and establish proof of certification to work in confined spaces.

2.2 CONDUIT INSTALLATION & MATERIAL SPECIFICATIONS:

2.2.1 All underground cables shall be installed in Rigid PVC Conduit or **Threaded Intermediate Metallic Conduit (IMC) as indicated in the Project Scope**. Fiber Optic cable shall also be installed in innerduct. Direct burial of cable is not acceptable except when authorized by Salt Lake County in writing.

2.2.2 Underground conduit shall be 4" Schedule 40 Rigid PVC Nonmetallic or **Threaded Intermediate Metallic Conduit (IMC) as indicated in the Project Scope**. Standard of quality is Carlon Telecom Systems (Part # 49015), or equivalent.

2.2.3 Underground conduit shall be 4" Multi-Cell Schedule 40 Rigid PVC Nonmetallic when installing fiber-optic cables in campus backbone system or **Threaded Intermediate Metallic Conduit (IMC) as indicated in the Project Scope**. Standard of quality is Carlon Telecom Systems 3 or 4 cell Multi-Gard, or approved equivalent.

2.2.4 Encase conduit(s) in concrete 17,238 kPA (2,500 psi) where:

- Minimum depth cannot be obtained,
- Conduits pass under roads, driveways, or railways,
- Bend points are subject to movement,

Except when terminating at a pole. When terminating at a pole, clamp the conduit(s) rigidly to the field side of the pole at a 90° separation from power.

2.2.5 All couplers, plugs, fittings and sweeps shall be of the same manufacturer and model as the conduit. Standard of quality is Carlon Telecom Systems (Part # E940N), or equivalent. Note, all bends shall use sweeps to maintain proper bend radius of cables.

2.2.6 The ends of metallic conduits shall be reamed, bushed, and grounded according to the National Electric Code and the National Electric Safety Code.

2.2.7 The total number of bends in a conduit section run shall not exceed two 90° bends or equivalent of sweeps and radius bends. Each bend shall have a minimum radius in accordance with the most current ANSI/EIA/TIA Standards.

2.2.8 In all Interbuilding backbone cabling systems the Contractor will install an additional 4" conduit with pull rope for future applications.

2.2.9 All conduits shall be plugged to prevent gases and/or water from entering building.

2.2.10 All conduits shall be pre-lubed prior to pulling of cable.

2.2.11 All conduits shall be equipped with a pule rope. Contractor will include a pull rope to be pulled with cables to facilitate future installations.

2.2.12 **IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ALL UNDERGROUND UTILITIES AND FACILITIES**. It is the responsibility of the agency to supply any drawings available and to work closely with the Contractor in the location of underground utilities and facilities.

2.2.13 Conduit must be placed at least 90 cm (36") below roadway, parking lot or street. **Conduit required will be Schedule 80 Rigid PVC Nonmetallic Conduit for light traffic drive-way or parking lot or extremely rocky area, or Threaded Intermediate Metallic Conduit (IMC) for Roadways, Streets, or harsh environments, as indicated in the Project Scope.**

2.3 SERVICE BOX (HANDHOLE) INSTALLATION & MATERIAL SPECIFICATIONS

2.3.1 Service Box Assemblies shall be installed every 600' as a pull box or at a transition point for the outside Structured Cabling System. A transition point is defined as entry into a building, a cable intersection point, a cable passing under a roadway, or a cable splicing point. Specifications for the Service Box Assemblies are:

2.3.2 The Service Box shall be constructed of polymer concrete consisting of sand and aggregate bound together with a polymer resin. Internal reinforcement may be provided by means of steel, fiberglass, or a combination of the two. To assure consistent production from part to part, only matched metal tooling is to be used in the manufacturing of this product. Standard of quality is Quazite Composolite PG or approved equivalent.

2.3.3 The Service Box shall sustain a minimum vertical test of 12,000 lbs. over a 10" square for standard cover (occasional non-deliberate light vehicle traffic) or a minimum vertical test of 22,568 lbs. Over a 10" square for heavy duty cover (occasional non-deliberate heavy vehicles).

2.3.4 The Service Box shall be flush mount with ground grade level.

2.3.5 The Service Box shall be installed in a hole with a base of 6" to 8" of gravel or crushed rock to promote drainage. Fill and compact soil to grade level with cover in box.

2.4 FIBER INSTALLATION SPECIFICATIONS

2.4.1 At all sites requiring fiber, all fiber is to be run in a collapsed backbone configuration with fiber collapsing into a single location. See Attachments included of each site for the proposed configurations.

2.4.2 All fiber optic cable shall be installed in innerduct (including fiber in conduit and cable trays). Plenum rated innerduct must be used in air plenum areas.

2.4.3 Innerduct shall be a non-metallic 1 ¼" corrugated flexible raceway for use as an innerduct conduit system. Color of innerduct is to be orange. A pull line shall be pre-installed at the factory. Standard of quality is Carlon Telecom Systems Riser-Gard (Part # AF-4X1A-500), or equivalent.

2.4.4 All couplers, fittings and sweeps shall be of the same manufacturer and model as the innerduct.

2.4.5 Contractor will include the technical specifications of the innerduct quoted as part of their quotation submittal.

2.4.6 Fiber-optic cable runs shall be continuous single runs with no splices.

2.5 ELECTRICAL SEPARATION:

2.5.1 Horizontal Pathways.

2.5.1.1 1.2 m (4') from large motors or transformers.

2.5.1.2 30 cm (1') from conduit and cables used for electrical power distribution.

2.5.1.3 12 cm (5") from fluorescent lighting.

2.5.2 In Electrical Power Wiring (tunnel, buried, backbone applications): A Minimum of 61cm (2') between electrical power cables and telecommunication cables is required. Contractor must conform to standards as specified in ANSI/EIA/TIA 569A and ANSI/NFPA 708.

2.5.3 In tunnels where separation is not possible Contractor must use a shielded cable.

2.5.4 In trenches there should be a minimum of 30 cm (12") of well-tamped earth, or 10 cm (4") of masonry, or 8 cm (3") of concrete.

2.6 LIGHTNING PROTECTION:

Lightning Protection will be provided by the Contractor for all cables leaving and entering a building by underground conduit, direct burial or aerial.

2.6.1 Lightning Protection will include a Protector Unit properly sized to protect the associated cables. Standard of quality is a RELTEC (Model # BUP), or **Avaya Systimax** Components, or equivalent.

2.6.2 5-Pin Protector Modules shall be provided to fill each protector unit. These modules shall be Solid State Protector Modules, standard of quality is RELTEC (Model # S3AB), or **Avaya Systimax** Components, or equivalent.

2.7 CORE DRILLING

All core drilling (Into buildings, between floors, and through fire walls) will be the responsibility of the Contractor. Contractor will be required to sleeve and firestop all holes used in their cabling installation. Contractor is to sleeve and seal all holes used to enter or exit a building. The Contractor will consult with the Department of Public Works to obtain approval for core drills into buildings and between floors.

3.0 UNDERGROUND COPPER CABLE SPECIFICATOINS

The cable shall meet all requirements stated in this specification. The cable shall meet the latest requirements of the United States Department of Agriculture Rural Utilities Service (RUS), ANSI/TIA/EIA-758, and the ANSI/ICEA Standards Outside Plant Communications Cable. Cable shall be gel filled, or dry water blocked. **Following is a list of cable manufacturers that have been approved:**

- **General (Direct Buried, Duct & Armored)**

- **ESSEX (Direct Buried, Duct & Armored)**

3.1 COPPER CABLE IN BURIED CONDUIT OR TUNNELS (NOT PART OF AIR RETURN SYSTEM):

3.1.1 Cable shall be multi-pair gel filled, or dry water blocked, solid Qualpeth® cable.

3.1.2 Cable shall be compliant with the Rural Utilities Service (RUS) 7 CFR 1756.390 (REA PE-39) Standards.

3.1.3 Core Construction:

3.1.3.1 Conductors shall be solid, annealed copper, 22 or 24 awg.

3.1.3.2 Insulation shall be solid, high density polyethylene, color coded in accordance with telephone industry standards.

3.1.3.3 Insulated conductors shall be twisted into pairs with varying lay lengths to minimize cross-talk.

3.1.3.4 Core assemblies with 25 pairs and less shall be assembled together in a single group. Core assemblies with more than 25 pairs shall be arranged in groups, each group having a color coded unit binder.

3.1.3.5 The entire core assembly shall be completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.

3.1.3.6 The core shall be wrapped with non-hygroscopic dielectric tape applied longitudinally with an overlap.

3.1.4 Qualpeth® Sheath Construction:

3.1.4.1 The sheath shall have an aluminum shield consisting of a corrugated, copolymer coated, 0.008 aluminum tape applied longitudinally with an overlap.

3.1.4.2 The sheaf interfaces shall be flooded with an adhesive water blocking compound.

3.1.4.3 The jacket shall be a black, linear low density polyethylene.

3.2 DIRECT BURIED COPPER CABLE:

3.2.1 Cable shall be multi-pair gel filled, or dry water blocked, solid copper bearing gopher resistant cable.

3.2.2 Cable shall be compliant with the Rural Utilities Service (RUS) 7 CFR 1756.390 (REA PE-39) Standards.

3.2.3 Core Construction:

3.2.3.1 Conductors shall be solid, annealed copper, 22 or 24 awg.

3.2.3.2 Insulation shall be solid, high density polyethylene, color coded in accordance with telephone industry standards.

3.2.3.3 Insulated conductors shall be twisted into pairs with varying lay lengths to minimize cross-talk.

3.2.3.4 Core assemblies with 25 pairs and less shall be assembled together in a single group. Core assemblies with more than 25 pairs shall be arranged in groups, each group having a color coded unit binder.

3.2.3.5 The entire core assembly shall be completely filled with ETPR compound,

filling the interstices between the pairs and under the core tape.

3.2.3.6 The core shall be wrapped with non-hygroscopic dielectric tape applied longitudinally with an overlap.

3.2.4 **Sheath Construction:**

3.2.4.1 The sheath shall have a copper-bearing shield consisting of a corrugated, copper bearing gopher resistant tape applied longitudinally with an overlap.

3.2.4.2 The sheaf interfaces shall be flooded with an adhesive water blocking compound.

3.2.4.3 The jacket shall be a black, linear low density polyethylene.

4.0 UNDERGROUND FIBER OPTIC – LOOSE TUBE DISTRIBUTION CABLE

4.1 GENERAL SPECIFICATIONS

The cable shall meet all requirements stated in this specification. The cable shall meet the requirements of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 and the ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1992. Cable shall be gel filled, or dry water blocked. **Following is a list of cable manufacturers that have been approved:**

- **Corning (Outdoor & Armored)**
- **Berk-Tek (Outdoor & Armored)**
- **Optical Cable Corp. (Outdoor & Armored)**
- **CommScope (Outdoor & Armored)**
- **Avaya (Outdoor & Armored)**
- **Mohawk (Outdoor & Armored)**

  xxx = Fiber Count (i.e.: 24 strands = 024)

4.1.1 All Campus Backbone fiber is to be at least twenty-four (24) strand Multi-mode 50/125 □m or 62.5/125 □m fiber unless otherwise specified in drawings. An optional multi strand with at least twelve (24) strands of single mode fiber shall be included in the main backbone for future applications.

The cable must meet the requirements of the National Electrical Code (NEC).

4.1.2 All multi-mode backbone fiber cable bid and installed by the Contractor shall be 50/125 µm or 62.5/125 µm, fiber optic cable, as described in the Scope of Work. The mechanical and environmental specifications for outdoor optical fiber shall be in accordance with ANSI/TIA/EIA-472DAAA and other constructed indoor fiber cable shall be in accordance with ANSI/ICEA S-83-640.

4.1.3 CONTRACTOR **MUST** PROVIDE DOCUMENTATION / Specification SHEETS FROM THE MANUFACTURER TO SALT LAKE COUNTY ABOUT THE FIBER CABLES WHICH THE CONTRACTOR PROPOSES TO INSTALL AS A PART OF THE BID RESPONSE. This documentation will be reviewed by Salt Lake County to ensure that the cable selected by the Contractor does in fact meet or exceed the specifications for a Fiber Optic cable as specified in the ANSI/EIA/TIA-568-B.3. Review of this documentation by Salt Lake County does not relieve the Contractor of any requirements specified in this Invitation to Bid.

4.1.4 The fiber shall have a minimum bandwidth capacity of 10 GHz for the 90 m (295') distance specified for horizontal cabling. Contractor is to indicate the transmission rate

of the cable being bid.

4.1.5 All backbone fiber optic cable shall be run in Innerduct or shall have an armor jacket. Innerduct or armored jacket shall be plenum rated in a plenum environment.

4.1.6 Contractor is required to receive final approval from Salt Lake County on the fiber optic cable type selected prior to installation.

4.2 MULTI-MODE FIBER OPTIC SPECIFICATIONS

The optical fiber shall be multi-mode, graded-index optical waveguide with a nominal 50 □m or 62.5 □m core/cladding diameter. The optical fiber shall comply with ANSI/Eia/Tia-492AAAA.

4.2.1 **Cable Transmission Performance Specifications:** Each cabled optical fiber shall meet the graded performance specifications in ANSI/TIA/EIA-568-B.3. Information transmission capacity shall be measured in accordance with ANSI/TIA/EIA-455-51 or 30. The cable shall be measured at 23˚ C ± 5˚ C.

Maximum attenuation for outdoor multi-mode fiber-optic cabling shall meet the ANSI/TIA/EIA-568-B.3 Specifications:

- At 850 nm the maximum attenuation shall be 3.5 dB/km.
- At 1300 nm the maximum attenuation shall be 1.5 dB/km.

4.2.2 **Physical Cable Specifications:** The mechanical and environmental specifications for plenum all-dielectric outdoor optical fiber cable shall be in accordance with ANSI/TIA/EIA-472DAAA. The specifications for other constructed outdoor fiber optic cables shall be in accordance with ANSI/ICEA S-83-640.

4.2.3 Length: 300 Meter link length guarantee

4.2.4 Cable must be installed with a laser performance guarantee.

4.3 SINGLE-MODE FIBER OPTIC SPECIFICATIONS

Single-mode optical fibers shall be 8.3 □m/125.0 □m, Class IVa Dispersion-Unshifted Single-Mode Optical Fibers and shall comply with ANSI/EIA/TIA-492BAAA.

4.3.1 **Cable Transmission Performance Specifications**: Each cabled fiber shall meet the attenuation performance specifications of ANSI/TIA/EIA-568-B.3, and measured in accordance with ANSI/EIA/TIA-455-78A or 61. The cable shall be measured at 23˚ C ± 5˚ C.

The attenuation of the cabled fiber shall be uniformly distributed throughout its length such that there are no discontinuities greater than:

- 1.0 dB/km at 1310 nm
- 1.0 dB/km at 1550 nm
- 1.0 dB/km at 1625 nm

4.3.2 **Physical Cable Specifications:** The mechanical and environmental specifications for outdoor optical fiber cable shall be in accordance with ANSI/ICEA S-83-640.

4.3.3 **Chromatic Dispersion:** The Zero Dispersion Wavelength (□) shall be between 1300 nm and 1321.5 nm, and the maximum value of dispersion slope at $□_0$, shall be no greater than 0.093 ps/km-mm². Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-168, Spectral Group Delay, ANSI/EIA/TIA-455-169, Phase-Shift, or ANSI/EIA/TIA-455-175, Differential Phase-Shift.

4.3.4 **Mode Field Diameter:** The nominal mode field diameter shall be 8.7 □m to 10.0 □m with a tolerance of ± 0.5 □m at 1300 nm when measured in accordance with ANSI/EIA/TIA-455-164, Far-Field Scanning, or ANSI/EIA/TIA-455-167, Variable Aperture Method in the Far Field.

4.3.5 **Cut-Off Wavelength:** The cutoff wavelength of cabled single-mode optical cable shall be < 1270 nm when measured in accordance with ANSI/EIA/TIA-455-170.

4.4 SPECIFICATIONS FOR OUTDOOR FIBER CABLE CONSTRUCTION

4.4.1 Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 3.0 mm. All cables will be gel filled, or dry water blocked.

4.4.2 Each buffer tube shall contain up to 12 fibers.

4.4.3 The fibers shall not adhere to the inside of the buffer tube.

4.4.4 Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-A, "Optical Fiber Cable Color Coding."

4.4.5 The fibers shall be colored with ultraviolet (UV) curable inks.

4.4.6 Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598-A, "Optical Fiber Cable Color Coding."

Buffer tube colored stripes shall be inlaid in the tube by means of co-extrusion when required. The nominal stripe width shall be 1 mm.

4.4.7 For dual layer buffer tube construction cables, standard colors are used for tubes 1 through 12 and stripes are used to denote tubes 13 through 24. The color sequence applies to tubes containing fibers only, and shall begin with the first tube. If fillers are required, they shall be placed in the inner layer of the cable. The tube color sequence shall start from the inside layer and progress outward.

4.4.8 In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature range and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together.

4.4.9 The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements of 7 CFR 1755.900.

4.4.10 Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed. Fillers shall be placed so that they do not interrupt the consecutive positioning of the buffer tubes. In dual layer cables, any fillers shall be placed in the inner layer. Fillers shall be nominally 3.0 mm in outer diameter.

4.4.11 The central anti-buckling member shall consist of a dielectric, glass reinforced plastic (GRP) rod. The purpose of the central member is to prevent buckling of the cable. The GRP rod shall be overcoated with a black colored thermoplastic when required to achieve dimensional sizing to accommodate buffer tubes/fillers.

4.4.12 Each buffer tube shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional nontoxic solvents.

4.4.13 Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process. Water blocking yarn(s) shall be applied longitudinally along the central member during stranding.

4.4.14 Two polyester yarn binders shall be applied contrahelically with sufficient tension to secure each buffer tube layer to the dielectric central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking and dielectric with low shrinkage.

4.4.15 For single layer cables, a water blocking tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

4.4.16 For dual layer cables, a second (outer) layer of buffer tubes shall be stranded over the original core to form a two layer core. A water blocking tape shall be applied longitudinally over both the inner and outer layer with each being held in place with a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

4.4.17 The cable shall contain at least one ripcord under the sheath for easy sheath removal of all-dielectric cable. The cable shall contain at least one ripcord under the inner sheath and under the steel armor for armored cable. The ripcord color shall be orange for non-armored sheaths and red for armored sheaths.

4.4.18 Dielectric yarns shall provide tensile strength.

4.4.19 The high tensile strength dielectric yarns shall be helically stranded evenly around the cable core.

4.4.20 All-dielectric cables (non-armored) shall be sheathed with medium density polyethylene (MDPE). The minimum nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus. See Figure 1.

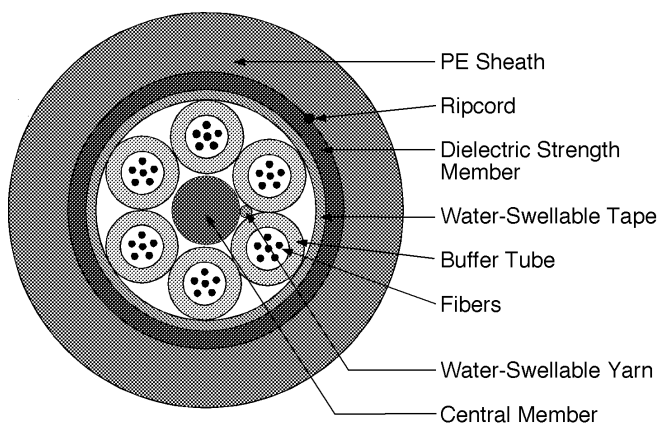


Figure 1

4.4.21 Armored cables shall have an inner sheath of MDPE. The minimum nominal jacket thickness of the inner sheath shall be 1.0 mm. The inner jacket shall be applied directly over the tensile strength members and water blocking tape. A water blocking tape shall be applied longitudinally around the outside of the inner jacket. The tape shall be held in place by a single polyester binder yarn. The armor shall be a corrugated steel tape, plastic-coated on both sides for corrosion resistance, and shall be applied around the

outside of the water blocking tape with an overlapping seam with the corrugations in register. The outer jacket shall be applied over the corrugated steel tape armor. The outer jacket shall be a MDPE with a minimum nominal jacket thickness of 1.4 mm. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus. See Figure 2.

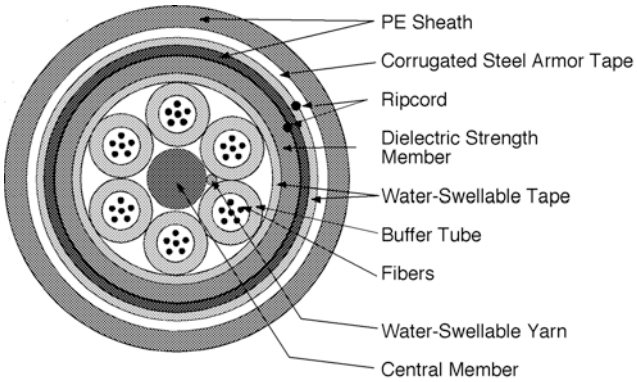


Figure 2

4.4.22 The MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C and Grades J4, E7 and E8.

4.4.23 The jacket or sheath shall be free of holes, splits, and blisters.

4.4.24 The cable jacket shall contain no metal elements and shall be of a consistent thickness.

4.4.25 Cable jackets shall be marked with manufacturer's name, sequential meter or foot markings, month and year, or quarter and year of manufacture, and a telecommunication handset symbol, as required by Section 350G of the National Electrical Safety Code (NESC). The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more coextruded white stripes shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

4.4.26 The maximum pulling tension shall be 2700 N (608 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

4.5 FIBER CABLE PERFORMANCE SPECIFICATIONS

4.5.1 When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the change in attenuation at extreme operational temperatures (-40°C and +70°C) shall not exceed 0.2 dB/km at 1550 nm for single-mode fiber and 0.5 dB/km at 1300 nm for multimode fiber.

4.5.2 When tested in accordance with FOTP-82, "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable." a one meter length of unaged cable shall withstand a one meter static head or equivalent continuous pressure of water for one hour without leakage through the open cable end.

4.5.3 When tested in accordance with FOTP-81, "Compound Flow (Drip) Test for Filled Fiber Optic Cable", the cable shall exhibit no flow (drip or leak) of filling and/or flooding material at 80°C.

4.5.4 When tested in accordance with FOTP-41, "Compressive Loading Resistance of Fiber Optic Cables," the cable shall withstand a minimum compressive load of 440 N/cm

(250 lbf/in) for armored cables and 220 N/cm (125 lbf/in) for non-armored cables applied uniformly over the length of the sample. The load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for ten minutes. The change in attenuation shall not exceed 0.4 dB during loading at 1550 nm for single-mode fiber and 1.0 dB during loading at 1300 nm for multimode fiber. The repeatability of the measurement system is typically ± 0.05 dB or less. No fibers shall exhibit a measurable change in attenuation after load removal.

4.5.5 When tested in accordance with FOTP-104, "Fiber Optic Cable Cyclic Flexing Test," the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The change in attenuation shall not exceed 0.1 dB at 1550 nm for single-mode fiber and 0.3 dB at 1300 nm for multimode fiber.

4.5.6 When tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies," the cable shall withstand 25 impact cycles. The change in attenuation shall not exceed 0.2 dB at 1550 nm for single-mode fiber and 0.3 dB at 1300 nm for multimode fiber.

4.5.7 When tested in accordance with FOTP-33, "Fiber Optic Cable Tensile Loading and Bending Test," using a maximum mandrel and sheave diameter of 560 mm, the cable shall withstand a tensile load of 2700 N (608 lbf). The change in attenuation shall not exceed 0.2 dB during loading and 0.1 dB after loading at 1550 nm for single-mode fiber and 0.5 dB during loading and 0.2 dB after loading at 1300 nm for multimode fiber.

4.5.8 When tested in accordance with FOTP-85, "Fiber Optic Cable Twist Test," a length of cable no greater than 4 meters shall withstand 10 cycles of mechanical twisting. The change in attenuation shall not exceed 0.1 dB at 1550 nm for single-mode fiber and 0.2 dB at 1300 nm for multimode fiber.

4.5.9 When tested in accordance with FOTP-181, "Lightning Damage Susceptibility Test for Optic Cables with Metallic Components," the cable shall withstand a simulated lightning strike with a peak value of the current pulse equal to 105 kA without loss of fiber continuity. A damped oscillatory test current shall be used with a maximum time-to-peak value of 15 □s (which corresponds to a minimum frequency of 16.7 kHz) and a maximum frequency of 30 kHz. The time to half-value of the waveform envelope shall be from 40 - 70 □s.

4.5.10 When tested in accordance with FOTP-37, "Low or High Temperature Bend Test for Fiber Optic Cable", the cable shall withstand four full turns around a mandrel of □ 10 times the cable diameter for non-armored cables and □ 20 times the cable diameter for armored cables after conditioning for four hours at test temperatures of -30°C and +60°C. Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears or other openings. Optical continuity shall be maintained throughout the test."

4.6 QUALITY ASSURANCE PROVISION

4.6.1 All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.

4.6.2 The cable manufacturer shall be ISO 9001 registered.

4.7 FIBER-OPTIC DISTRIBUTION CENTERS

4.7.1 Fiber Optic Closet Connector Housing for the MCs and TRs shall be a rack mountable. The Connector Housing shall be made of 16 gauge steel with multiple cable entry points. The manufacturer selected must have a 24 port module, a 48 port module and a 72 port module available. Standard of quality shall be a Corning (Model CCH-03U or CCH-01U), or equivalent.

4.7.2 Jumper Management Panels shall be installed directly below the Closet Connector Housing to facilitate jumper cable management. Standard of quality shall be Corning (Model # CJP-03U), or equivalent.

4.7.3 Individual fibers shall terminate in Fiber Closet Connector Housing detailed in 3.2.1 utilizing Duplex SC Connector Panels with six duplex (6) SC compatible multimode adapters and insert installed or ST Connector Panels with six (6) ST compatible multimode adapters and inserts installed or Fiber LC Connector Panels with twelve (12) Fiber-LC compatible multimode adapters and inserts installed.

4.7.3.1 **Duplex SC Connector Panel:** Standard of quality shall be a Corning 12-fiber connector panel (Model # CCH-CP12-91), or equivalent.

4.7.3.2 **ST Connector Panel:** Standard of quality shall be a Corning, or equivalent, with six SC Module – Jacks installed.

4.7.3.3 **Small Form Fiber-Jack (FJ) Connector Panel:** Standard of quality shall be a Corning Fiber LC, or equivalent, with Connector Module – Jacks installed.

4.7.4 A Closet Splice Housing will be provided in the MCs to facilitate the transition spice between outside fiber and inside fiber. Standard of quality shall be a Corning Closet Splice Housing (Model CSH-03U), or equivalent.

4.7.5 Contractor will include the technical specifications of the fiber termination shelves and components quoted as part of their quotation submittal.

4.8 FIBER-OPTIC CONNECTORS

4.8.1 Fiber Optic Connectors shall be SC Connectors with a composite ferrule, it shall incorporate a multimode fiber stub that is fully bonded into the ferrule. Or ST Connector Jacks that includes an RJ45 style housing with ferrule assembly, crimp sleeves and boots. Must be compliant with ANSI/EIA/TIA-568B.

4.8.1.1 **SC Multi-mode Connectors:** Standard of quality shall be Corning Hot Melt Multimode SC Connector, or Corning, or equivalent. Duplex Clips shall be provided for installation into Fiber Distribution Cabinets.

4.8.1.2 **SC Single-mode Connectors:** Standard of quality shall be Corning Hot Melt Multimode SC Connector or Corning (Model # 95-200-41), or equivalent. Duplex Clips shall be provided for installation into Fiber Distribution Cabinets.

4.8.1.3 **ST Connectors:** Standard of quality shall be a Corning , or equivalent.

4.8.1.4 **Small Form Fiber-Jack (FJ) Connectors:** Standard of quality shall be Corning "LC" type Connector Module – Jack, or equivalent.

4.8.2 Contractor will include the cost of fiber patch cords. Patch Cable will be plenum or non-plenum rated depending on MC or TR requirements. Each end of the patch cord shall be equipped with either a SC Duplex Connector, or ST Connector that is factory installed.

4.8.2.1 **SC Patch Cords:** Standard of quality is Corning Fiber Optic Cable Assembly, Panduit Fiber Optic Cable Assemblies (or **Avaya** Cable Assemblies, or

equivalent. Patch Cables shall be available in 1, 2, 3, and 10 Meter lengths. Patch Cables will be available with ceramic Ferrules. Connector plugs shall include: Simplex SC to ST, Duplex SC to ST, Simplex SC to SC, Duplex SC to SC.

4.8.2.3 **ST Patch Cords:** Standard of quality shall be a Panduit Fiber Opti-Jack Optical Fiber Patch Cords, or equivalent. Patch Cables shall be available in 1, 2, 3, and 10 Meter lengths. Patch Cables shall be available with Opti-Jack Duplex Plug to Opti-Jack Duplex Plug (Part # FJPN51MEI, FJPN52MEI, FJPN53MEI, and FJPN510MEI), Opti-Jack Duplex Plug to SC Plugs (Part # FJPDSC51MEI, FJPDSC52MEI, FJPDSC53MEI, and FJPDSC510MEI), or Opti-Jack Duplex Plug to ST Plugs (Part # FJPDST51MEI, FJPDST52MEI, FJPDST53MEI, and FJPDST510MEI)

4.8.2.3 **Small Form Fiber-Jack (FJ) Patch Cords:** Standard of quality shall be Corning "LC" type Optical Fiber Patch Cords, or equivalent. Patch Cables shall be available in 1, 2, 3, and 10 Meter lengths. Patch Cables shall be available with Small Form Fiber-Jack (FJ) Plug to Small Form Fiber-Jack (FJ) Plug, Small Form Fiber-Jack (FJ) Plug to SC Plugs or Small Form Fiber-Jack (FJ) Plug to ST Plugs.

4.9 INSTALLATION CONSIDERATIONS

4.9.1 At all sites requiring fiber, all fiber is to be run in a Hierarchical Star Backbone configuration with fiber starred from a single location. See Attachments included of each site for the proposed configurations.

4.9.2 All backbone fiber is to be **a minimum of twenty-four (24)** strand Multimode 62.5/125 □m or 50/125 □m fiber. **A minimum of a twelve (24)** strand single mode fiber shall be included in the main backbone for future applications. The multimode optical fiber cable system shall be capable of transmitting signals with a minimum bandwidth of 160 MHz at both 850 or 1300 nm. The cumulative signal loss, through connectors, jumpers, couplings, and fiber cable, shall be less than 10 dB. The singlemode optical fiber cable system shall be capable of transmitting signals with a bandwidth of up to 500 MHz at both 1310nm, 1550 nm, and 1625 nm. The cumulative signal loss, through connectors, jumpers, couplings, and fiber cable, shall be less than 10 dB.

4.9.3 All fiber optic cable shall be installed in innerduct (including fiber in conduit and cable trays). Plenum rated innerduct must be used in air plenum Areas, including tunnels connecting buildings that are considered part of the air return system .

4.9.4 All fiber-optic cable runs shall be continuous single runs with no splices.

4.9.5 The Minimum Bend Radius of the fiber shall be 20 X cable O.D. during installation and 10 X cable O.D. long term.

4.9.6 Contractor must provide 20% spare capacity above the project requirements on each fiber patch panel/distribution center.

4.9.7 All cable shall be installed and terminated in accordance with the manufacturers recommended procedures.

4.9.8 Any portion of the inter-building optical fiber that is trenched (buried) must be loose tube dielectric cables and consist of color-coded Multimode graded index fibers contained in gel-filled color-coded loose buffer tubes. Each color-coded buffer tube shall be filled with a gel to prevent the penetration of moisture. All other areas around the buffer tubes

and cable core components shall be filled with water-blocking compounds for added moisture blocking protection. A glass reinforced plastic (GRP or epoxy matrix rod) shall be used for a central strength member. High tensile aramid yarns shall be utilized over the cable core for additional tensile strength. A single medium density polyethylene outer jacket shall be applied overall.

4.9.9 Contractor will include the technical specifications of the Multimode fiber-optic cable quoted as part of their quotation submittal.

5.0 TUNNEL SPECIFICATIONS

5.1 Communication cables shall be placed on opposite side of tunnel from electrical service (when this type of separation is not possible all cables shall be shielded to reduce the effects of electromagnetic Interference). Always maintain adequate separation between telephone and electrical power facilities to prevent accidental contact between the telephone and electrical plant.

5.2 All fiber optic cable run in the tunnel systems shall be installed in innerduct in a Cable Tray, or a **4" Threaded Intermediate Metallic Conduit (IMC)** where it is determined to be required for the protection of the fiber cables. Where this requirement does not exist the fiber must be installed in fire retardant non-PVC innerduct in Cable Tray.

The Contractor shall comply to all NEC Codes that may dictate the type of conduit and cable to be used.

5.3 All cables will be placed off of the floor of the tunnel with proper support hardware and shall be supported every 4'. **When specified, the Contractor will supply Cable Tray appropriate for tunnel installation.** When specified, the Contractor will provide 4" **Threaded Intermediate Metallic Conduit (IMC)** in tunnel system to protect cable. Cable will not be supported by existing steam pipe, sewer, electrical, or water pipe support structure.

5.4 Properly ground and bond the telephone facilities to the electrical facilities to prevent hazardous working conditions.

5.4.1 Design and use the cable trays and support hardware as a common bond.

5.4.2 Provide a common grounded bonding busbar throughout the tunnel.

5.4.3 Install separate bonding points on the cables at required locations.

5.4.4 Use a water main in the tunnel as a common ground.

5.5 All copper cable run in the tunnel systems shall be either installed in a Cable Tray or a **4" Threaded Intermediate Metallic Conduit (IMC)** where it is determined to be required for the protection of the copper cables. Where this requirement does not exist the copper cable used in tunnels shall be Plastic Insulated Conductor (PIC) **Steampeth** Cable.

The Contractor shall comply to all NEC Codes that may dictate the type of conduit and cable to be used.

5.6 Protective conduit is generally not used for telephone cabling installations. Unless otherwise stated the cable distribution system installed inside tunnels shall consist of either Cable Tray or a Cable Distribution Support System installed by the Contractor. When conduit is required it shall be rigid 4" **Threaded Intermediate Metallic Conduit (IMC)**, properly bonded and grounded and anchored securely and neatly to the tunnel wall. Junction boxes are to be placed every 100' of conduit.

5.7 All Cable Tray, Distribution Cable Systems, and Conduit will be installed plumb and square.

5.8 All fiber optic cable installed in the tunnel systems shall be a tight buffer design (OFNR designated).

6.0 AERIAL SPECIFICATIONS

6.1 Communication cables shall be self-supporting (Air Core) Cable with a reinforced sheath or Alpeath Sheath (Air Core) Cable with unsoldered mechanical protection. The second cable requires a supporting strand to be installed.

6.2 The Contractor shall be responsible for all permits and easements required for the Aerial Cable runs.

6.3 The Contractor shall be responsible to coordinate with other utilities (Power, etc.) possible joint use of poles and minimizing inductive interference.

6.4 The Contractor will provide poles if necessary for Aerial Cable Run.

6.4.1 The poles shall be of the proper class to support the necessary pole loading as set forth in NESC-242-2 as Grade B, C, or N. All poles shall be of the same class, regardless of length and timber species, and must be able to withstand the same horizontal load applied 60 cm (2 ft.) from the top of the pole.

6.4.2 The poles shall be designed to meet all loading requirements including Transverse Storm Loading, Vertical Loading and Bending moments due to eccentric loads.

6.4.3 Dead end and corners in pole line shall be properly guyed to support the cable or wire facility.

6.4.4 All exposed guy wires shall be properly grounded and insulated.

6.5 Self-supporting cable shall be used rather than lashed cable if:

- It is available in the required size
- There is no existing strand
- New cable cannot be lashed to an existing cable
- Adequate space exists for future growth

Contractor shall use proper stringing tension for strand to minimize high-tension bowing and creeping and low tension sagging.

6.6 Suspension strand will be used to support cables when self-supporting cables are not used. Suspension strand and cable shall be placed on the road side of the pole. Suspension strand shall be carefully configured to meet the load requirement of the cable. All suspension strand shall be galvanized Class A suspension strand.

6.6.1 **Messenger Strand System**: Contractor shall consist of 3/16" diameter 7-wire galvanized "6M" steel messenger strand. Messenger strand shall be manufactured to ASTM-A475 specifications and be accepted by USDA Rural Utilities Service (RUS) standards. Strand to be at least a utilities grade, and have a minimum breaking strength of 5,500 lbs., and have a left lay and at least an "A" rated galvanized coating weight.

6.6.2 **Strand Attachments:**

- Contractor shall provide and install the appropriate S guy bolts, B beam clamps, wall straps, brackets, etc., as necessary to adequately support the strand as per RUS standards.
- S guy bolts (or commonly called anchor rods or thimbleye bolts) shall be a minimum 5/8" diameter with a straight shank and be designed for attaching messenger strand

deadends. The bolt length shall be at least 4" longer than the pole width it will be attached to.

6.6.3 **<u>Strand Connectors</u>:** Contractor shall provide and install all B strand connectors, suspension/cable clamps, grounding tap clamps, hangers, 1-bolt and 3-bolt clamps to adequately support the strand as indicated.

6.6.4 **<u>Strand Cable Rings</u>**: Contractor will provide and install cable rings, or equivalent, to all strand runs after strand is installed. Rings shall be spaced on maximum 16" centers with the latching ring oriented in the same direction. Ring size required for each strand run shall be identified on the drawings,

6.6.5 **Acceptable Manufacturers:**

- Messenger Strand: Alumoweld
- Strand Cable Rings: Clifford #2X5/16 or #3 X3/8 cable rings
- Strand attachment hardware (connectors, suspension/cable clamps, grounding tap clamps, etc.):
    - Senior
    - A.B Chance
    - Dimond
    - Reliable
    - S guy bolts
    - Josyln #j805X

6.6.6 **Anchors and Guys:** Provide as necessary including but not limited to:

- **Expansion anchors**
- **Screw anchors**
- **Plate anchors**
- **Pole to Pole anchors**
- **Stub and anchor**

6.7 All Aerial Optical Fiber shall be placed in an aerial duct manufactured with a built-in support strand (Figure 8). Fiber Optic Cable will require a separate suspension strand and should occupy the uppermost communications space on the pole.

6.8 All Aerial Cables shall meet the required separation from Power and Traffic and shall meet the requirements as detailed in the National Electric Safety Code, Section 23.

6.9 Aerial Cable shall be attached to a poles and building by using the proper supporting attachments (support clamps, thru bolts, mast clamps, suspension clamps, mast brackets, eye bolts, anchors, etc.). A properly designed vertical wall attachment shall be used to attach the aerial cable to the wall. Follow the installation requirements of ANSI/TIA/EIA-758 and the BICSI TDM.

6.10 Aerial Cable shall enter a building through a raceway (conduit) with an approved service head. And must be properly grounded and attached to the building. See BICSI Manual for detail.

6.10.1 Cable shall be terminated in a protector box mounted on the exterior wall or,

6.10.2 Enter the building through the roof.

6.11 Entrance through a wall shall require the entry conduit sleeve to be sloped downward to the outside so that the outward sleeve is 1.3 cm (1/2") below the inside end.

6.12 All cables shall be properly lashed to cable supports and shall have spacers to separate cables and suspension strand at lashing points.

6.13 AERIAL INSTALLATION

6.13.1 Pole installation shall be in accordance with all Local, NESC and RUS requirements.

6.13.2 Pre existing pole lines must be capable of supporting proposed cables. To determine the adequacy of an existing pole line inspect for loading capabilities. Verification should include the following:

- Poles physical integrity (i.e. Poles bent or split)
- Presents of guys or anchors
- Existence of a ground system
- Clearance from other utilities
- Specifications of pole – height, class, age, composition
- Ownership and Joint use issues

6.13.3 All aerial fibers will include a support strand or will be properly lashed to a strength member. The installation will be according to all manufactures' recommended specifications and procedures for the installation of the type of aerial cable quoted by the vendor.

6.13.4 Connections to poles as well as minimum clearance from streets will be in compliance with REA/RUS specifications.

6.13.5 Use an approved cable guide and lashing device to secure the cable to messenger strand.

6.13.6 Clamp cable to exterior of building with approved galvanized steel cable clamps.

6.13.7 System shall be engineered and constructed for 3 types of loading

- Transverse Loading
- Vertical Loading
- Bending due to forces produced by objects attached to poles

6.13.8 NESC clearance standards shall be strictly observed.

6.13.9 Provide anchors and guys as field conditions require.

7.0 FIELD TEST REQUIRMENTS

7.1 100 Ω UTP BACKBONE CABLING SYSTEM FIELD TEST REQUIRMENTS

7.1.1 General Requirements

7.1.1.1 Every backbone cable in the installation shall be tested in accordance with the latest Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-B.3

7.1.1.2 The installed backbone cables shall be tested from the MC in the main equipment room to the TRs performance limits specification as defined in ANSI/TIA/EIA-568-B.3

7.1.1.3 100% of the installed cables must be tested and must pass the requirements of the standards mentioned above and as further detailed in this specification. Any failing pair must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected cable meets the performance requirements. The final and passing result of the tests for all cables shall be provided in the test results documentation in accordance with this specification.

7.1.1.4 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

7.1.1.5 The test equipment (tester) shall comply with or exceed the accuracy requirements for field testers as defined in TIA-568-B. The tester including the appropriate interface adapter must meet the specified accuracy requirements.

7.1.1.6 The tester shall be within the calibration period recommended by the Manufacturer in order to achieve the manufacturer-specified measurement accuracy.

7.1.1.7 The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters.. The contractor shall provide proof that the interface has been calibrated within the period recommended by the Manufacturer. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

7.1.1.8 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2)

7.1.1.9 A representative of Salt Lake County's Inspection Team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commence.

7.1.1.10 A representative of Salt Lake County's Inspection Team will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in Section 0. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing and the cost shall be borne by the installation contractor.

7.1.2 <u>Performance Test Parameters</u>

7.1.2.1 The test parameters for Backbone Cable are defined in ANSI/TIA/EIA standard 758; Section 6.1.5. The test of each Backbone Cable shall contain all of the following parameters as detailed below.

7.1.2.2 **<u>DC Loop Resistance</u>**: All backbone cables will meet the requirements of Section 5.2.4.

7.1.2.3 **<u>Wire Map</u>**: Wire Map shall report Pass if the wiring of each wire-pair from end to end is determined to be correct. The Wire Map results shall include the continuity of the shield connection if present.

7.1.2.4 Continuity to Remote End

7.1.2.5 Shorts Between Two or More Conductors

7.1.2.6 Crossed Pairs

7.1.2.7 Reversed Pairs

7.1.2.8 Split Pairs

7.1.2.9 Any Other Mis-Wiring

7.1.3 Test Result Documentation

7.1.3.1 The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.

7.1.3.2 The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time. Testers that transfer the numeric measurement data from the tester to the PC in a non-printable format in this regard offer superior protection.

7.1.3.3 The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.

7.1.3.4 A paper copy of the test results shall be provided that lists all the links that have been tested

7.1.3.5 General Information to be provided in the electronic data base with the test results information for each link:

- The identification of the customer site as specified by Salt Lake County
- The identification of the link in accordance with the naming convention defined in the overall system documentation
- The overall Pass/Fail evaluation of the test
- The name of the standard selected to execute the stored test results
- The cable type and the value of NVP used for length calculations
- The date and time the test results were saved in the memory of the tester
- The brand name, model and serial number of the tester
- The identification of the tester interface
- The revision of the tester software and the revision of the test standards database in the tester
- The test results information must contain information on each of the required test parameters that are listed in this specification and as further detailed below.

7.2 FIBER-OPTIC CABLING SYSTEM FIELD TEST REQUIRMENTS

7.2.1 General Requirements

7.2.1.1 Every fiber optic cabling link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-B.3 (or by the appropriate network application standard(s) whichever is more demanding.

7.2.1.2 ANSI/TIA/EIA-568-B.3, defines the passive cabling network, to include cable, connectors, and splices (if present), between two optical fiber patch panels (connecting hardware). A typical horizontal link segment is from the telecommunications outlet/connector to the horizontal cross-connect. This TIA document describes three typical backbone link segments: (1) main cross-connect to intermediate cross-connect, (2) main cross-connect to horizontal cross-connect, or (3) intermediate cross-connect to horizontal cross-connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

7.2.1.3 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned in A.1 above and as further detailed in this Section. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with this Section.

7.2.1.4 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

- the manufacturer of the fiber optic cable and/or the fiber optic connectors
- the manufacturer of the test equipment used for the field certification
- Training organizations authorized by BICSI (Building Industry Consulting Services International with headquarters in Tampa, Florida) or by the ACP (Association of Cabling Professionals™) Cabling Business Institute located in Dallas, Texas.

7.2.1.5 Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.3) with a Category 1 light source.

7.2.1.6 Field test instruments for singlemode fiber cabling shall meet

the requirements of ANSI/EIA/TIA-526-7.

7.2.1.7 The tester shall be within the calibration period recommended by the vendor in order to achieve the manufacturer-specified measurement accuracy.

7.2.1.8 The fiber optic launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

7.2.1.9 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.

7.2.1.10 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

7.2.1.11 A representative of Salt Lake County's Inspection Team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commence.

7.2.1.12 A representative of Salt Lake County's Inspection Team will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in this Section. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing and the cost shall be borne by the installation contractor.

7.2.1.13 The Contractor in a table shall record light loss performance.

7.2.1.14 All cable shall be factory tested on a reel basis with performance data for each cable supplied to Salt Lake County. Tests shall be conducted at 850 NM and 1300 NM with the attenuation in dB/km recorded for each fiber.

7.2.1.15 Contractor shall supply Quality Control data sheets prepared by the cable supplier for each cable reel.

7.2.1.16 All fiber optic cable shall be visually inspected, and continuity testing shall be performed on each fiber of each cable reel on-site prior to installation to insure no damage occurred during shipment. Contractor shall submit these results.

7.2.2 **<u>Performance Test Parameters</u>**

6.7.2.2.1 ANSI/TIA/EIA standard 568-B prescribes that the single performance parameter for field testing of fiber optic links is link attenuation (alternative and equivalent term: insertion loss), when installing components compliant with this standard.

6.7.2.2.2 The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B

- *Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn*
- *Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)*
  The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5
	1300	1.5
Multimode 50/125 µm	850	3.5
	1300	1.5
Single-mode (Inside plant)	1310	1.0
	1550	1.0
Single-mode (Outside plant)	1310	0.5
	1550	0.5

- *Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)*
  Maximum allowable connector_loss = 0.75 dB
- *Splice_Attn (dB) = number of splices (S) * splice_loss (dB)*
  Maximum allowable splice_loss = 0.3 dB

7.2.2.3 Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

Test equipment that measures the link length and automatically calculates the link loss based on the above formulas is preferred. Standard of quality is the Fluke DSP-FTA410S, or equivalent.

7.2.2.4 The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1; or the equivalent method such as Fluke Network's application note *Loss Testing of Premises Fiber Optic Links (Lit # 1560065).* The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

7.2.2.5 The horizontal link (multimode): acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum 90 m (295 ft) distance. The horizontal optical fiber cabling link segments need to be tested at only one (1) wavelength. Because of the short length of cabling [90 m (295 ft) or less], attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850 nm *or* 1300 nm in one direction in accordance with

ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or Fluke Networks application note *Loss Testing of Premises Fiber Optic Links (Lit # 1560065)*.

The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two (2) connector pairs, one (1) pair at the telecommunications outlet/connector and one (1) pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fiber cable.

7.2.2.6 The backbone link (multimode) shall be tested in one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.

7.2.2.7 Multimode backbone links shall be tested at 850 nm *and* 1300 nm in accordance with ANSI/EIA/TIA-526-14A.

7.2.2.8 Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation (Section B.2) shall be used to determine limit (acceptance) values.

7.2.2.9 Singlemode backbone links shall be tested at 1310 nm *and* 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method outlined in Fluke Networks application note *Loss Testing of Premises Fiber Optic Links (Lit # 1560065).* All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm (See Note below).

(NOTE: Link attenuation has been based upon the use of a light source categorized by a Coupled Power Ratio (CPR) of Category 2, Underfilled, per Annex B of ANSI/EIA/TIA-526-14A. The use of a light source categorized as Category 1, Overfilled, may provide results higher than the 2.0 dB limit. A field test tool based on LED (light emitting diode) light sources is a Category 1 device and typically yields high attenuation results.)

7.2.2.10 Links destined to be used with network applications that use laser light sources (underfilled launch conditions) shall be tested with test equipment based on laser light sources. This rule should be followed for cabling systems to support Gigabit Ethernet. Gigabit Ethernet only specifies laser light sources.

7.2.2.11 For Gigabit Ethernet compliant certification (IEEE std 802.3z application), use test equipment which uses a VCSEL (Vertical cavity surface emitting laser) at 850 nm (compliant with 1000BASE-SX) and an FP laser at 1310 nm (compliant with 1000BASE-LX). Standard of quality is the Fluke DSP-FTA440S, or equivalent.

7.2.2.12 Additional requirement: Each fiber optical link terminated with an optical adapter system which does not impose a transmission direction because the adapters are not or cannot

be ganged should be tested and documented in both direction since the direction of the signal transmission cannot be predicted at the time of installation.

7.2.2.13 After completion of installation and termination, each fiber shall be tested using an Optical Time Domain Reflectometer (OTDR) at 850 NM and 1300 NM. A trace of each fiber shall be made depicting the following:

- Cross-referenced cable assignment
- Actual fiber length
- Calculated fiber loss based on the fiber manufacturer specifications and actual fiber length
- Point-to-point fiber loss at 850 NM
- Point-to-point fiber loss at 1300 NM

7.2.2.14 Traces for the OTDR shall include a notation of scale divisions.

7.2.2.15 Each installed fiber cable shall be tested for insertion loss to reflect total end-to-end loss.

7.2.2.16 End-to-end loss shall be measured from patch panel to patch panel and must include bulkhead connector loss. A one-jumper reference shall be measured prior to measuring system losses. The actual loss shall be calculated by subtracting the measured loss from the reference.

7.2.3 Test Result Documentation

7.2.3.1 The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

7.2.3.2 The test result records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that these results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test.

The popular 'csv' format (comma separated value format) does not provide adequate protection and shall not be acceptable.

7.2.3.3 The database for the completed job – including twisted-pair copper cabling links if applicable –shall be stored and delivered on CD-ROM; this CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

7.2.3.4 A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information

- The identification of the link in accordance with the naming convention defined in the overall system documentation
- The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst case margin (margin is

defined as the difference between the measured value and the test limit value).

- The date and time the test results were saved in the memory of the tester

7.2.3.5 General Information to be provided in the electronic data base containing the test result information for each link:

- The identification of the customer site as specified by the end-user
- The overall Pass/Fail evaluation of the link-under-test
- The name of the standard selected to execute the stored test results
- The cable type and the value of the 'index of refraction' used for length calculations
- The date and time the test results were saved in the memory of the tester
- The brand name, model and serial number of the tester
- The revision of the tester software and the revision of the test standards database in the tester

7.2.3.6 The detailed test results data to be provided in the electronic database for each tested optical fiber must contain the following information

- The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation
- The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength and the margin (difference between the measured attenuation and the test limit value).
- The link length shall be reported for each optical fiber for which the test limit was calculated based on the formulas in this section.

7.2.3.7 The Contractor must submit to Salt Lake County a formal report listing all fibers and all test specification results. The technician performing the test must sign the report and present the test equipment for inspection. The project representative shall select various fiber links for on-site testing to verify compliance prior to final system acceptance.

7.2.3.8 The Contractor must submit final test results for tests as conducted on each installed fiber. Data shall include a block diagram of the entire system depicting the imprinted length markings of both ends of each installed cable. End splice losses shall be taken with an OTDR, bi-directional average through splice losses as taken with an OTDR, bi-directional OTDR signature traces and insertion loss testing using a light source and power meter taken from one direction at both 850 NM and 1300 NM.

END OF SECTION

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Attachment B
Horizontal Specifications

1.0 HORIZONTAL CABLE INSTALLATION REQUIREMENTS

A minimum of two (2) approved cables are to be run from the telecommunication closets to each jack location. **All cabling shall be installed based on the recommendations of the EIA/TIA-568-B-1-2-3 and Salt Lake County's Specifications. And shall also be based on the installation practices as outlined in BICSI's most current TDM Manual. Approved cables include:**

- **Four-pair 100-ohm unshielded twisted pair (UTP) rated Category 6 or higher.**
- **Two-strand 50/125 micron optical fiber cable or 62.5/125 micron* optical fiber cable (*only where 62.5 is already existing).**

The Contractor shall take all steps necessary to **minimize** cable tensions and sharp bends in all cables. The Contractor shall also isolate the cable from sources of EMI and shall insure that pairs are properly twisted to the point of termination. A Structured Cabling System installation, which ignores these requirements, **will not be accepted by the County**.

1.1 Bridge taps or splices are not acceptable as part of the horizontal cabling.

1.2 The **maximum horizontal cable drop length** is **ninety (90) meters (295feet)**. The drop length is measured from the IDF termination block in the Communications Equipment Room to the telecommunications outlet. **Contractor shall closely monitor the length of station runs, which approach this distance limitation and shall take all necessary precautions in the routing of such station runs to avoid violation of this requirement. If the Contractor determines that a particular station can not be run under this requirement, the Contractor must notify the County contact person to receive approval to commence. Any horizontal cable drop longer than eighty-seven (87) meters (285.5feet) must be appropriately labeled and documented.**

1.3 When installing the four-pair horizontal cable, pulling tension shall not exceed manufacturers recommendations.

1.4 The jacketing of the UTP LAN Cables contributes to the performance and electrical characteristics of the cable. The County, therefore, is requiring the Contractor to exercise careful handling procedures and to follow the cable manufacturer's guidelines for installing and terminating the cable. The Contractor must take care to avoid crimping, crushing, and/or any other damage to the cable during shipping, handling, installing, and terminating.

1.5 The cable sheath shall be protected from damage from sharp metal edges. Where the cable passes over a sharp edge, a bushing or grommet shall be installed to protect the cable. An example of when grommets will be required is where the cable passes through a metal header to enter a wall or where a cable enters or leaves a sleeve used for wall penetration. It is the Contractor's responsibility to make the County aware of any conduits that have not been properly reamed and bushed. Corrective action must be taken prior to the installation of cabling in these conduits.

1.6 **Each of the two four-pair sheaths from each station will be separately terminated on its respective cross-connect field i.e., the two cables shall be terminated to separate wiring blocks (Side 1 and Side 2) or patch panels.**

1.7 All horizontal cables and cable pairs must be terminated in numerical order across the wiring block field with the lowest number station run or pair first.

1.8 Each four-pair cable shall be bundled with like kinds. Velcro wraps or other approved methods for forming bundles shall be utilized. Plastic Cable Ties will not be used in County Installations.

1.9 At the Intermediate Distribution Frames (IDF's), the cables shall be bundled with like kinds and secured to building structure. Bundling shall be accomplished with tie wraps or other approved methods. Cable shall be secured to building structure with category 6 compliant "D" Rings or J-Hooks to the point that the cable is introduced into to the raceway structure.

1.10 Unshielded media is subject to Cross-talk and electrical interference. The Contractor shall take all steps **necessary** to route all cables away from sources of interference. To reduce EMI/RFI induced into cabling from fluorescent lights or other EMI sources, the Contractor shall observe the following **minimum clearances** for the installed cable ***(where possible, at a minimum the contractor must meet EIA/TIA Standards)***:

1.10.1 Six (6”) inches between the cable and finished ceiling.

1.10.2 Six (6”) inches between the cable and the nearest fluorescent light.

1.10.3 Thirty-six (36”) inches between the cable and any electric motor.

1.10.4 Twenty-four (24”) inches between the cable and any electrical cable or electrical cable conduit.

1.10.5 Thirty-six (36”) inches between the cable and any High Voltage Alternating Current (AC) Equipment.

NOTE: Where the Contractor finds it impossible to meet the minimum clearance requirements, the Contractor must notify and consult with the County to determine a better route or receive approval for a modified clearance requirement. The County will review these situations on a case-by-case basis, i.e., each horizontal cable run will be subject to review.

1.11 **Twelve (12”)** inches of slack shall be left in each horizontal cable under 270 feet in length for copper cable and three feet, three inches (3’3”) of slack shall be left for fiber-optic cable. This slack shall be left at the telecommunications outlet (jack) end of the run. **Ten (10’) feet shall be left at the telecommunications closet (IDF) end of the run.** The slack shall be neatly coiled and looped on the hangar assembly supporting the cable just before it drops through the ceiling or into a stubbed conduit or power pole. The coil of cable shall be loosely tied with a velcro wrap or similar fastener. The velcro wrap shall be loose around the coil thereby allowing the wrap to rotate. A tightly wrapped coil will potentially alter the electrical characteristics and performance of the cable.

1.12 In ceiling and below floor distribution systems, the cable shall be supported a **minimum of every four (4') feet** along the length of its run.

1.13 Contractor shall be responsible to handle acoustical ceiling units in such a manner that the units are not chipped or otherwise damaged in any way. **Contractor shall be responsible for replacing any damaged units.** Prior to and after the cabling Contractor enters an area or floor to perform work, a survey will be conducted to establish the condition of the suspended ceiling.

1.14 **The Contractor shall pay particular attention to careful handling of all cables during shipping, handling, and installation. The Contractor shall strictly adhere to the installation procedures outlined in this section and elsewhere in this document. Failure to adhere to the installation methods proscribed by the County shall result in the rejection of your Structured Cabling System installation and the Contractor will forfeit any rights to payment. CABLE AND EQUIPMENT DAMAGED IN SHIPPING AND UNLOADING WILL BE REPLACED BY THE RESPONDENT AT NO COST TO THE COUNTY.**

1.15 When requested by the County the Contractor shall supply and install all connecting cables, including but not limited to patch cables, work station patch cables, octopus cables, fiber jumper cables and connectors, and baluns required to provide connectivity of all workstations to the County's Data Equipment.

1.16 Contractor shall reference all attachments to assist with jack locations and counts. Contractor is responsible to notify the County with their bid, their recommended horizontal and backbone design. This design shall include, but not be limited to, the number of fibers to each building, the copper cable pairs to each building, and total Structured Cabling System design.

2.0 HORIZONTAL CABLE SPECIFICATIONS

2.1 UNSHIELDED TWISTED PAIR (UTP)

2.1.1 GENERAL REQUIREMENTS

2.1.1.1 **A minimum of two (2) four-pair, plenum/non-plenum rated, unshielded twisted-pair cables shall be pulled from the IDF to each telecommunications outlet. Blue cable shall be used for data, yellow cable shall be used for voice, white wire shall be used for paging, unless otherwise agreed upon.** The requirements for this cabling, its installation and termination equipment are very stringent to support high-speed data communications. **All voice and data Horizontal Cable shall be Category 6, or higher, as defined by this specification or the Scope of Work provided by SALT LAKE COUNTY.**

2.1.1.2 All **horizontal copper cable** bid and installed by the Contractor shall be 23 AWG or 24 AWG, Four (4) pair, Unshielded Twisted Pair.

2.1.1.3 CONTRACTOR **MUST** PROVIDE DOCUMENTATION / SPECIFICATION SHEETS FROM THE MANUFACTURER TO THE COUNTY ABOUT THE UTP (PVC and plenum rated) CABLES WHICH THE CONTRACTOR PROPOSES TO INSTALL AS A PART OF ANY BID RESPONSE. This documentation will be reviewed by the County to ensure that the cable selected by the Contractor does in fact meet or exceed the specifications. Review of this documentation by the County does not relieve the Contractor of any requirements specified in these specifications.

2.1.1.4 **The Horizontal cabling system shall be capable of transmitting data signals at a minimum rate of 1 Gigabit (10 Gigabit for 6A) or better. Contractor is to indicate the transmission rate of the cable being bid.**

2.1.1.5 **Contractor is required to receive final approval from the County on the Unshielded Twisted Pair cable type selected prior to installation.**

2.1.1.6 Only virgin material shall be used.

2.1.1.7 Plenum-rated cables shall use 100% FEP for the insulation except where it is proven that the cable constructed with alternate materials meets or exceeds the electrical performance of FEP.

2.1.1.8 The manufacturer of the cables shall be ISO 9002 registered.

2.1.1.9 Certified Test Data demonstrating compliance to the specification will be supplied for all manufacturers that are not on the approved manufacturer's list.

2.1.2 CATEGORY 3 PERFORMANCE REQUIREMENTS:

TIA/EIA NO LONGER RECOMMENDS THE USE OF CATEGORY 3 CABLE IN A HORIZONTAL STRUCTURED CABLING SYSTEM FOR VOICE OR DATA COMMUNICATIONS. CONSEQUENTLY, SALT LAKE COUNTY DOES NOT RECOMMEND THE USE OF CATEGORY 3 CABLE IN ANY COUNTY STRUCTURED CABLING SYSTEM EXCEPT PAGING INSTALLATIONS.

2.1.2.1 All **horizontal UTP cable** bid and installed by the Contractor, for paging or voice applications, **MUST MEET OR EXCEED** all requirements for a **Category 3** Unshielded Twisted Pair (UTP) cable as set forth and delineated by the **ANSI/EIA/TIA-568-B-1 standards for horizontal wiring. Following is a list of cable manufacturers that have been approved (Other manufacturers must submit testing requirements that meet or exceed Category 3 as defined by ANSI/EIA/TIA 568-B-1):**

Manufacturer

- **Beldon**
- **General Cable**

2.1.2.2 All Category 3 cables shall meet, as a minimum, the requirements of**:**

- CSA
- NEC
- UL 444
- ANSI/TIA/EIA-568-B-1 Category 3
- ISO/IEC 11801 Category 3

2.1.3 CATEGORY 5 - PERFORMANCE REQUIREMENTS:

TIA/EIA NO LONGER RECOMMENDS NOR RECOGNIZES THE USE OF CATEGORY 5 CABLE IN ANY HORIZONTAL STRUCTURED CABLING SYSTEM. CONSEQUENTLY, SALT LAKE COUNTY DOES NOT PERMIT THE USE OF CATEGORY 5 CABLE IN ANY COUNTY STRUCTURED CABLING SYSTEM FOR DATA COMMUNICATIONS APPLICATIONS. (ANSI/TIA/EIA-568-B-3 Paragraph 4.2.1)

2.1.4 CATEGORY 5e - PERFORMANCE REQUIREMENTS:

Category 5e Cable will be 4-pair unshielded twisted pair (UTP), 24 AWG solid bare copper, insulated adjoined singles, and ripcord. CMP is FEP insulated with overall FlamArrest, or equivalent, jacket. CMR is polyolefin insulated with flexible PVC jacket.

2.1.4.1 All **horizontal UTP cable** bid and installed by the Contractor **MUST MEET OR EXCEED** all requirements for a **Category 5e** Unshielded Twisted Pair (UTP) cable as set forth and delineated by the **ANSI/EIA/TIA-568-B-1 standards for horizontal wiring and must meet the performance standards as defined in 4.2.1.4. Following is a list of cable manufacturers that have been approved (Other manufacturers must submit independent testing requirements from UL, ETL, or other indiependent testing lab, that the cable will meet or exceed Category 5e as defined by the performance specifications in this document):**

Manufacturer	Model
PanGen	**GenSPEED 5500**
Beldon	**Data Twist 350**

2.1.4.2 Applications:

Category 5e Cable shall support current Category 5e applications such as 10BaseT (Ethernet), 100BaseT (Fast Ethernet), 100BaseVG AnyLAN, and 155 ATM. Should be able to be used for high bandwidth future applications such as 622 ATM and 1000BaseT (Gigabit Ethernet). It should support multimedia applications including AES/EBU digital audio, RS-422 machine control, which normally requires shielded twisted pairs. It should also support NTSC and PAL composite serial digital video and NTSC/PAL component serial digital video, which normally requires coaxial cables. It should be UL tested for use with high speed Audio-Video Systems in accordance with FCC Class A Digital Devices at a fundamental frequency of 135 MHz (270 Mbps).

2.1.4.3 All Category 5e cables shall meet, as a minimum, the requirements of**:**

- CSA
- NEC
- UL 444
- ANSI/TIA/EIA-568-B-3 Category 5e
- ISO/IEC 11801 Category 5

2.1.4.4 <u>HIGHEST TEST FREQUENCY</u>: 350 MHz minimum (all parameters)

2.1.4.5 <u>INPUT IMPEDANCE</u>: Input impedance shall be measured per ASTM 4566-94, 43.2 Method 2, Option 2, (Method 3 will not be allowed), Category 5e input impedance shall be swept out to 350 MHz and meet **100 Ohms +/- 12%**:

2.1.4.6 <u>MINIMUM PAIR-TO-PAIR NEXT AND ELFEXT</u>: Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Pair-to-Pair Equal Level Far End Crosstalk (ELFEXT) shall not be less than the minimum numbers shown in the following table.

2.1.4.7 <u>MINIMUM POWER SUM NEXT AND ELFEXT</u>: Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Equal Level Far End Crosstalk (PSELFEXT) shall not be less than the minimum numbers shown in the following table.

2.1.4.8 <u>MAXIMUM ATTENUATION, MINIMUM PAIR-TO-PAIR ACR AND POWER SUM ACR</u>: Attenuation shall not be greater than the maximum numbers shown in the following table when measured at an ambient temperature of 20°C (68°F). Pair-to-Pair Attenuation to Crosstalk Ratio (ACR) shall not be less than the minimum numbers shown in the following table. Power Sum Attenuation to Crosstalk Ratio shall not be less than the minimum numbers shown in the following table.

** Attenuation for Level 6 stranded patch cordage is allowed to be up to 20% greater.*

2.1.4.9 <u>MAXIMUM SKEW</u>

- **25 ns at 100 meters**

2.1.4.10 All components used in a Category 5e channel shall meet the following requirements

County Office of Telecom Cable Performance Standards										
Category 5e										
FREQ (MHz)	**ATTEN (dB/100m) max.**	**NEXT (dB/100m) min**	**ACR (dB/100m) min**	**PS-NEXT (dB/100m) min**	**PS-ACR (dB/100m) min**	**ELFEXT (dB/100m) min**	**PS-ELFEXT (dB/100m) min**	**LCL (dB) min**	**RL (dB) min**	**ELTCTL (dB/100m)**
1.00	1.9	70.3	70.1	68.3	68.1	65.0	62.0		20.0	
4.00	3.9	61.3	59.1	59.3	57.1	53.0	50.0		23.0	
10.00	6.1	55.3	50.9	53.3	48.9	45.0	42.0		25.0	
16.00	7.8	52.3	46.1	50.3	44.1	40.9	37.9		25.0	
20.00	8.8	50.8	43.7	48.8	41.7	39.0	36.0		25.0	
31.25	11.2	47.9	38.4	45.9	36.4	35.1	32.1		23.6	
62.50	16.2	43.4	28.9	41.4	26.9	29.1	26.1		21.5	
100.00	21.0	40.3	21.0	38.3	19.0	25.0	22.0		20.1	
155.00	26.8	37.5	12.3	35.5	10.3	21.2	18.2		18.8	
200.00	31.0	35.8	6.5	33.8	4.5	19.0	16.0		18.0	
250.00	35.3	34.3	0.8	32.3		17.0	14.0		17.3	
300.00	39.2	33.2		31.2		15.5	12.5		16.8	
350.00	43.0	32.2		30.2		14.1	11.1		16.3	

2.1.5 CATEGORY 6 PERFORMANCE REQUIREMENTS:

Category 6 Cable will be 4-pair unshielded twisted pair (UTP), 23 AWG solid bare copper, bonded-pairs, and ripcord. CMP is FEP insulated with overall FlamArrest, or equivalent, jacket. CMR is polyolefin insulated with flexible PVC jacket.

2.1.5.1 When required by Salt Lake County the Contractor will provide Category 6 Unshielded Twisted Pair (UTP) cable as set forth and delineated by the **ANSI/EIA/TIA-568-B-1 Category 6 standards for horizontal wiring and must meet the performance standards as defined in 4.2.1.5.** Following is a list of cable manufacturers that have been approved (Other manufacturers must submit testing requirements that meet or exceed Category 6 as defined by the performance specifications in this document):

Manufacturer	**Model**
❑ **PanGen**	**GenSPEED 6000**
❑ **Beldon**	**Media Twist**

2.1.5.2 Applications:

Category 6 Cable shall support current Category 6 applications such as 10BaseT (Ethernet), 100BaseT (Fast Ethernet), 100BaseVG AnyLAN, 155 ATM, 622 ATM and 1000BaseT (Gigabit Ethernet), 10 Gig Ethernet to 55 meters. It should support multimedia applications including AES/EBU digital audio, RS-422 machine control, which normally requires shielded twisted pairs. It should also support NTSC and PAL composite serial digital video and NTSC/PAL component serial digital video, which normally requires coaxial cables. It should be UL tested for use with high speed Audio-Video Systems in accordance with FCC Class A Digital Devices at a fundamental frequency of 135 MHz (270 Mbps).

2.1.5.3 All cables shall meet, as a minimum, the requirements of:

- **CSA**
- **NEC**
- **UL 444**
- **ANSI/TIA/EIA-568-B-3 Category 6**
- **ISO/IEC 11801 Category 6**

2.1.5.4 **HIGHEST TEST FREQUENCY:** 500 MHz minimum (all parameters)

2.1.5.5 **INPUT IMPEDANCE:** Input impedance shall be measured per ASTM 4566-94, 43.2 Method 2, Option 2, (Method 3 will not be allowed), Category 6 input impedance shall be swept out to 400 MHz and meet **100 Ohms +/- 12%.**

2.1.5.6 **MINIMUM PAIR-TO-PAIR NEXT AND ELFEXT:** Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Pair-to-Pair Equal Level Far End Crosstalk (ELFEXT) shall not be less than the minimum numbers shown in the following table.

2.1.5.7 **MINIMUM POWER SUM NEXT AND ELFEXT:** Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Equal Level Far End Crosstalk (PSELFEXT) shall not be less than the minimum numbers shown in the following table.

2.1.5.8 **MAXIMUM ATTENUATION, MINIMUM PAIR-TO-PAIR ACR AND POWER SUM ACR:** Attenuation shall not be greater than the maximum numbers shown in the following table when measured at an ambient temperature of 20°C (68°F). Pair-to-Pair Attenuation to Crosstalk Ratio (ACR) shall not be less than the minimum numbers shown in the following table. Power Sum Attenuation to Crosstalk Ratio shall not be less than the minimum numbers shown in the following table.

** Attenuation for Level 6 stranded patch cordage is allowed to be up to 20% greater.*

2.1.5.9 **MAXIMUM SKEW**

- **25 ns at 100 meters**

2.1.5.10 All components used in a Category 6 channel shall meet the following requirements:

County Office of Telecom Cable Performance Standards										
Category 6										
FREQ (MHz)	**ATTEN (dB/100m) max**	**NEXT (dB/100m) min**	**ACR (dB/100m) min**	**PS-NEXT (dB/100m) min**	**PS-ACR (dB/100m) min**	**ELFEXT (dB/100m) min**	**PS-ELFEXT (dB/100m) min**	**LCL (dB) min**	**RL (dB) min**	**ELTCTL (dB/100m)**
1.00	2.0	75.3	73.3	73.3	71.3	68.8	65.8	50.0	20.0	35.0
4.00	3.8	66.3	62.5	64.3	60.5	56.8	53.8	44.0	23.0	23.0
10.00	5.9	60.3	54.4	58.3	52.4	48.8	45.8	40.0	25.0	15.0
16.00	7.5	57.3	49.7	55.3	47.7	44.7	41.7	38.0	25.0	10.9
20.00	8.4	55.8	47.4	53.8	45.4	42.8	39.8	37.0	25.0	9.0

31.25	10.6	52.9	42.3	50.9	40.3	38.9	37.8	35.1	23.6	5.1
62.50	15.3	48.4	33.1	46.4	31.1	32.9	29.9	32.0	21.5	
100.00	19.7	45.3	25.6	43.3	23.6	28.8	25.8	30.0	20.1	
200.00	28.8	40.8	11.9	38.8	9.9	22.8	19.8	27.0	18.0	
250.00	32.7	39.3	6.6	37.3	4.6	20.8	17.8	26.0	17.3	
350.00	39.6	37.2	2.0	35.2				24.6		
400.00	42.7	36.3		34.3				24.0		
500.00	48.7	34.8		32.8				23.0		

2.1.6 CATEGORY 6A PERFORMANCE REQUIREMENTS:

Category 6A (Augmented) Cable will be 4-pair unshielded twisted pair (UTP), 23 AWG solid bare copper, patented E-Spline, or equivalent, bonded-pairs, and ripcord. CMP is FEP insulated with overall FlamArrest, or equivalent, jacket. CMR is polyolefin insulated with flexible PVC jacket.

2.1.6.1 When required by Salt Lake County the Contractor will provide Category 6A Unshielded Twisted Pair (UTP) cable as set forth and delineated by the developing **ANSI/EIA/TIA-568-B-1 Draft 10 Category 6A standards for horizontal wiring and must meet the performance standards as defined in 4.2.1.6.** Following is a list of cable manufacturers that have been approved (Other manufacturers must submit testing requirements that meet or exceed Category 6 as defined by the performance specifications in this document):

Manufacturer	Model
❑ **PanGen**	**GenSPEED 6600**
❑ **Beldon**	**Data Twist 600e**

2.1.5.2 Applications:

Category 6A Cable shall support current Category 6A applications such as 10BaseT (Ethernet), 100BaseT (Fast Ethernet), 100BaseVG AnyLAN, 155 ATM, 622 ATM and 1000BaseT (Gigabit Ethernet) 10000BaseT (10 Gigabit Ethernet). It should support multimedia applications including AES/EBU digital audio, RS-422 machine control, which normally requires shielded twisted pairs. It should also support NTSC and PAL composite serial digital video and NTSC/PAL component serial digital video, which normally requires coaxial cables. It should be UL tested for use with high speed Audio-Video Systems in accordance with FCC Class A Digital Devices at a fundamental frequency of 135 MHz (270 Mbps).

2.1.6.3 All cables shall meet, as a minimum, the requirements of:

- ❑ **CSA**
- ❑ **NEC**
- ❑ **UL 444**
- ❑ **ANSI/TIA/EIA-568-B-3 Category 6**
- ❑ **ANSI/TIA/EIA-568-B-3 Category 6A**
- ❑ **ISO/IEC 11801 Category 6**

2.1.6.4 HIGHEST TEST FREQUENCY: 500 MHz minimum (all parameters)

2.1.6.5 INPUT IMPEDANCE: Input impedance shall be measured per ASTM 4566-94, 43.2 Method 2, Option 2, (Method 3 will not be allowed), Category 6A

input impedance shall be swept out to 500 MHz and meet **100 Ohms +/- 22%.**

2.1.6.6 **MINIMUM PAIR-TO-PAIR NEXT AND ELFEXT:** Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Pair-to-Pair Equal Level Far End Crosstalk (ELFEXT) shall not be less than the minimum numbers shown in the following table.

2.1.6.7 **MINIMUM POWER SUM NEXT AND ELFEXT:** Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Equal Level Far End Crosstalk (PSELFEXT) shall not be less than the minimum numbers shown in the following table.

2.1.6.8 **MAXIMUM ATTENUATION, MINIMUM PAIR-TO-PAIR ACR AND POWER SUM ACR:** Attenuation shall not be greater than the maximum numbers shown in the following table when measured at an ambient temperature of 20°C (68°F). Pair-to-Pair Attenuation to Crosstalk Ratio (ACR) shall not be less than the minimum numbers shown in the following table. Power Sum Attenuation to Crosstalk Ratio shall not be less than the minimum numbers shown in the following table.

** Attenuation for Level 6A stranded patch cordage is allowed to be up to 20% greater.*

2.1.6.9 **MAXIMUM SKEW**

- **25 ns at 100 meters**

2.1.6.10 **All components used in a Category 6A channel shall meet the following requirements**

County Office of Telecom Cable Performance Standards										
Enhanced Category 6(A) – 10Gig										
FREQ (MHz)	**ATTEN (dB/100m) max.**	**NEXT (dB/100m) min**	**ACR (dB/100m) min**	**PS-NEXT (dB/100m) min**	**PS-ACR (dB/100m) min**	**ELFEXT (dB/100m) min**	**PS-ELFEXT (dB/100m) min**	**LCL (dB) min**	**RL (dB) min**	**ELTCTL (dB/100m)**
1.00	1.8	82.3	80.5	80.3	78.5	75.0	72.0	50.0	20.0	35.0
4.00	3.4	73.3	69.9	71.3	67.9	63.0	60.0	44.0	23.0	23.0
10.00	5.3	67.3	62.0	65.3	60.0	55.0	52.0	40.0	25.0	15.0
16.00	6.8	64.2	57.4	62.2	55.4	50.9	47.9	38.0	25.0	10.9
20.00	7.6	62.8	55.2	60.8	53.2	49.0	46.0	37.0	25.0	9.0
31.25	9.6	59.9	50.3	57.9	48.3	45.1	42.1	35.1	26.1	5.1
62.50	13.9	53.4	41.5	53.4	39.5	39.1	36.1	32.0	24.0	-
100.00	17.9	52.3	34.4	50.3	32.4	35.0	32.0	30.0	22.5	-
200.00	26.4	47.8	21.4	45.8	19.4	29.0	26.0	27.0	20.5	-
250.00	30.0	46.3	16.3	44.3	14.3	27.0	24.0	26.0	19.8	-
350.00	36.4	44.2	7.8	42.2	5.8	24.1	21.1	24.6	18.8	-
400.00	39.4	43.3	3.9	41.3	1.9	23.0	20.0	24.0	18.4	-
500.00	45.0	41.8	-	39.8	-	21.0	18.0	23.0	17.7	-

2.2 FIBER-OPTIC HORIZONTAL CABLING

2.2.1 **When required, a minimum of two (2) two-strand, plenum/non-plenum rated, 50/125 µm fiber optic cables or 62.5/125 µm fiber optic cables (only when there is existing 62.5/125 µm fiber optic cables exist) shall be pulled from the IDF to each telecommunications outlet.** The requirements for this cabling, its installation and termination equipment are very stringent to support high-speed data communications.

2.2.2 All **horizontal fiber cables** bid and installed by the Contractor **MUST MEET OR EXCEED** all requirements for a **fiber** cable as set forth and delineated by the **ANSI/EIA/TIA-568-B-3 standards for fiber cabling and must meet the performance standards as defined by the County. Following is a list of cable manufacturers and part numbers that have been approved:**

Manufacturer	Model
❑ **Corning**	**LANscape**

2.2.3 All horizontal fiber cable bid and installed by the Contractor shall be 50/125 µm or 62.5/125 µm, two (2) strand fiber optic cable, as described in the Scope of Work. The mechanical and environmental specifications for plenum all-dielectric indoor optical fiber shall be in accordance with ANSI/TIA/EIA-472CAAA and other constructed indoor fiber cable shall be in accordance with ANSI/ICEA S-83-596.

2.2.4 CONTRACTOR **MUST** PROVIDE DOCUMENTATION / SPECIFICATION SHEETS FROM THE MANUFACTURER TO THE COUNTY ABOUT THE FIBER (PVC and plenum rated) CABLES WHICH THE CONTRACTOR PROPOSES TO INSTALL AS A PART OF THE BID RESPONSE. This documentation will be reviewed by the County to ensure that the cable selected by the Contractor does in fact meet or exceed the specifications for a Fiber Optic cable as specified in the ANSI/EIA/TIA-568-B-3. Review of this documentation by the County does not relieve the Contractor of any requirements specified in this Invitation to Bid.

2.2.5 The fiber shall have a minimum bandwidth capacity of 10 GHz for the 90 m (295') distance specified for horizontal cabling. Contractor is to indicate the transmission rate of the cable being bid.

2.2.6 Maximum attenuation for indoor multi-mode fiber-optic cabling shall meet the ANSI/TIA/EIA-568-B.3 Specifications:

- ❑ At 850 nm the maximum attenuation shall be 3.5 dB/km.
- ❑ At 1300 nm the maximum attenuation shall be 1.5 dB/km.

2.2.7 All horizontal fiber optic cable shall be run in Innerduct or shall be have an armor jacket. Innerduct or armored jacket shall be plenum rated in a plenum environment.

2.2.8 Contractor is required to receive final approval from the County on the fiber optic cable type selected prior to installation.

2.3 PAGING APPLICATIONS

2.3.1 For Self Amplified, low voltage paging systems: One (1) four-pair, plenum/non-plenum rated, Category 3 or 5e, unshielded twisted-pair, 24 awg cable shall be pulled from the IDF to each paging speaker. White cable shall be used for paging, unless otherwise agreed upon.

2.3.2 For Central Amplified, 70 volt paging systems: One (1) two conductor, plenum/non-plenum rated, shielded stranded, 18 awg cable shall be pulled from the IDF to each paging speaker. White cable shall be used for paging, unless otherwise agreed upon.

2.3.3 CONTRACTOR **MUST** PROVIDE DOCUMENTATION / SPECIFICATION SHEETS FROM THE MANUFACTURER TO THE COUNTY ABOUT THE UTP or STP (PVC and plenum rated) CABLES WHICH THE CONTRACTOR PROPOSES TO INSTALL AS A PART OF THE BID RESPONSE. This documentation will be reviewed by the County to ensure that the cable selected by the Contractor does in fact meet or exceed the specifications for a Category 3 or 5e cable as specified in the ANSI/EIA/TIA-568-B-1. Review of this documentation by the County does not relieve the Contractor of any requirements specified in this Invitation to Bid.

2.3.4 The Paging cabling system shall be capable of transmitting voice paging to all speakers clearly.

2.3.5 Contractor is required to receive final approval from the County on the Twisted Pair cable type selected prior to installation.

2.4 COAXIAL CABLE

2.4.1 **One (1) Solid Copper RG-/6u or RG-59/u Coaxial Cable will be pulled from the Video Tap to each room's TV Port. The RG-59/u will be pulled from each rooms TV Port to any video jack required for Local Access to the Video System.** The requirements for this cabling, its installation and termination equipment are very stringent to support video communications.

2.4.2 All Coaxial Broadband Video cable bid and installed by the Contractor MUST MEET OR EXCEED all requirements for a MATV and Broadband Video System as set forth and delineated by the NEC Article 820 standards for community antenna television and RF cable. Following is a list of cable manufacturers that have been approved (Other manufacturers must submit testing requirements that meet or exceed the specifications in this document):

Manufacturer	Model
❑ **Beldon**	**RG-6/u (1530A, 1530AP)**
❑ **Beldon**	**RG-11/u (1523A, 89292)**
❑ **Beldon**	**RG-59/u (9100, 82108)**
❑ **West Penn**	**RG-6/u (841, 25841)**
❑ **West Penn**	**RG-11/u (821, 25821)**
❑ **West Penn**	**RG-59/u (843, 25843)**

2.4.3 One (1) Solid Copper RG-11/u Coaxial Cable will be pulled as the main trunk cable for a each Broadband Video Distribution System Trunk Line. The RG-11/u will be pulled from the Video Headend Location to any splitters or video amplifiers and on to the taps leading to each room. The requirements for this cabling, its installation and termination equipment are very stringent to support video communications.

2.4.4 Taps shall have Superior Performance to 750 MHz. They shall either be 2, 3, 4 or 8 way models. They shall be constructed of Die Cast Housing. They shall include in-line and style models. They shall have RF Shielding Mounting Tabs and Grounding Blocks. Standard of quality shall be Blonder-Tongue Indoor Splitters (Model # CRS-2, CRS-3, CRS-4, CRS-8) or equivalent.

2.4.5 BNC Connectors shall be of a 3 Piece Construction and shall be attached to the Coaxial Cables by using the proper Crimp Tool. The BNC connector must be compatible to the type of Coaxial Cable provided and must be recommended for use on that cable by the cable Manufacturer.

2.4.6 F Connectors shall be attached to the Coaxial Cables by using the proper Crimp Tool.

The F connector must be compatible to the type of Coaxial Cable provided and must be recommended for use on that cable by the cable Manufacturer.

2.4.7 75 Ohm 500 type Coaxial Cable will be used to connect the Video Headend Building to other Building ICs in a Campus Environment. Standard of quality for underground use is CommScope PIII JACASS 75 Ohm Coaxial Cable, or equivalent. Standard of quality for aerial or tunnel use is CommScope PIII 500 JCA 75 Ohm Coaxial Cable, or equivalent.

3.0 UTP CHANNEL SPECIFICATIONS

The Category 5e, Category 6, and Category 6e cable and connectivity performance specification shall be a combined end-to-end solution for consistency and impedance issues. The components used must be as close to 100 ohms as possible.

3.1 CATEGORY 5e CABLE CHANNEL MANUFACTURERS:

Following is a list of cable manufacturers and termination device manufacturers that have been approved (Other manufacturers must submit testing requirements that meet or exceed Category 5e as defined by the specifications in this document):

Cable Manufacturer	Termination Device Mfr.
❑ **Beldon Data Twist 350**	**Panduit TX-5e**
❑ **PanGen GenSPEED 5500**	**Panduit TX-5e**

3.2 CATEGORY 6 CABLE CHANNEL MANUFACTURERS:

Following is a list of cable manufacturers and termination device manufacturers that have been approved (Other manufacturers must submit testing requirements that meet or exceed Category 6 as defined by the specifications in this document):

Cable Manufacturer	Termination Device Mfr.
❑ **Beldon Media Twist**	**Panduit Giga Channel TX-6**
❑ **PanGen GenSPEED 6500**	**Panduit Giga Channel TX-6**

3.3 CATEGORY 6A CABLE CHANNEL MANUFACTURERS:

Following is a list of cable manufacturers and termination device manufacturers that have been approved (Other manufacturers must submit testing requirements that meet or exceed Category 6A as defined by the specifications in this document):

Cable Manufacturer	Termination Device Mfr.
❑ **Beldon Data Twist 600e**	**Beldon IBDN System**
❑ **PanGen GenSPEED 6600**	**Panduit Giga Channel TX-6A**

3.4 All Contractors must submit to independent, third party, UL Certified lab-based test reports indicating that the proposed combination of products meets or exceeds all of the specifications outlined in the channel and component specifications.

3.5 TELECOMMUNICATION OUTLETS FOR WORK AREA OUTLETS, PATCH PANELS AND PATCH CORDS:

3.5.1 The Telecommunications Outlet

3.5.1.1 The **telecommunication outlet** for Work Area Outlets shall consist of at least a **duplex, eight-conductor modular jack**. Unless otherwise indicated, all data and voice outlets shall be fully Category 5e, 6, or 6A compliant RJ45 connectors. Outlets must meet Salt Lake County's Category 5e, 6, or 6A Standards. Outlets shall consist of one single-gang Quad faceplate with at least one (1) RJ45 Yellow modular jack for voice and one (1) RJ45 Blue modular jack for data. Standard of quality is Panduit, or equivalent. Note: All connectors must meet the same Category listing as the cable (I.e. Category 6 Connectors shall be used to connect to Category 6 Cable).

3.5.1.2 The **telecommunication outlet** for Patch Panels, shall consist of **field connected, eight-conductor modular jack**. Unless otherwise indicated, all patch panels shall be fully Category 5e, 6, or 6A compliant RJ45 connectors. Patch Panels must meet Salt Lake County's Category 5e, 6, or 6A Standards. Patch Panels shall consist of a rack-mounted 24-port or 48-port jack panel with either factory installed and tested RJ45 Jacks or Field installed snap-in jack modules with RJ45 Yellow modular jacks for voice and RJ45 Blue modular jacks for data. Standard of quality for Patch Panel is Panduit, or equivalent. All connectors must meet the same Category listing as the cable (I.e. Category 6 Connectors shall be used to connect to Category 6 Cable).

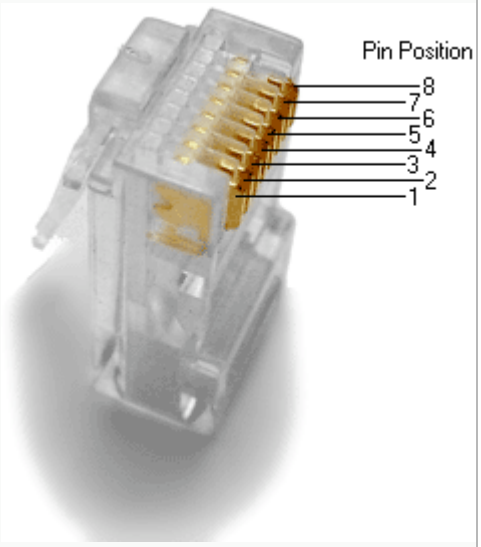
3.5.1.3 **All** Patch Cords, shall consist of **eight-conductor modular plug ends**. Unless otherwise indicated, all data and voice patch cords shall be fully Category 5e, 6, or 6A compliant RJ45 connectors. Patch Cords must meet Salt Lake County's Category 5e, 6 or 6A Standards. Patch Cords shall consist of RJ45 Yellow plug ends for voice and RJ45 Blue plug ends for data. **The same manufacturer as the Patch Panels must make Patch Cords**. All patch cables must meet the same Category listing as the connector & cable (I.e. Category 6 Patch Cables shall be used to connect to Category 6 Connectors & Cable).

3.5.1.4 All 100 Ohm UTP shall be wired to 8 position modular jacks using the T568B pin-out unless otherwise specified, consistent with Salt Lake County's existing facility standard. See Diagram 1.

Diagram 1

See modular connector for numbering of the pins in these 8P8C modular connectors.

The assignments of wire pairs to plug and jack pins are as follows:

T568A and T568B Wiring						
Pin	**T568A Pair**	**T568B Pair**	**Wire**	**T568A Color**	**T568B Color**	**Pins on plug face (jack is reversed)**
1	3	2	tip	white/green stripe	white/orange stripe	
2	3	2	ring	green solid	orange solid	
3	2	3	tip	white/orange stripe	white/green stripe	
4	1	1	ring	blue solid	blue solid	
5	1	1	tip	white/blue stripe	white/blue stripe	
6	2	3	ring	orange solid	green solid	
7	4	4	tip	white/brown stripe	white/brown stripe	
8	4	4	ring	brown solid	brown solid	

3.5.2 Each surface-mounted telecommunications outlet must meet Salt Lake County's Category 5e, 6, or 6A Standards. Outlets shall consist of one surface-mounted outlet box, single-gang duplex faceplates with one (1) RJ45 Yellow modular jack for voice and one (1) RJ45 Blue modular jack for data.

3.5.3 **The modular jack shall be designed to maintain the horizontal cable pair twists and sheath as closely as possible to the point of contact element termination, and the installer shall insure that this twist is preserved.**

3.5.4 All face-plates, surface-mount boxes, and blank covers shall be the same color as indicated by the agency and match any existing telecommunications, data, and electrical face-plates.

3.5.5 Jacks mounted on drywall shall be flush mounted and at the same level as the electrical outlets and shall be ADA compliant. Jacks mounted in modular furniture shall be mounted in a surface mount receptacle box at desktop level unless otherwise indicated. The Contractor must supply all face-plates, boxes, brackets and jacks.

3.5.6 Contractor shall supply and install an adequate number of solid (no cutouts) face-plate covers to conceal all outlet boxes, which go unused (i.e., no jack is installed). These outlet covers shall be the same color as station face-plate covers. Blanks will be used to cover cutouts in face-plate where no jack is installed.

3.5.7 Contractors shall work closely with the County to determine the final telecommunications outlet locations and requirements. Exact faceplate locations shall be determined just prior to installation. Contractor is required to seek final approval from the County on final locations of jacks prior to the installation of cables or jacks. Floor plans will be provided for the Contractor's reference, when available.

3.5.8 When it is necessary to run cable on wall surfaces this cable must be enclosed in surface raceway. Standard of quality is Panduit or equivalent. This raceway must be securely attached to the wall using screws and must be the same color as the surface mounted outlet box.

3.5.9 All floor outlets shall be of a size and type compatible with the floor box provided. Jacks shall be as specified in this section. Standard of quality is Wiremold Floor Boxes, or equivalent.

3.6 FIBER HORIZONTAL TELECOMMUNICATION OUTLETS

All multimode connectors, adapters and cable assemblies (Patch Cords) shall comply with, or be better than, the requirements of this specifications, TIA/EIA 568-B-3, and TIA/EIA 568-B-3 Annex A.

3.6.1 **SC Connector Outlet:** When required the **telecommunication outlet** for fiber shall consist of two (2) duplex SC type Connectors, a fiber spool and a **duplex, eight-conductor modular jack**. Outlets must meet TIA/EIA-568-B-3, and IEC 874-14 (SC-D) Standards. Outlets must terminate each horizontal optical fiber directly to a duplex plug which is mated to a back-to-back female adapter mounted on the faceplate. Outlets shall consist of one single-gang duplex faceplate with two (2) duplex SC, multi-mode/single-mode fiber optic adapter module. Standard of quality is Panduit, or equivalent. A Fiber Spool with a minimum of one (1) meter slack for in-wall installations. Standard of quality is Corning, or equivalent.

3.6.2 **ST Connector Outlet:** When required the **telecommunication outlet** for fiber shall consist of tow (2) ST type Connector Multi-mode or Single-mode Module Jack. Outlets must meet TIA/EIA-568-B-3, and IEC 874-14 (SC-D) Standards. Outlets must terminate

each horizontal optical fiber directly to a ST type Fiber Optic Connector Module Jack which is mounted on the faceplate. Outlets shall consist of one single-gang duplex faceplate with two (2) ST multi-mode/single-mode RJ-45 type fiber optic adapter module jack. Standard of quality is Corning, or equivalent.

3.6.3 **Small Form Fiber-Jack (FJ) Connector Outlet:** When required the **telecommunication outlet** for fiber shall consist of two (2) Small Form (FJ) **"LC type"** Connector Multi-mode or Single-mode Module Jack. Outlets must meet TIA/EIA-568-B-3, and IEC 874-14 (SC-D) Standards. Outlets must terminate each horizontal optical fiber directly to a duplex Small Form FJ Fiber Optic Connector Module Jack which is mounted on the faceplate. Outlets shall consist of one single-gang duplex faceplate with two (2) Small Form Fiber-Jack (FJ) multi-mode/single-mode fiber optic adapter module jack. Standard of quality is Corning, or equivalent.

3.6.4 The following component manufacturers have been approved:

- **Corning**

3.6.5 **Any materials proposed must be approved by the County.**

3.6.6 All strands of fiber and pairs of the four-pair cables shall be terminated on the appropriate module.

3.6.7 **The modular fiber-connector shall be designed to maintain proper bend radius of the fiber and to keep the fiber cable pair and sheath as closely as possible to the point of contact element termination.**

3.6.8 Signal impairments caused by the terminating contact element shall be minimal at all frequencies up through 10 Gigabits.

3.6.9 Terminating contact elements shall maintain their reliability and performance over time and through several cycles of plugging and unplugging.

3.6.10 All face-plates, surface-mount boxes, and blank covers shall be the same color as indicated by the agency and match any existing telecommunications, data, and electrical face-plates.

3.6.11 The modules shall be made to close tolerances so that the plug fits snugly into the module. The module depth shall allow the plug to be completely inserted into the jack.

3.6.12 Modules mounted on drywall shall be flush mounted and at the same level as the electrical outlets. Modules mounted in modular furniture shall be mounted in a surface mount receptacle box. The Contractor must supply all face-plates, boxes, brackets and jacks.

3.6.13 When it is necessary to run fiber on wall surfaces this fiber must be enclosed in surface raceway. Standard of quality is Panduit or equivalent. This raceway must be securely attached to the wall using screws and must be the same color as the surface mounted outlet box.

3.6.14 All floor outlets shall be of a size and type compatible with the floor box provided. Jacks shall be as specified in this section.

4.0 FIELD TEST REQUIRMENTS

4.1 CATEGORY 5E TWISTED PAIR FIELD TEST REQUIRMENTS

4.1.1 General Requirements

4.1.1.1 Every cabling link in the installation shall be tested in accordance with the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-B.3 Section 11.2: *100-Ohm twisted-pair transmission performance and field test requirements.*

4.1.1.2 The installed twisted-pair horizontal links shall be tested from the IDF in the telecommunications room to the telecommunication wall outlet in the work area against the "Permanent Link" performance limits specification as defined in ANSI/TIA/EIA-568-B.3.

4.1.1.3 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned above and as further detailed in this specification. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with this specification.

4.1.1.4 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

4.1.1.5 The test equipment (tester) shall comply with or exceed the accuracy requirements for enhanced level II (Level II-E) field testers as defined in TIA-568-B; Annex I: Section I.4. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table I.4 of Annex I of TIA/EIA-568-B.3. (Table I.5 in this TIA document specifies the accuracy requirements for the Channel configuration.)

4.1.1.6 The tester shall be within the calibration period recommended by the Manufacturer in order to achieve the manufacturer-specified measurement accuracy.

4.1.1.7 The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the Manufacturer. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction. Standard of quality is the Fluke DSP-LIA101S permanent link adapter available for the DSP-4000 Series CableAnalyzer™, or equivalent.

4.1.1.8 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests detailed in this specification. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass

condition, the results for each individual test parameter must Pass or Pass*.

4.1.1.9 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2)

4.1.1.10 A representative of the County's Inspection Team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

4.1.1.11 A representative of the County's Inspection Team will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in this Section. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing and the cost shall be borne by the installation contractor.

4.1.2 <u>Performance Test Parameters</u>

4.1.2.1 The test parameters for Cat 5e are defined in ANSI/TIA/EIA standard 568-B.1; Section 11.2.4 as well as in Annex I; Section I.2.1 "*Parameters to be reported.*" The test of each Cat 5e link shall contain all of the following parameters as detailed below. In order to pass the link test all measurements (at each frequency in the range from 1 MHz through 350 MHz) must meet or exceed the limit value determined in the above-mentioned Cat 5e standard. (Note: The Standard listed above list a frequency range of 1 MHz to 100 MHz. The County however has required a higher bandwidth frequency range to be tested.)

4.1.2.2 **Wire Map** [as defined in TIA/EIA-568-B.3; Section 11.2.4.2]: Wire Map shall report Pass if the wiring of each wire-pair from end to end is determined to be correct. The Wire Map results shall include the continuity of the shield connection if present.

4.1.2.3 **Length** [as defined in TIA/EIA-568-B.3; Section 11.2.4.3)]: The field tester shall be capable of measuring length of all pairs of a permanent link or channel based on the propagation delay measurement and the average value for NVP ([1]). The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the permanent link configuration (90 meters – 295 ft) or the channel (100 meters – 328 ft) plus 10% to allow for the variation and uncertainty of NVP.

4.1.2.4 **Insertion Loss (Attenuation)** [as defined in TIA/EIA-568-B.3; Section 11.2.4.4]: Insertion Loss is a measure of signal loss in the permanent link or channel. The term 'Attenuation' has been used to designate 'insertion loss'. Insertion Loss shall be tested from 1 MHz through 100 MHz in maximum step size of 1 MHz. It is preferred to measure attenuation at the same frequency

[1] Nominal Velocity of Propagation (NVP) expresses the speed of the electrical signals along the cabling link in relation to the speed of light in vacuum ($3x10^8$ m/second). Insulation characteristics and twist rate of the wire pair influence NVP in minor ways. Typically, an 'average' value for NVP is published for all four wire-pairs in a data cable.

intervals as NEXT Loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk Ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results for the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which this worst case value occurs, and the test limit value at this frequency.

4.1.2.5 **NEXT Loss, pair-to-pair** [as defined in TIA/EIA-568-B.3; Section 11.2.4.5]: Pair-to-pair near-end crosstalk loss (abbreviated as NEXT Loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1 through100 MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the standards as shown in **Error! Reference source not found.**, column 2. A smaller step size more accurately identifies worst case margin conditions (see summary results, below).

Table 1

Frequency Range (MHz)	Maximum Step size (MHz)	Fluke DSP-4000 Fluke DSP-4100
1 – 31.25	0.15	0.10
31.26 – 100	0.25	0.20

Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case NEXT margin ([2]) *and* the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.1.2.6 **PSNEXT Loss** [as defined in TIA/EIA-568-B.3; Section 11.2.4.6]: Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link-under-test (a total of 8 results). PSNEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through 100 MHz and the step size may not exceed the maximum step size defined in the standards as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSNEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.1.2.7 **ELFEXT Loss, pair-to-pair** [as defined in TIA/EIA-568-B.3; Section

[2] 'Margin' designates the difference between the measured value and the corresponding test limit value. For passing links, 'worst case margin' identifies the **smallest** margin over the entire frequency range; the point at which the measured performance is "closest" to the test limit.

11.2.4.7]: Pair-to-pair FEXT Loss shall be measured for each wire-pair combination from both ends of the link-under-test. FEXT Loss measures the unwanted signal coupling (crosstalk disturbance) on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ELFEXT Loss that must be evaluated and reported in the test results. ELFEXT measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire-pair combinations. ELFEXT is to be measured from 1 through 100 MHz and the maximum step size for FEXT Loss measurements shall not exceed the maximum step size defined in the standards as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case margin and the wire pair combination that exhibits the worst value for ELFEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.1.2.8 **PSELFEXT Loss** [as defined in TIA/EIA-568-B.3; Section 11.2.4.8]: Power Sum ELFEXT is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs on the fourth one. This test yields 8 wire-pair combinations. Each wire-pair is evaluated from 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the standards as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSELFEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.1.2.9 **Return Loss** [as defined in TIA/EIA-568-B.3; Section 11.2.4.9]: Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured form 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the standards as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.1.2.10 **ACR** (Attenuation to crosstalk ratio) [This parameter is not demanded by the standards but is required in order to obtain the premise wiring manufacturer's warranty]: ACR provides an indication of bandwidth for the two wire-pair network applications. ACR is a computed parameter that is analogous to ELFEXT and expresses the signal to noise ratio for a two wire-pair system. This calculation yields 12 combinations – six from each end of the link.

Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case margin and the wire pair combination that exhibits the worst value for ACR. These wire pair combinations must be

identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.1.2.11 **PSACR** [This parameter is not required by the standards but is required in order to obtain the premise wiring manufacturer's warranty]: The Power Sum version of ACR is based on PSNEXT and takes into account the combined NEXT disturbance of all adjacent wire pairs on each individual pair. This calculation yields 8 combinations – one for each wire pair from both ends of the link.

Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSACR. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.1.2.12 **Propagation Delay** [as defined in TIA/EIA-568-B.3; Section 11.2.4.10]: Propagation delay is the time required for the signal to travel from one of the link to the other. This measurement is to be performed for each of the four wire pairs.

Minimum test results documentation (summary results): Identify the wire pair with the worst case propagation delay. The report shall include the propagation delay value measured as well as the test limit value.

4.1.2.13 **Delay Skew** [as defined in TIA/EIA-568-B.3; Section 11.2.4.11]: This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero.

Minimum test results documentation (summary results): Identify the wire pair with the worst case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.

4.1.3 Test Result Documentation

4.1.3.1 The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.

4.1.3.2 The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time. Testers that transfer the numeric measurement data from the tester to the PC in a non-printable format in this regard offer superior protection. Standard of quality is the Fluke DSP-4000 Series CableAnalyzer™, or equivalent.

4.1.3.3 The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.

4.1.3.4 A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information

- The identification of the link in accordance with the naming convention

defined in the overall system documentation

- The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number
- The date and time the test results were saved in the memory of the tester

4.1.3.5 General Information to be provided in the electronic data base with the test results information for each link:

- The identification of the customer site as specified by the County
- The identification of the link in accordance with the naming convention defined in the overall system documentation
- The overall Pass/Fail evaluation of the link-under-test
- The name of the standard selected to execute the stored test results
- The cable type and the value of NVP used for length calculations
- The date and time the test results were saved in the memory of the tester
- The brand name, model and serial number of the tester
- The identification of the tester interface
- The revision of the tester software and the revision of the test standards database in the tester
- The test results information must contain information on each of the required test parameters that are listed in this specification and as further detailed below.

4.1.3.6 The detailed test results data to be provided in the electronic database for each tested link must contain the following information (only one of these two formats must be specified):

Option A: The results obtained for each parameter in accordance with the description in this document. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. In this case, the PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide and print the summary numeric information for each test parameter as defined and prescribed by the TIA/EIA-568-B.3 standard document. A description of the summary numeric test report is repeated under option b) below.

Option B: For each of the frequency-dependent test parameters, the minimum test results documentation shall be stored for each wire-pair or wire-pair combination as observed from each end of the link. The minimum test results documentation for each test parameter shall be in compliance with the information in this Section.

- **Length**: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.5 m *[optional:* foot*]* and the test limit value
- **Propagation delay**: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value
- Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value
- **Insertion Loss (Attenuation)**: Minimum test results documentation as explained in Section **Error! Reference source not found.** for the wire pair with the worst insertion loss
- **Return Loss**: Minimum test results documentation as explained in Section **Error! Reference source not found.**. Identify as detected from each end

of the link, the wire pair that exhibits the worst case margin and the wire pair with the worst RL. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

- **NEXT, ELFEXT, ACR**: Minimum test results documentation as explained in Section **Error! Reference source not found.**. Identify as measured from each end of the link, the wire pair combination that exhibits the worst case margin and the wire pair combination that delivers the worst case value. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.
- **PSNEXT, PSELFEXT, and PSACR**: Minimum test results documentation as explained in Section **Error! Reference source not found.**. Identify as detected from each end of the link, the wire pair that exhibits the worst case margin and the wire pair with the worst value. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

Link length, propagation delay, and delay skew shall be reported for each wire pair as well as the test limit for each of these parameters.

4.2 CATEGORY 6 TWISTED PAIR FIELD TEST REQUIRMENTS

4.2.1 General Requirements

4

.2.1.1 Every cabling link in the installation shall be tested in accordance with the field test specifications defined in the most recent draft of the *"Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling"*. This document will be referred to as the "TIA Cat 6 Standard."

4.2.1.2 The installed twisted-pair horizontal links shall be tested from the IDF in the telecommunications room to the telecommunication wall outlet in the work area against the "*Permanent Link*" performance limits specification as defined in the TIA Cat 6 Draft Standard.

4.2.1.3 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned in above and as further detailed in this Section. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with this Section.

4.2.1.4 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

4.2.1.5 The test equipment (tester) shall comply with the accuracy requirements for the proposed level III field testers as defined in the TIA Cat 6 Draft Document. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy *plus* adapter contribution) are specified in Table B.2 of Annex B of the TIA Cat 6 Standard. (Table B.3 in this TIA document specifies the accuracy requirements for the Channel configuration.)

4.2.1.6 The tester shall be within the calibration period recommended by the manufacturer in order to achieve the manufacturer-specified measurement accuracy.

4.2.1.7 The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the manufacturer. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction. Standard of quality is the Fluke DSP-LIA101S permanent link adapter available for the DSP-4000 Series CableAnalyzer™, or equivalent.

4.2.1.8 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

4.2.1.9 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks.

4.2.1.10 A representative of the County's Inspection Team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

4.2.1.11 A representative of the County's Inspection Team will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in this Section. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing and the cost shall be borne by the installation contractor.

4.2.2 Performance Test Parameters

4.2.2.1 The test parameters for Cat 6 are defined in TIA Cat 6 standard, which refers to the TIA/EIA-568-B.3 standard. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test all measurements (at each frequency in the range from **1 MHz through 350 MHz**) must meet or exceed the limit value determined in the above-mentioned draft standard. (Note: The Standard listed above list a frequency range of 1 MHz to 250 MHz. The County however has required a higher bandwidth frequency range to be tested.)

4.2.2.2 **Wire Map**: Wire Map shall report Pass if the wiring of each wire-pair from end to end is determined to be correct. The Wire Map results shall include the continuity of the shield connection if present.

4.2.2.3 **Length**: The field tester shall be capable of measuring length of all pairs of a basic link or channel based on the propagation delay measurement and the average value for NVP ([3]). The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the Permanent Link configuration (90 meters – 295 feet) plus 10% to allow for the variation and uncertainty of NVP.

4.2.2.4 **Insertion Loss (Attenuation)**: Insertion Loss is a measure of signal loss in the permanent link or channel. The term "Attenuation" has been used to designate "Insertion Loss." Insertion Loss shall be tested from 1 MHz through 250 MHz in maximum step size of 1 MHz. It is preferred to measure insertion loss at the same frequency intervals as NEXT Loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results for the worst wire pair must show the

[3] Nominal Velocity of Propagation (NVP) expresses the speed of the electrical signals along the cabling link in relation to the speed of light in vacuum ($3x10^8$ m/second). Insulation characteristics and twist rate of the wire pair influence NVP in minor ways. Typically, an 'average' value for NVP is published for all four wire-pairs in a data cable.

highest attenuation value measured (worst case), the frequency at which this worst case value occurs, and the test limit value at this frequency

4.2.2.5 **<u>NEXT Loss</u>**: Pair-to-pair near-end crosstalk loss (abbreviated as NEXT Loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1 through 250 MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the draft standard as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case NEXT margin ([4]) *and* the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

Table 2

Frequency Range (MHz)	Maximum Step size (MHz)	Fluke DSP-4000 Fluke DSP-4100
1 – 31.25	0.15	0.10
31.26 – 100	0.25	0.20
100 – 250	0.50	0.50
250 – 350	—	0.50

4.2.2.6 **<u>PSNEXT Loss</u>**: Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link-under-test (a total of 8 results). PSNEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through 250 MHz and the step size may not exceed the maximum step size defined in the draft standard as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSNEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.2.2.7 **<u>ELFEXT Loss, pair-to-pair</u>**: Pair-to-pair FEXT Loss shall be measured for each wire-pair combination from both ends of the link-under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ELFEXT Loss that must be evaluated and reported in the test results. ELFEXT measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ELFEXT is to be measured from 1 through 250 MHz and the maximum step size for FEXT Loss measurements shall not exceed the maximum step size defined in the draft

[4] 'Margin' designates the difference between the measured value and the corresponding test limit value. For passing links, 'worst case margin' identifies the **smallest** margin over the entire frequency range; the point at which the measured performance is "closest" to the test limit.

standard as in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case margin and the wire pair combination that exhibits the worst value for ELFEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.2.2.8 **PSELFEXT Loss**: Power Sum ELFEXT is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs on the fourth one. This test yields 8 wire-pair combinations. Each wire-pair is evaluated from 1 through 250 MHz in frequency increments that do not exceed the maximum step size defined in the draft standard as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSELFEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency

4.2.2.9 **Return Loss**: Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured form 1 through 250 MHz in frequency increments that do not exceed the maximum step size defined in the draft standard as shown in **Error! Reference source not found.**, column 2.

Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.2.2.10 **ACR (Attenuation to crosstalk ratio)** [This parameter is not demanded by the draft standard but is required in order to obtain the premise wiring manufacturer's warranty]: ACR provides an indication of bandwidth for the two wire-pair network applications. ACR is a computed parameter that is analogous to ELFEXT and expresses the signal to noise ratio for a two wire-pair system. This calculation yields 12 combinations – six from each end of the link.

Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case margin and the wire pair combination that exhibits the worst value for ACR. These wire pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.2.2.11 **PSACR** [This parameter is not required by the draft standard but is required in order to obtain the premise wiring vendor's warranty]: The Power Sum version of ACR is based on PSNEXT and takes into account the combined NEXT disturbance of all adjacent wire pairs on each individual pair. This calculation yields 8 combinations – one for each wire pair from both ends of the link. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the

worst value for PSACR. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

4.2.2.12 **<u>Propagation Delay</u>**: Propagation delay is the time required for the signal to travel from one of the link to the other. This measurement is to be performed for each of the four wire pairs.

Minimum test results documentation (summary results): Identify the wire pair with the worst case propagation delay. The report shall include the propagation delay value measured as well as the test limit value.

4.2.2.13 **<u>Delay Skew</u>** [as defined in TIA/EIA-568-B.3; Section 11.2.4.11]: This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero.

Minimum test results documentation (summary results): Identify the wire pair with the worst case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.

4.2.3 <u>Test Result Documentation</u>

4.2.3.1 The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.

4.2.3.2 The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time. Testers that transfer the numeric measurement data from the tester to the PC in a non-printable format in this regard offer superior protection. Standard of quality is the Fluke DSP-4000 Series CableAnalyzer™, or equivalent.

4.2.3.3 The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.

4.2.3.4 A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information

- The identification of the link in accordance with the naming convention defined in the overall system documentation
- The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number
- The date and time the test results were saved in the memory of the tester

4.2.3.5 General Information to be provided in the electronic data base with the test results information for each link:

- The identification of the customer site as specified by the County
- The identification of the link in accordance with the naming convention defined in the overall system documentation
- The overall Pass/Fail evaluation of the link-under-test

- The name of the standard selected to execute the stored test results
- The cable type and the value of NVP used for length calculations
- The date and time the test results were saved in the memory of the tester
- The brand name, model and serial number of the tester
- The identification of the tester interface
- The revision of the tester software and the revision of the test standards database in the tester
- The test results information must contain information on each of the required test parameters that are listed in this Section, and as further detailed below.

4.2.3.6 The detailed test results data to be provided in the electronic database for each tested link must contain the following information (only one of these two formats must be specified):

Option A: For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. In this case, the PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.

- **Length**: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.5 m *[optional:* foot*]* and the test limit value
- **Propagation delay**: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value
- **Delay Skew**: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value
- **Attenuation**: Minimum test results documentation as explained in this Section for the worst pair
- **Return Loss**: Minimum test results documentation as explained in this Section for the worst pair as measured from each end of the link
- **NEXT, ELFEXT, ACR**: Minimum test results documentation as explained in this Section for the worst pair combination as measured from each end of the link
- **PSNEXT, PSELFEXT, and PSACR**: Minimum test results documentation as explained in this Section for the worst pair as measured from each end of the link

Option B: For each of the frequency-dependent test parameters, the minimum test results documentation shall be stored for each wire-pair or wire-pair combination as observed from each end of the link. The minimum test results documentation for each test parameter shall be in compliance with the information in this Section.

Link length, propagation delay, and delay skew shall be reported for each wire pair as well as the test limit for each of these parameters.

4.3 FIBER-OPTIC CABLING SYSTEM FIELD TEST REQUIRMENTS

4.3.1 General Requirements

4.3.1.1 Every fiber optic cabling link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-B.3 (or by the appropriate network application standard(s) whichever is more demanding).

4.3.1.2 ANSI/TIA/EIA-568-B.3, defines the passive cabling network, to include cable, connectors, and splices (if present), between two optical fiber patch panels (connecting hardware). A typical horizontal link segment is from the telecommunications outlet/connector to the horizontal cross-connect. This TIA document describes three typical backbone link segments: (1) main cross-connect to intermediate cross-connect, (2) main cross-connect to horizontal cross-connect, or (3) intermediate cross-connect to horizontal cross-connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

4.3.1.3 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned in A.1 above and as further detailed in this Section. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with this Section.

4.3.1.4 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

- the manufacturer of the fiber optic cable and/or the fiber optic connectors
- the manufacturer of the test equipment used for the field certification
- Training organizations authorized by BICSI (Building Industry Consulting Services International with headquarters in Tampa, Florida) or by the ACP (Association of Cabling Professionals™) Cabling Business Institute located in Dallas, Texas.

4.3.1.5 Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.3) with a Category 1 light source.

4.3.1.6 Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

4.3.1.7 The tester shall be within the calibration period recommended by the vendor in order to achieve the manufacturer-specified measurement accuracy.

4.3.1.8 The fiber optic launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and

storing of the tester interface adapters.

4.3.1.9 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.

4.3.1.10 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

4.3.1.11 A representative of the County's Inspection Team shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

4.3.1.12 A representative of the County's Inspection Team will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in this Section. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing and the cost shall be borne by the installation contractor.

4.3.2 <u>Performance Test Parameters</u>

4.3.2.1 ANSI/TIA/EIA standard 568-B prescribes that the single performance parameter for field testing of fiber optic links is link attenuation (alternative and equivalent term: insertion loss), when installing components compliant with this standard.

4.3.2.2 The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B

- *Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn*
- *Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)*
  The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5
	1300	1.5
Multimode 50/125 µm	850	3.5
	1300	1.5
Single-mode (Inside plant)	1310	1.0
	1550	1.0
Single-mode (Outside plant)	1310	0.5
	1550	0.5

- *Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)*
  Maximum allowable connector_loss = 0.75 dB
- *Splice_Attn (dB) = number of splices (S) * splice_loss (dB)*
  Maximum allowable splice_loss = 0.3 dB

4.3.2.3 Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

Test equipment that measures the link length and automatically calculates the link loss based on the above formulas is preferred. Standard of quality is the

Fluke DSP-FTA410S, or equivalent.

4.3.2.4 The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1; or the equivalent method such as Fluke Network's application note Loss Testing of Premises Fiber Optic Links (Lit # 1560065). The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

4.3.2.5 The horizontal link (multimode): acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum 90 m (295 ft) distance. The horizontal optical fiber cabling link segments need to be tested at only one (1) wavelength. Because of the short length of cabling [90 m (295 ft) or less], attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850 nm *or* 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or Fluke Networks application note Loss Testing of Premises Fiber Optic Links (Lit # 1560065).

The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two (2) connector pairs, one (1) pair at the telecommunications outlet/connector and one (1) pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fiber cable.

4.3.2.6 The backbone link (multimode) shall be tested in one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.

4.3.2.7 Multimode backbone links shall be tested at 850 nm *and* 1300 nm in accordance with ANSI/EIA/TIA-526-14A.

4.3.2.8 Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation (Section B.2) shall be used to determine limit (acceptance) values.

4.3.2.9 Singlemode backbone links shall be tested at 1310 nm *and* 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method outlined in Fluke Networks application note Loss Testing of Premises Fiber Optic Links (Lit # 1560065). All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm (See Note below).

(NOTE: Link attenuation has been based upon the use of a light source categorized by a Coupled Power Ratio (CPR) of Category 2, Underfilled, per Annex B of ANSI/EIA/TIA-526-14A. The use of a light source categorized as Category 1, Overfilled, may provide results higher than the 2.0 dB limit. A field test tool based on LED (light emitting diode) light sources is a Category 1 device and typically yields high attenuation results.)

4.3.2.10 Links destined to be used with network applications that use laser light sources (underfilled launch conditions) shall be tested with test equipment based on laser light sources. This rule should be followed for cabling systems to support Gigabit Ethernet. Gigabit Ethernet only specifies laser light sources.

4.3.2.11 For Gigabit Ethernet compliant certification (IEEE std 802.3z application), use test equipment which uses a VCSEL (Vertical cavity surface emitting laser) at 850 nm (compliant with 1000BASE-SX) and an FP laser at 1310 nm

(compliant with 1000BASE-LX). Standard of quality is the Fluke DSP-FTA440S, or equivalent.

4.3.2.12 Additional requirement: Each fiber optical link terminated with an optical adapter system which does not impose a transmission direction because the adapters are not or cannot be ganged should be tested and documented in both direction since the direction of the signal transmission cannot be predicted at the time of installation.

4.3.3 Test Result Documentation

4.3.3.1 The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

4.3.3.2 The test result records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that these results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test.

The popular 'csv' format (comma separated value format) does not provide adequate protection and shall not be acceptable.

4.3.3.3 The database for the completed job – including twisted-pair copper cabling links if applicable –shall be stored and delivered on CD-ROM; this CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

4.3.3.4 A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information

- The identification of the link in accordance with the naming convention defined in the overall system documentation
- The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst case margin (margin is defined as the difference between the measured value and the test limit value).
- The date and time the test results were saved in the memory of the tester

4.3.3.5 General Information to be provided in the electronic data base containing the test result information for each link:

- The identification of the customer site as specified by the end-user
- The overall Pass/Fail evaluation of the link-under-test
- The name of the standard selected to execute the stored test results
- The cable type and the value of the 'index of refraction' used for length calculations
- The date and time the test results were saved in the memory of the tester
- The brand name, model and serial number of the tester
- The revision of the tester software and the revision of the test standards database in the tester

4.3.3.6 The detailed test results data to be provided in the electronic database for each tested optical fiber must contain the following information

- The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation
- The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength and the margin (difference

between the measured attenuation and the test limit value).

- The link length shall be reported for each optical fiber for which the test limit was calculated based on the formulas in this section.

5.0 LABELING

5.1 Telecommunications outlets shall be covered with an outlet face-plate or surface-mount box that identifies the outlet for **location "T"** for Telephone**, location "D"** for Data, **location "V"** for Video, and **location "F"** for fiber operations. These outlets shall serve as outlets for voice, data, and video services. Contractor shall also permanently affix labels that identify the face-plate with a **unique alphanumeric number** for identification at the IDF. If jack contains 2 or more jacks for one type of service the Contractor will label the jacks as "X1", "X2" (X=T, D, V, F).

5.2 Each face-plate and surface-mount box shall be labeled with a unique alphanumeric number that corresponds to the **building, floor, equipment (telecommunications) room (# or location like North, South, etc.*), jack number, and Side "X"/Side "X" designation** where the horizontal cable is terminated. A proposed labeling system for the horizontal cables is described below (Note: use 0 when description does not apply. For a single multi-story building the number would be 0-2-1-025-D1, a single story building would be 0-0-1-025-D1; a single equipment room would be 0-0-0-025-D1):

Alphanumeric label shall consist of **five (5) characters.** Characters shall correspond to the following designations: (**EXAMPLE: Jack label and corresponding station cable block: 20251).**

Building - Floor - Equipment Room - Jack Number - "X" or X" Side

21 - 2 - 1 (or N*) - 025 - D1

In this example, the label would indicate **Building 21, Second Floor**, Equipment (**Telecommunications) Room 1** or **North**, horizontal station run number **"025"**, and specifically the jack on **Side "Data 1"** of the station blocks.

5.3 The UTP horizontal cable terminations shall be **identically labeled** on the **cross-connect field**. Each four-pair group shall be labeled with the **corresponding jack (face-plate or surface-mount box) number**.

5.4 The UTP station cable shall be **permanently** labeled on both ends to allow easy identification during installation and rearranging of cables in the future. The same number shall be placed on the cable as that used to label the cross-connect field terminations.

5.5 All labeling shall be **permanent** and **neat**. **Hand printed labels are not acceptable.** A permanent label shall be installed on each face-plate or surface-mount box, cable ends, and designation strips on the cross-connect equipment. The designation strips shall be of the correct color, as identified in this section. Standard of quality will be the Brady Labeling System, or equivalent.

6.0 HORIZONTAL PATHWAY:

The Horizontal Pathway consists of a series of conduits, cable trays, cable hangers, chases, surface raceway, and power poles that connect the IDF to office work station area. It generally houses the horizontal system.

6.1 CONDUIT:

6.1.1 Metallic raceways or conduits shall be used to run cables point to point when intermediate splices or terminations are not required. This includes dedicated fiber to a

specific point or a high degree of security. The applicable guidelines for the building entrance conduit apply along with the following:

6.1.2 They shall be used when it is not possible to conceal horizontal wire in the ceilings or floors, and when there is a security issue.

6.1.3 Conduits not being used must be threaded and capped at both ends. The bend radius and tensile strength rating shall not exceed the manufacturer's specifications at any time. The maximum specification for conduit shall contain no more than two 90 degrees bends. The inside radius of the bend not less than 10 times the normal diameter of the conduit and not less than 24 inches. All inside building conduit runs exceeding two 90 degree bends must contain accessible pull boxes. Conduit runs must not contain square or oval conduit fittings. Installation of the Structured Wiring System will only begin after it is approved by the COUNTY.

6.1.4 The Contractor must provide 3/32 inch O.D., 200 pound strength, polyethylene pull lines in all conduits.

6.1.5 Parallel cable runs, pulled through conduit raceway, shall be placed in as few conduits as space will allow. **Active conduits shall be fully utilized before parallel empty conduits are used**.

6.1.6 Maximum cross-sectional area fill of conduits is not to exceed latest EIA/TIA Standards.

6.1.7 Conduit shall not be connected to audio or electronics ground except at equipment cabinet.

6.1.8 The Contractor must provide pull boxes in accessible positions with screw covers.

6.2 CABLE HANGERS

6.2.1 Acceptable Manufacturers

Manufacturer: Subject to compliance with these specifications, cable hanger support systems shall be as manufactured by B-Line Systems, ERICO, or equivalent.

6.2.2 Cable Hanger Systems

6.2.2.1 Cable hangers shall have a flat or curved bottom and provide a minimum of 1-5/8" cable bearing surface. Cable hangers shall have 90-degree radiused edges to prevent damage while installing cables.

6.2.2.2 Cable hangers shall be designed so the mounting hardware is recessed to prevent cable damage.

6.2.2.3 Cable hangers shall have a stainless steel cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.

6.2.2.4 Cable hangers shall be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.

6.2.2.5 Factory assembled multi-tiered cable hangers shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

6.2.3 Finishes

6.2.3.1 Cable hangers for non-corrosive areas shall be pre-galvanized steel, ASTM A653 G90. Where additional strength is required, cable hooks shall be spring steel with a zinc plated finish, ASTM B633, SC3.

6.2.3.2 Cable hangers for corrosive areas shall be stainless steel, AISI type 304.

6.2.4 Cable Hook Capacity And Load Rating

6.2.4.1 Cable hangers shall be capable of supporting a minimum of 30 lbs. with a safety factor of 3.

6.2.4.2 Spring steel cable hangers shall be capable of supporting a minimum of 100 lbs. with a safety factor of 3 where extra strength is required.

6.2.4.3 Follow manufacturer's recommendations for allowable fill capacity for each size of cable hanger.

6.2.5 Installation

Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

6.3 UTILITY POWER POLES

The utility power poles must meet the following specifications:

6.3.1 The power pole must be constructed specifically for use with the systems furniture installed at the site and shall be equivalent in size, structure, materials, and color as those poles provided by the County.

6.3.2 Provide a **dual compartment** with a **metallic barrier** separating telecommunications cables from electrical cables, **per the latest National Electrical Code standards.**

6.3.3 Provide knockouts for a minimum of **two (2) duplex, eight-position, surface-mount jacks**

6.3.4 Provide knockouts for a minimum of **two standard duplex AC electrical outlets.**

6.3.5 Surface mount boxes mounted to power poles are not acceptable, except when using existing power poles that do not have knockouts for faceplates.

6.3.6 The contractor is required to seek final approval from the County on the selection of a utility power pole type and color. Standard of quality is Panduit Pan-Way Pan-Poles, or equivalent.

6.4 SURFACE RACEWAY

6.4.1 No cabling shall be exposed. All cabling shall be enclosed in conduit or in surface raceway. Surface raceway shall be used to route, protect and conceal cabling in offices and classrooms. Conduit shall be used to route, protect and conceal cabling in walls, warehouses, tunnels, outside and in the backbone (when required). Please refer to the project Scope of Work to determine if metallic conduit, metallic surface raceway, or plastic raceway will be required.

6.4.2 All surface raceway shall be of a single channel design or dual channel when electrical wiring is run in the raceway. Raceway shall be manufactured from impact-resistant material, or metallic, with a flammability rating of U.L. 94V-0.

6.4.3 Surface Raceway shall be available in multiple sizes and multiple colors. Contractor is to match color as close as possible the aesthetics of the office environment of the installation site. Raceway finish shall be pure color and will resist scratches and dents and will not peel or corrode. Contractor must receive approval from Salt Lake County prior to installation of surface raceway.

6.4.4 All surface raceway shall have a full compliment of bend radius control and standard fittings including, but not limited to: elbows (internal & external), couplings for joining raceway sections, blank end fittings for closing open ends of the raceway, and tee fittings.

6.4.6 All surface raceway shall incorporate a minimum 1" bend radius as recommended for Category 6 UTP & fiber optic cables.

6.4.6 All surface raceway shall consist of an adhesive backed base and cover in sections. Securely install all surface raceway by using proper installation screws into walls. Screws shall be within 2" of the top and bottom of each end and shall have mounting screws at 6" intervals.

6.4.7 Standard of Quality is Panduit Pan-Way Surface raceway, or equivalent for plastic raceway. Metallic Surface Raceway's standard of quality will be Panduit Metallic Raceway, or equivalent.

6.4.8 Contractor must prove that other components such as surface boxes, faceplates, etc. are of the same manufacturer and compatible with the surface raceway provided.

6.4.8.1 Surface Mount Boxes shall be single gang low profile box allowing the utilization of up to 6 ports, or a double gang low profile box with up to 10 ports. The box shall be 1.06" in height and must match the color of the surface raceway installed. The box shall mount with adhesive and screws onto the mounting surface.

6.4.8.2 Faceplate shall be a 2, 4 or 6 port single gang faceplate with screw cover, labels, and a curved, designer appearance. Each faceplate accepts individual connector modules. The faceplate must match the color of the surface mount box and/or surface raceway.

6.4.8.3 All outlets shall utilize interchangeable connector modules that mount side by side to facilitate moves, adds and changes. Connector modules shall be available to support high performance copper and fiber cabling systems. All outlets shall be manufactured from high impact thermoplastic material with an U.L. flammability rating of 94HB or better.

6.4.9 When security is an issue, and only when requested by the County, the Contractor shall supply metallic raceway metallic faceplates. Standard of quality is Panduit, or equivalent.

6.5 SYSTEMS (MODULAR) FURNITURE

Office furniture will be the responsibility of the Agency. The Agency will provide the Contractor with the contact name and telephone number of the office furniture installing company and the office furniture manufacturer. The Contractor will be responsible for obtaining the proper mounting hardware and for planning the installation of cables through office furniture troughs. The material and installation cost will be included in the contractor's bid response. **NOTE: CATEGORY 6 AND 6A CABLE (OR ANY CABLE RUNNING AT SPEEDS AT 100 MEGABITS OR HIGHER), SHALL NOT BE PLACED IN THE BOTTOM CHANNEL OF MODULAR FURNITURE WITH ELECTRICAL CABLE. ALL CATEGORY 6 AND 6A CABLE SHALL BE PULLED IN THE TOP CHANNEL OF THE MODULAR FURNITURE**.

6.5.1 The Contractor is responsible for and required to provision and install all necessary materials to effect the cabling of the systems furniture.

6.5.2 Flexible conduit, elbows, wall face-plates, and connection hardware must be supplied and installed by the Contractor **and must be compatible with the Modular Furniture.**

6.5.3 The Contractor is required to put in place all systems furniture top or base plates, which have been left open for the installation of communications cabling.

6.5.4 Standard of quality for Category 6 and 6A Cable pathway for modular furniture will be Panduit Pan-Way Office Furniture Raceway System, or equivalent.

6.5.4.1 Must be UL listed in accordance with UL-5C requirements for Class 2 Communication Cable Management Systems

6.5.4.2 Must maintain bend radius control throughout the entire Office Furniture Raceway System as required by TIA/EIA-568-B and 569-B standards.

6.5.4.3 Faceplates must be compliant with labeling requirements of TIA/EIA-606-A standards.

6.5.4.4 Must be designed for tamper resistant closure.

6.5.4.5 Must be supplied with adhesive backing for fast and easy installation.

6.5.4.6 Top cap width must be between 1.88" and 2.30" and must be compatible with all common manufacturers of modular furniture.

6.5.4.7 Must be designed for jack placement at the desktop.

6.5.4.8 Must have all raceway fittings necessary for a complete modular furniture installation.

6.6 OPEN OFFICE CABLING

Recent office design practices have introduced flexible layouts designed to support frequent reconfigurations of the office environment. An interconnection in the Horizontal Cabling allows open office spaces to be reconfigured frequently without disturbing horizontal cable runs.

6.6.1 MULTI-USER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

MUTOAs facilitate the termination of single or multiple Horizontal Cables in a common location within a furniture cluster or similar open area. The use of MUTOAs allows horizontal cabling to remain intact when the open office space is changed. Work area cables originating from the MUTOA shall be routed through top panel area pathways of modular furniture when using a Ceiling Distribution Horizontal Cabling System. When using a Floor Distribution Cabling System the Horizontal Cabling will either be routed to the top panel or enclosed in surface raceway attached to the modular furniture. **UNDER NO CIRCUMSTANCES SHOULD THE HORIZONTAL CABLE OR PATCH CORDS BE ROUTED WITH ELECTRICAL CABLE.**

6.6.1.1 MUTOAs should be located in an open work area so that each furniture cluster is served by at least one MUTOA. The MUTOA should be limited to serving a maximum of twelve (12) work areas. Do not exceed the horizontal cable length requirements. Spare capacity should be considered when sizing the MUTOA.

6.6.1.2 MUTOAs shall be located in fully accessible, permanent locations such as building columns, and permanent walls. MUTOAs shall not be located in ceiling spaces, or obstructed areas. MUTOAs shall not be installed in furniture unless that unit of furniture is permanently secured to the building structure. MUTOA units that are designed to attach to furniture, or to replace power poles, which can be easily detached, and reattached, may be used if approved by SALT LAKE COUNTY.

6.6.1.3 The maximum lengths for copper cabling in the context of MUTOAs and open office furniture, shall meet the requirements of ANSI/TIA/EIA-568-B-3. See Chart below:

Length of Horizontal Cable (24 AWG)	Maximum Length of Work Area Cable (24 AWG)	Maximum Combined Length of Work Area Cables, Patch Cords, and Equipment Cable (24 AWG)
M (ft)	**M (ft)**	**M (ft)**
90 (295)	5 (16)	10 (33)
85 (279)	9 (30)	14 (46
80 (262)	13 (44)	18 (59)
75 (246)	17 (57)	22 (72)
70 (230)	22 (72)	27 (89)

6.6.1.4 Standard of Quality shall be Panduit Pan-Net Passive or Active Gateway Terminal (MUTOA), Top Cap Raceway, Vertical Wire Manager, and Jumper Cable – Take Up Spool, or equivalent. Jacks used in MUTOA will be the same make and model as used in the TR, MER, and at the Work Area Wall Locations.

6.6.2 CONSOLIDATION POINT (CP)

A CP is an interconnection point within the horizontal cabling using aANSI/TIA/EIA-568-B-2 or B-3 compliant connecting hardware installed in accordance with the requirements of clause 10 and rated for at least 200 cycles of reconnection.

6.6.2.1 No more than one consolidation point shall be used in the same horizontal cable run.

6.6.2.2 A transition point and consolidation point shall not be used in the same horizontal-cabling link.

6.6.2.3 Each horizontal cable extending to the work area outlet from the consolidation point shall be terminated to a telecommunications outlet/connector or MUTOA, meeting the latest County standards.

6.6.2.4 CPs should be located in an open work area so that each furniture cluster is served by at least one CP. The CP should be limited to serving a maximum of twelve (12) work areas. Do not exceed the horizontal cable length requirements. Spare capacity should be considered when sizing the CP.

6.6.2.5 CPs shall be located in fully accessible, permanent locations such as building columns, and permanent walls. CPs shall not be located in ceiling spaces, or obstructed areas. CPs shall not be installed in furniture unless that unit of furniture is permanently secured to the building structure.

6.7 INNERDUCT SPECIFICATIONS

Innerduct shall be U.L. Listed, non-metallic corrugated flexible raceway used to route fiber-optic cables in the horizontal cable routes from the IDF to the work area jack locations. All Innerduct shall have the following specifications:

6.7.1 Innerduct shall be available in ¾” through 2” sizes for indoor use.

6.7.2 Innerduct shall be “orange” in color.

6.7.3 All Innerduct will be plenum rated in accordance with the NEC 1999 (Article 770-53).

6.7.4 All Innerduct installed will include pre-installed pull tape.

6.7.5 All couplers and adapters shall be of the same manufacturer as the Innerduct and shall be installed in accordance with manufacturer's specifications.

6.7.6 Standard of quality for Innerduct is Carlon Plenum-Gard / Riser-Gard, or equivalent.

7.0 BUILDING AUTOMATION SYSTEMS (BAS):

Building Automation Systems include the following type of systems:

- Fire Alarm Systems (FA)
- Security & Access Control Systems (SAC)
- Heating, Ventilating, and Air Conditioning Systems (HVAC)
- Energy Management System (EMS)
- Lighting Control Systems (LC)
- Future Automation Systems

Most BASs operate using low-speed data networks or local area networks (LAN) typically transmitting at rates less than 1 Mbps in the horizontal and up to 10 Mbps in the backbone (riser). By providing a common cabling distribution system for voice, data, video, and BAS it is possible to reduce construction cost by as much as 25% to 50%. This is because the various systems can use the same pathways, equipment rooms, and most importantly one-project team to engineer, install, and project manage the installation of all cabling. This creates an Intelligent Building that also can reduce the cost of operation of these systems by integrating the cabling infrastructure.

7.1 APPLICABLE STANDARDS ALLOWING THE USE OF COMMUNICATION CABLES

- **NEC Article 725-61(g)** permits communications cables to be substituted for traditional Class 2 or Class 3 cable types (i.e. CL2, CL3, CL2R, CL3R, CL2P, CL3P)
- **NEC Article 760-8** addresses installation of fire alarm cables and references ANSI/TIA/EIA-568-B as nationally recognizes standards that determine acceptable industry practices.
- **NEC Article 760-54(b)** allows conductors of power-limited fire alarm circuits, Class 2, Class 3, and communications circuits to share the same cable, enclosure, or raceway.
- **NEC Article 760-61(d)** permits communications cables to be substituted for traditional power-limited fire alarm cables types (i.e. FPL, FPR, and FPLP).
- **NEC Article 820-53(d)** permits communications cables to be substituted for traditional coaxial cable types (i.e. CATV, CATVR, CATVP, and CCTV).

7.2 FIRE ALARM SYSTEM RESTRICTIONS

In the installation of FA structured Cabling it is important to consult and comply with the local Fire Codes for the installation site. Please note that only Power-Limited Fire Alarm (PLFA) can be integrated into the structured cabling system using communications-type cables. Non-Power-Limited Fire Alarm (NPLFA) use high voltage electrical cable and can only be installed by a certified electrician.

7.3 COVERAGE AREA (CA)

The coverage area is served by a BAS device. The BAS device can be connected to the horizontal cabling using:

- Unshielded twisted-pair (UTP) cable from the Horizontal Cross-connect.
- UTP cable or cordage from an outlet or control panel (CP).

Note, when hardwiring twisted-pair communications cabling to a BAS device, it may be necessary to use spade-tip or sleeve connectors to interface the cable connectors to the terminal strip. Always follow the manufacturer's specifications for terminating the cable. Always use an approved connector that properly fits the terminal strip connection of the device.

7.4 HORIZONTAL CABLING REQUIREMENTS

7.4.1 A minimum of Category 5e cable will be used to connect BAS devices to a horizontal channel with copper cable. A minimum of 50/125 micron Fiber-Optic cable can also be used when fiber is preferred over copper by the manufacturer of the BAS equipment.

7.4.2 When connecting BAS devices to a horizontal channel, the latest version of the ANSI/TIA/EIA-568-B.3 Standard will be used, including the total distance from a Telecommunications Room to the endpoint BAS device.

7.4.3 Follow the BAS vendor's guidelines, or the manufacturer's guidelines (if available) to determine the distance limitations and number of devices that can be connected to a horizontal cable run.

7.4.4 Although it is allowed by the NEC, BAS signals should not share the same horizontal cable as the telecommunications signal.

7.4.5 Each different BAS function (i.e. fire alarm, security, HVCA, and EMS) should us a separate 4-pair UTP cable with a minimum of four (4) 4-pair UTP cables for applications that include all four functions.

7.4.6 Signals from systems such as audio circuits (i.e. speakers and emergency sound) and some analog input/output circuits have sheath-sharing restrictions and may require separate cables for each audio, digital, or analog circuit. Consult the manufacturer's recommendations or requirements.

7.4.7 Horizontal cables should be limited to one device per cable run in order to provide maximum flexibility for future changes, but may contain as many as five devices per run in order to reduce cabling costs and still provide for some future flexibility.

7.4.8 Multiple horizontal cables can also be bridged or chained at the Horizontal Cross-connect located at the Telecommunications Room (TR) or CP,

- in order to extend a coverage area
- in order to connect multiple horizontal cable runs to one BAS controller point
- in order to create a fault-tolerance circuit
- or to connect multiple devices to one horizontal cable.

END OF SECTION

LEED 2009 for New Construction and Major Renovations

Project Checklist

Project Name

Date

Sustainable Sites — Possible Points: 26

Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
			Credit 1	Site Selection	1
			Credit 2	Development Density and Community Connectivity	5
			Credit 3	Brownfield Redevelopment	1
			Credit 4.1	Alternative Transportation—Public Transportation Access	6
			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
			Credit 4.4	Alternative Transportation—Parking Capacity	2
			Credit 5.1	Site Development—Protect or Restore Habitat	1
			Credit 5.2	Site Development—Maximize Open Space	1
			Credit 6.1	Stormwater Design—Quantity Control	1
			Credit 6.2	Stormwater Design—Quality Control	1
			Credit 7.1	Heat Island Effect—Non-roof	1
			Credit 7.2	Heat Island Effect—Roof	1
			Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points: 10

Y			Prereq 1	Water Use Reduction—20% Reduction	
			Credit 1	Water Efficient Landscaping	2 to 4
			Credit 2	Innovative Wastewater Technologies	2
			Credit 3	Water Use Reduction	2 to 4

Energy and Atmosphere — Possible Points: 35

Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
			Credit 1	Optimize Energy Performance	1 to 19
			Credit 2	On-Site Renewable Energy	1 to 7
			Credit 3	Enhanced Commissioning	2
			Credit 4	Enhanced Refrigerant Management	2
			Credit 5	Measurement and Verification	3
			Credit 6	Green Power	2

Materials and Resources — Possible Points: 14

Y			Prereq 1	Storage and Collection of Recyclables	
			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
			Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
			Credit 2	Construction Waste Management	1 to 2
			Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	?	N			
			Credit 4	Recycled Content	1 to 2
			Credit 5	Regional Materials	1 to 2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 15

Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan—During Construction	1
			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
			Credit 5	Indoor Chemical and Pollutant Source Control	1
			Credit 6.1	Controllability of Systems—Lighting	1
			Credit 6.2	Controllability of Systems—Thermal Comfort	1
			Credit 7.1	Thermal Comfort—Design	1
			Credit 7.2	Thermal Comfort—Verification	1
			Credit 8.1	Daylight and Views—Daylight	1
			Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process — Possible Points: 6

			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
			Credit 1.4	Innovation in Design: Specific Title	1
			Credit 1.5	Innovation in Design: Specific Title	1
			Credit 2	LEED Accredited Professional	1

Regional Priority Credits — Possible Points: 4

			Credit 1.1	Regional Priority: Specific Credit	1
			Credit 1.2	Regional Priority: Specific Credit	1
			Credit 1.3	Regional Priority: Specific Credit	1
			Credit 1.4	Regional Priority: Specific Credit	1

Total — Possible Points: 110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name:
Date:

Y	?	N			
			Credit	Integrative Process	1

0	0	0	**Location and Transportation**		**16**
			Credit	LEED for Neighborhood Development Location	16
			Credit	Sensitive Land Protection	1
			Credit	High Priority Site	2
			Credit	Surrounding Density and Diverse Uses	5
			Credit	Access to Quality Transit	5
			Credit	Bicycle Facilities	1
			Credit	Reduced Parking Footprint	1
			Credit	Green Vehicles	1

0	0	0	**Sustainable Sites**		**10**
Y			Prereq	Construction Activity Pollution Prevention	Required
			Credit	Site Assessment	1
			Credit	Site Development - Protect or Restore Habitat	2
			Credit	Open Space	1
			Credit	Rainwater Management	3
			Credit	Heat Island Reduction	2
			Credit	Light Pollution Reduction	1

0	0	0	**Water Efficiency**		**11**
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
			Credit	Outdoor Water Use Reduction	2
			Credit	Indoor Water Use Reduction	6
			Credit	Cooling Tower Water Use	2
			Credit	Water Metering	1

0	0	0	**Energy and Atmosphere**		**33**
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
			Credit	Enhanced Commissioning	6
			Credit	Optimize Energy Performance	18
			Credit	Advanced Energy Metering	1
			Credit	Demand Response	2
			Credit	Renewable Energy Production	3
			Credit	Enhanced Refrigerant Management	1
			Credit	Green Power and Carbon Offsets	2

0	0	0	**Materials and Resources**		**13**
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
			Credit	Building Life-Cycle Impact Reduction	5
			Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
			Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
			Credit	Building Product Disclosure and Optimization - Material Ingredients	2
			Credit	Construction and Demolition Waste Management	2

0	0	0	**Indoor Environmental Quality**		**16**
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
			Credit	Enhanced Indoor Air Quality Strategies	2
			Credit	Low-Emitting Materials	3
			Credit	Construction Indoor Air Quality Management Plan	1
			Credit	Indoor Air Quality Assessment	2
			Credit	Thermal Comfort	1
			Credit	Interior Lighting	2
			Credit	Daylight	3
			Credit	Quality Views	1
			Credit	Acoustic Performance	1

0	0	0	**Innovation**		**6**
			Credit	Innovation	5
			Credit	LEED Accredited Professional	1

0	0	0	**Regional Priority**		**4**
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1
			Credit	Regional Priority: Specific Credit	1

0	0	0	**TOTALS**	Possible Points:	**110**

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

Salt Lake County

2014 Stormwater Management Plan

October 2014

Submitted to: Utah Division of Water Quality

Submitted by: Salt Lake County

Prepared by: Stantec Consulting Services Inc.

SALT LAKE COUNTY

2014 SALT LAKE COUNTY
STORMWATER MANAGEMENT PLAN

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LIST OF ACRONYMS

BMP	Best Management Practice
County	Salt Lake County
DWQ	Utah Division of Water Quality
EPA	Environmental Protection Agency
IDDE	Illicit Discharge Detection and Elimination
JRWC	Jordan River Watershed Council
LID	Low Impact Design
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
SHPO	State Historic Preservation Office
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
UAC	Utah Administrative Code
UDOT	Utah Department of Transportation
UPDES	Utah Pollutant Discharge Elimination System
USWAC	Utah Stormwater Advisory Committee

1.0 CERTIFICATION

In accordance with Part 2.3.3.4 or the permit, the following statement must be incorporated and signed in this document:

Certification Statement:

I certify under penalty of law that this document and all attachments were prepared with direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: _____

Printed Name: Mayor Ben McAdams (or designee)

Date:

2.0 STORMWATER MANAGEMENT PLAN INTRODUCTION

Salt Lake County is an urban community within the Salt Lake Valley. The valley is a terminal valley which drains to the Great Salt Lake. The main conveyance system in the valley is the Jordan River, which flows from Utah Lake to the Great Salt Lake (Figure 1). The Salt Lake County stormwater system consists of a system of local municipal drainage pipes and open channel drainage facilities, which discharge to a larger countywide system of pipes, open channels, canals or natural channels. Flood control facilities are managed by Salt Lake County's Engineering and Flood Control Division. These facilities are defined in Chapter 17 of the Salt Lake County Code of Ordinances, and are provided in Figure 2.

Salt Lake County received a Utah Pollutant Discharge Elimination System (UPDES) Phase I Stormwater Discharge Permit in 1995 (Permit No. UTS000001) for stormwater discharges from unincorporated Salt Lake County. The permit was renewed on May 1, 2001, and reissued on June 1, 2006. On September 5, 2013, a new permit was issued to the Jordan Valley Municipalities that includes coverage for Cottonwood Heights, and requires the revision of Salt Lake County's Stormwater Management Plan (SWMP) within 120 days of the effective date of the permit.

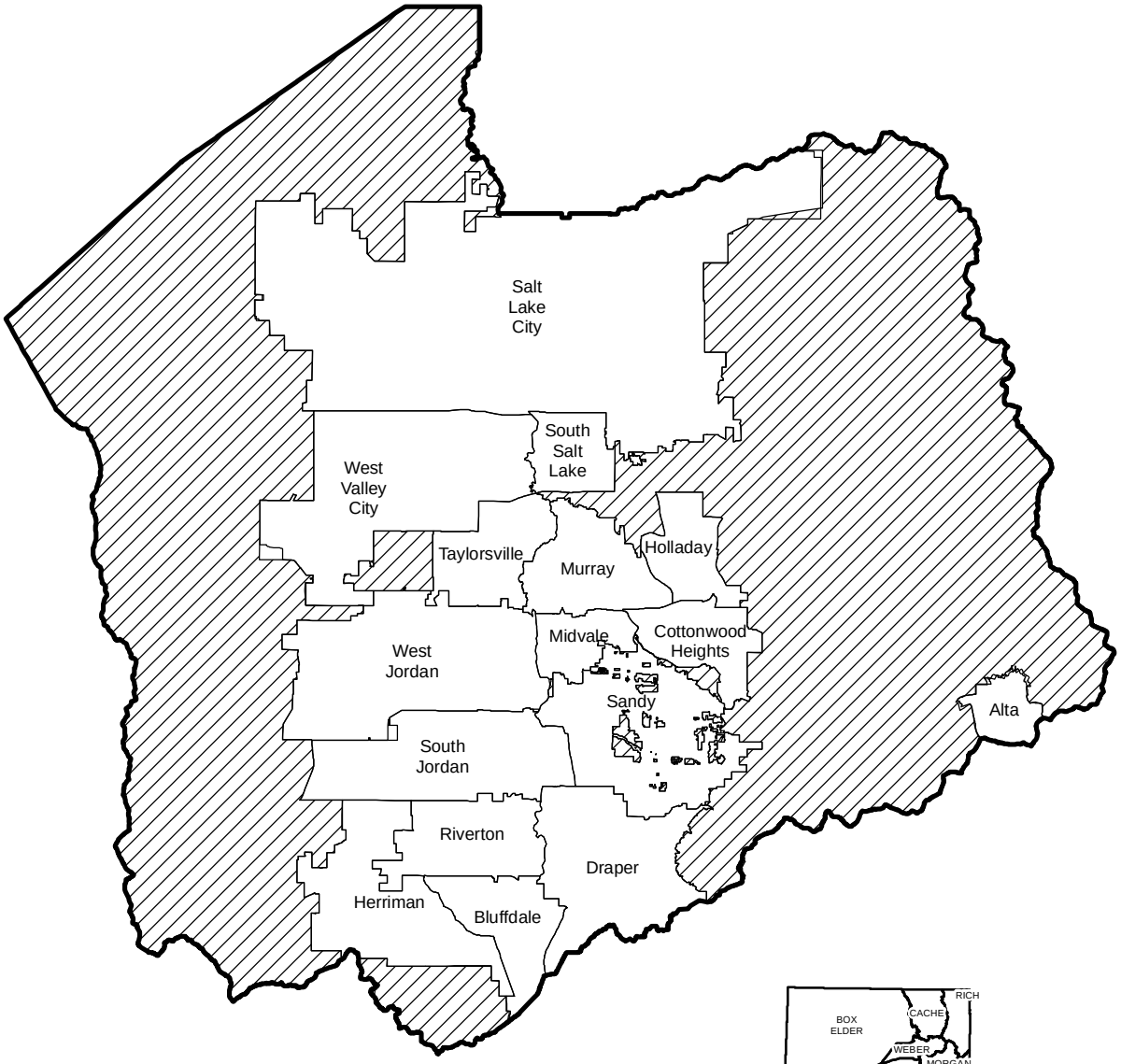
This revised SWMP was developed to comply with the new permit, and is designed to reduce, to the maximum extent practicable (MEP), the discharge of pollutants from the municipal storm drain system servicing unincorporated Salt Lake County. The SWMP includes stormwater management practices, control techniques, system design and engineering methods, an education component, and other provisions appropriate for the control of pollutants. The development, implementation and enforcement of the SWMP are to fulfill requirements under the permit, in accordance with Section 402(p)(3)(B) of the Federal Clean Water Act and State Storm Water Regulations *(UAC R317-8-3.8).*

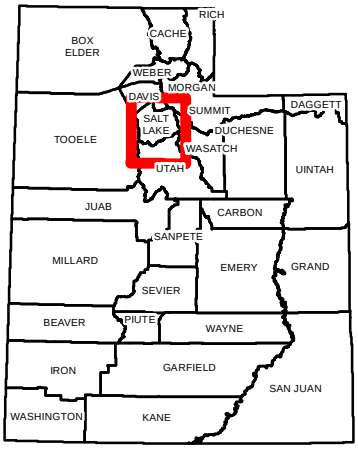
2.1 SWMP COORDINATION

The Salt Lake County Engineering and Flood Control Division is responsible for the overall implementation of the SWMP. Other County divisions assist in this implementation as appropriate and as discussed in Section 2.4 and provided in the flow chart in Figure 3. The responsible parties are as follows:

Agency: Salt Lake County, Engineering and Flood Control Division

Contact: Mr. Scott Baird, Division Director, (385) 468-6600
Mr. Dan Drumiler, Stormwater Program Manager, (385) 468-6640





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6 3 0 6 Miles

Stantec

3995 South 700 East, Suite 300
Salt Lake City UT 84107
801-261-0090

Legend

Unincorporated Areas

Client / Project

Salt Lake County
Stormwater Management Plan

Title

Figure 1 SLCo Stormwater Management Plan Vicinity Map

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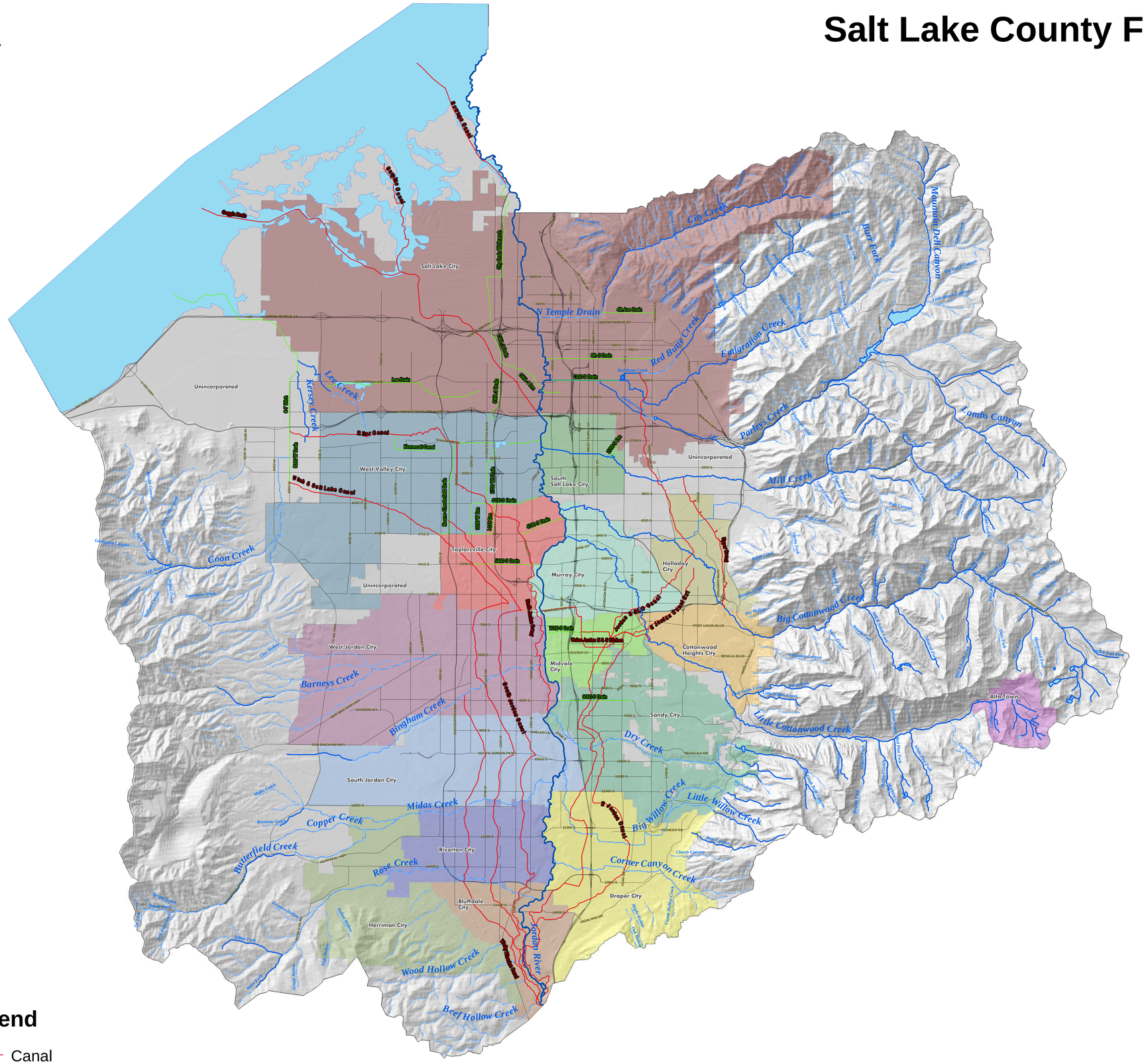
Salt Lake County Flood Control Facilities



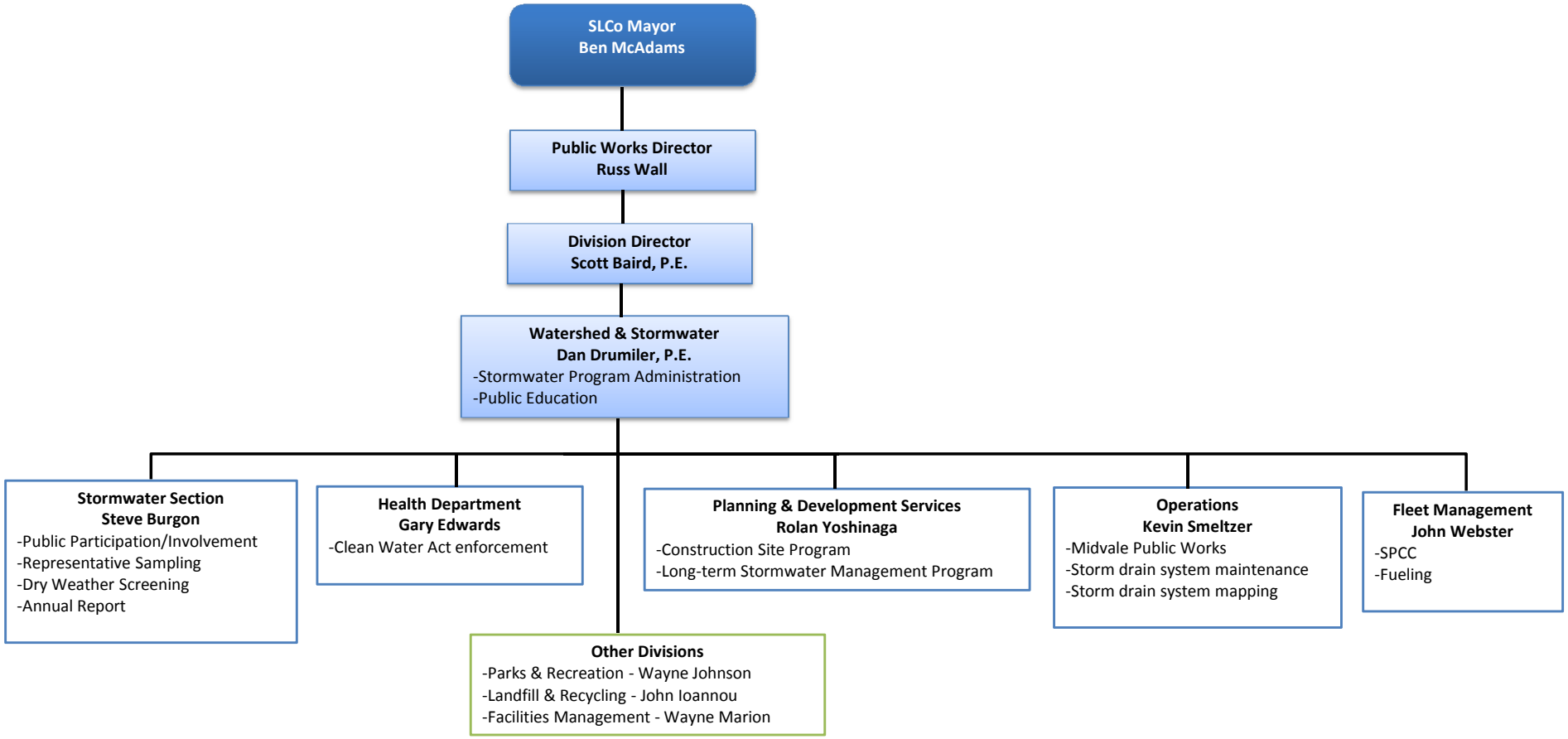
Information Regarding Ordinance Title 17-08

FILE	NAME	Ordinance	Miles	DESCRIPTION
1	Jordan River	1	43.6	All, Utah County to Davis County
2	City Creek	2	6.9	Water treatment plant to Jordan R, includes N Te
3	Red Butte Creek	3	8	Red Butte Reservoir to Jordan R, includes 1300 S
4	Emigration Creek	4	16.4	Left Hand Fork to Jordan R, includes 1300 S. Dra
5	Parleys Canyon Creek	5	18.4	Headwaters to Jordan R excluding Little Dell Res
6	Mountain Dell Canyon Creek	6	5.9	Headwaters to Mountain Dell Reservoir, excludin
7	Lambs Canyon Creek	7	5.1	Headwaters from switchback to Parleys Creek
8	Mill Creek	8	17	Headwaters at upper gate to Jordan River
9	Neffs Creek	9	5.5	East of 2300 S. and "JJ" system
10	Big Cottonwood Creek	10	24.4	Silver Lake to Jordan River
11	Little Cottonwood Creek	11	20.9	Albion Basin gate to Jordan River
12	Dry Creek	12	9.2	Bell's Canyon Reservoir to Jordan River
13	Big Willow Creek	13	9.5	Wasatch Blvd to Jordan River
14	Little Willow Creek	14	1.9	Canyon mouth to Big Willow Creek
15	Corner Canyon Creek	15	5.2	Canyon mouth to Jordan River
16	Beef Hollow Creek	16	0.2	Camp Williams to Jordan River
17	Wood Hollow Creek	17	1.2	Camp Williams to Jordan River
18	Rose Creek	18	11.2	Headwaters from Yellow Fork confluence to Jorda
19	Butterfield Creek	19	9.9	Headwaters of Tooele Fork to 6000 W. storm dra
20	Copper Creek	20	4.7	U-111 to Midas Creek
21	Midas Creek	21	10.3	U-111 to Jordan River
22	Bingham Creek	22	9.1	U-111 to Jordan River
23	Barneys Creek	23	10.5	Headwaters to New Bingham Highway
24	Harkers Canyon Creek	24	7.9	Headwaters to U-111
25	Coon Canyon Creek	25	9.9	Headwaters of Right Hand Fk to 8000 W storm d
26	Provo Reservoir Canal		NA	All, Also called Welby Jacob Canal
27	Utah Lake Distributing Canal	26	11.9	All, Utah County Boundary to Bingham Creek
28	Utah and Salt Lake Canal	27	24.7	All, Jordan Narrows to 8000 West Storm Drain
29	South Jordan Canal	28	18.1	All, Jordan Narrows to approx. 4300 W 4200 S
30	North Jordan Canal	29	11.2	All, 9400 S at Jordan River to Riter Canal 3600 W
31	Kennecott Canal	30	2	
32	Riter Canal	31	6.6	All, North Jordan Canal 3600 W 3100 S to C-7 D
33	Kersey Creek	32	2.3	2700 S. to C-7 Ditch
34	C-7 Ditch	33	8	All, 8000 W U-201 to Great Salt Lake
35	Lee Creek	34	3.9	2400 S. to C-7 Ditch
36	8000 W Drain	35	1.7	Utah and Salt Lake Canal to C-7 Ditch
37	Kearns-Chesterfield Drain	36	5.8	Utah & Salt Lake Canal to Jordan River, including
38	Lee Drain	37	5.4	Lee Drain Pump Station to Lee Creek
39	Goggin Drain	38	7.8	Surplus Canal to Great Salt Lake
40	Surplus Canal	39	11.8	All, 2100 S to Great Salt Lake
41	2700 West Drain	40	1.8	North Jordan Canal to I-215 Drain
42	I-215 Drain	41	1.5	4700 South to 4100 South and 2700 West to Dec
43	4100 South Drain	42	2.2	3200 West to Jordan River
44	4700 South Drain	43	2.5	South Jordan Canal to I-215 & North Jordan Can
45	3200 West Drain	44	1	4700 South to 4100 South
46	5400 South Drain	45	2.2	Utah and Salt Lake Canal to Jordan River
47	City Drain West Branch	46	6.1	CWA-2 Drain to Sewage Canal
48	Sewage Canal	47	5.1	City Drain to Great Salt Lake
49	CWA-2 Drain	48	0.6	CWA-1 Drain to City Drain
50	CWA-3 Drain	49	1.9	Brighton Canal Extension to CWA-2 Drain
51	CWA-1 Drain	50	2.4	Roper Yard to CWA-2 Drain
52	4th Avenue Drain	51	1.8	Virginia Street to City Creek
53	8th South Drain	52	3.7	East High School Detention Basin to Jordan Rive
54	7200 South Drain	53	2.7	East Jordan Canal to Jordan River
55	9000 South Drain	54	2.5	East Jordan Canal to Jordan River
56	Upper Canal	55	5.5	All, Big Cottonwood Cr at 3000 E to Mill Cr at 200
57	Jordan and Salt Lake City Canal	56	2.4	Jordan Narrows to Red Butte Creek
58	East Jordan Canal	57	17.7	Jordan Narrow to 7200 South
59	East Jordan Canal Extension	58	3.7	7200 South to Walker Lane
60	Draper Irrigation Canal		NA	Jordan Narrows to 11000 S
61	Sandy Irrigation Canal		NA	11000 S to 7800 S
62	Union Jordan No and S Ditches	59	1.6	Little Cottonwood Creek to Jordan River
63	Brown and Sanford Ditch		NA	Area of mouth of Big Cottonwood Canyon
64	2700 South Storm Drain	60	0.6	Nibley Park to Mill Creek

Flood Control and Water Quality Division 2011

SALT LAKE COUNTY

Figure 3
SLCO Municipal Stormwater Program
Organization Flow Chart



2.2 PURPOSE

This 2014 SWMP identifies tasks for completion over the next five years. These tasks are designed to address the seven minimum control measures for Phase I permittees, and are listed below:

- Public Education and Outreach on Stormwater Impacts
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Long-term Stormwater Management in New Development and Redevelopment
- Pollution Prevention and Good Housekeeping for Municipal Operations
- Industrial and High Risk Runoff
- Monitoring, Evaluation and Reporting

2.3 SWMP REVIEW AND MODIFICATION

An annual review of this SWMP will be conducted in conjunction with the required Annual Stormwater Report; any changes or modifications will be submitted to the Utah Division of Water Quality (DWQ) in accordance with Part 4.4 of the permit. This review will include the following:

- A review of the status of program implementation and permit compliance.
- A review of any revision or change of BMPs during the year and an assessment of the effectiveness of such revision. The DWQ will be notified of any changes to the implementation of BMPs. This notification will include the rationale supporting the modification in accordance with Part 4.5.2 of the permit.
- An overall assessment of the goals and direction of the SWMP and effectiveness of BMPs.
- A review of monitoring data, any changes in monitoring methods and parameters, and an assessment of the overall monitoring program.

2.4 STAFFING AND RESOURCE ALLOCATIONS

Management and oversight of the Stormwater Management Program is funded by Salt Lake County through the municipal generated sales tax (approximately 60%) and the *ad valorem* property tax (approximately 40%) assessed Countywide. The Stormwater Management Program has been programmed to include 2.5 full-time equivalent personnel on an annual basis. The County also utilizes the services of contractors to implement portions of the stormwater program, including technical assistance and the public education program. Some of the implementation of the 2014 Stormwater Management Program is performed by other departments and divisions within the County and is therefore not included in this funding (e.g.

Pollution Prevention and Good Housekeeping Program and the Household Hazardous Waste Program).

Salt Lake County is also conducting a stormwater utility study as a potential funding source for future compliance efforts.

The **Public Education and Outreach** on Stormwater Impacts Program is conducted in large part by the Salt Lake County Stormwater Coalition. This program is discussed in detail in Section 4.0 of this plan. This Coalition is funded by the Co-permittees, as well as the Utah Department of Transportation and Davis and Weber Counties. The Coalition is responsible for developing and distributing the educational materials.

In regards to the **Illicit Discharge Detection and Elimination Program**, the Salt Lake County Health Department responds to complaints regarding spills and illegal discharges, and takes enforcement actions as necessary. The portion of the SWMP that is funded by the County's *ad valorem* property tax is the Dry Weather Screening Program, stormwater system map and coordination with the Salt Lake County Health Department. The Engineering Division and the Health Department have entered into a Memorandum of Understanding (MOU) to more formally define the interaction between the implementation and management phases of the SWMP.

Implementation of the **Construction Site Stormwater Runoff Control Program** and the **Long-term Stormwater Management Program** are performed by Salt Lake County's Planning and Development Services (P&DS) department. This department conducts SWPPP reviews of planned development, construction site inspections, permit enforcement, and long-term BMP plan reviews and inspections. The primary funding source of the program is provided by fees generated from development plan reviews, inspections, building and development permits, and impact fee.

Implementation of the **Pollution Prevention and Good Housekeeping Program** is performed by Public Works Operations Division. This division implements street sweeping, road deicing, truck washing, etc. The funding source is the Municipal Services Fund which is assessed on the unincorporated County only. The Household Hazardous Waste Program is funded by the Salt Lake County Health Department through the collection of a tipping fee at the Salt Lake Valley Solid Waste Management Facility, the Tri-Community Landfill and at the transfer station.

Currently, the majority of the **High Risk Industrial Program** is performed by Salt Lake County's Engineering and Flood Control Division in conjunction with the Salt Lake County Health Department, and Planning and Development Services Division. Assistance is also provided by the County's technical consultant. The funding for this program is currently the same as the funding for the management and oversight of the overall Stormwater Management Program. Other potential sources are being evaluated.

Monitoring, evaluation and reporting is also performed by the County's Engineering and Flood Control Division in conjunction with the Salt Lake County Health Department. Assistance is also provided by the County's technical consultant. The funding for this program is currently the same as the funding for the management and oversight of the overall Stormwater Management Program. Other potential sources are being evaluated.

2.5 PROGRAM SUMMARY

This SWMP has been developed to meet the requirements of the UPDES permit and consists of the six minimum control measures established by EPA for Phase II stormwater discharges. In addition, this SWMP addresses the requirement for Phase I municipalities to implement an industrial and high-risk runoff program, as well as stormwater monitoring. Implementation of these control measures are designed for the purpose of minimizing the discharge of stormwater pollutants to the maximum extent practicable. Each control measure contains best management practices (BMPs) necessary for proper stormwater management. The BMPs contained herein include specific tasks to meet the objective of that control measure. A total of 42 BMP programs and 89 tasks are contained in this SWMP. Many of these tasks are on-going tasks from previous SWMPs; all of these tasks are scheduled to be conducted or completed during the permit term. These BMPs include the permit requirement to conduct representative stormwater monitoring in order to calculate annual pollutant loading rates and submittal of an Annual Stormwater Report. This SWMP is intended to be a dynamic document with BMPs added and deleted as new management practices arise and other management practices are found to be ineffective.

A brief description of each BMP program relating to the minimum control measures is provided below. A list of each program with a five-year implementation schedule is provided in Table 1.

Chapter Four – Public Education and Outreach on Stormwater Impacts
This measure is intended to ensure greater public support for the stormwater program and greater compliance through education. An informed public can significantly contribute to the success of the program. In 1999, Salt Lake County implemented the use of a Focus Group to determine the most effective mechanism for educating the public on stormwater issues. Results of the Focus Group indicated that by educating school children (4th graders); the children are likely to take the information to their family.

In general, Salt Lake County emphasizes education in the SWMP because it is a cost-effective BMP and is proactive in trying to reduce stormwater pollutants rather, than reactive by treating the stormwater pollutants. The BMP programs in this chapter include:

1. Residents Education Program
2. Businesses, Institutions and Commercial Facilities Education Program
3. Developers and Contractor Education Program
4. MS4 Industrial Facilities Program
5. Public Survey
6. Salt Lake County Stormwater Coalition

Chapter Five – Public Involvement/Participation
This measure is intended to provide opportunities for the public to play an active role in both the development and implementation of the stormwater program. An active community is important to the success of a stormwater program. The BMPs in this chapter not only serve to involve the public in the stormwater program, but also function to educate the public on stormwater issues. The BMP programs in this chapter include:

1. Public involvement
2. Public participation

Chapter Six – Illicit Discharge Detection and Elimination
This measure is intended to minimize the illicit discharges into the storm drain system. Illicit discharges are discharges that are not composed entirely of stormwater (except as allowed by permit, Part 1.2.2.2), as storm drain systems are not designed to accept, process or discharge such non-stormwater wastewaters. Minimizing these discharges can help to prevent high levels of pollutants from entering receiving waters. The BMP programs in this chapter include:

1. Illicit Discharge Ordinance
2. Agency MOUs
3. Mapping
4. Illicit Detection and Elimination (IDDE) Plan
5. Program Evaluation and Assessment
6. IDDE Training

Chapter Seven – Construction Site Stormwater Runoff Control
This measure is intended to minimize polluted stormwater runoff from construction activities. Construction activities can contribute significant levels of sediment to stormwater runoff if erosion and sediment controls are not implemented. The BMP programs in this chapter include:

1. Construction Site Runoff Ordinance
2. Pre-Construction Reviews
3. Inspection and Enforcement
4. Construction Site Runoff Training
5. Records Keeping

Chapter Eight – Long-term Stormwater Management in New Development and Redevelopment
This measure is intended to minimize the impact to stormwater quality caused by development and redevelopment. The increase in impervious areas caused by development can result in an increase in the type and quantity of pollutants in stormwater runoff. Prior planning and design to minimize pollutants in runoff from these areas is an important component to stormwater quality management. The BMP programs in this chapter include:

1. Long-term Stormwater Management Ordinance
2. Long-Term Stormwater BMPs
3. Site Plan Review Procedures
4. Inspections and Enforcement
5. Long-term Stormwater Management Training
6. Long-Term Stormwater BMP Inventory

Chapter Nine – Pollution Prevention and Good Housekeeping for Municipal Operations
This measure is intended to ensure a reduction in the amount and type of stormwater pollutants by establishing routine activities in the operation and maintenance of municipal operations that

address stormwater runoff. Setting particular guidelines routine activities that have the potential to impact stormwater quality is an important component to stormwater quality management. The BMP programs in this chapter include:

1. Municipal Maintenance
2. Facility Inventory
3. High-Priority Facility Identification and SOPs
4. Third-party Maintenance
5. High-Priority Operation, Maintenance and Inspections
6. Water Quality Assessment of Flood Control Projects
7. County Construction Projects
8. Employee Training

Chapter Ten – Industrial and High Risk Runoff

This measure meets the requirements of Phase I permittees to implement a program that addresses runoff from industrial facilities and commercial businesses. Proper stormwater management of the runoff from these areas can help to minimize the pollutant loading to the stormwater system. This chapter establishes criteria to develop a program for industrial and high-risk facilities and include the following BMPs:

1. Facility Inventory
2. Industrial Facility Stormwater BMPs
3. Facility Prioritization
4. Facility Inspections
5. Facility Enforcement
6. Staff Training

Chapter Eleven – Monitoring, Evaluation and Reporting

This chapter provides a summary of the monitoring, SWMP effectiveness evaluation and reporting that is required by the UPDES permit. Water quality sampling of representative storms is conducted in order to evaluate the effectiveness of the SWMP and to identify any trends in stormwater quality. The permit also requires reporting of all stormwater activities conducted under this SWMP and routine evaluation of the effectiveness of the SWMP in order to make modifications as necessary. The BMP programs in this chapter include:

1. Wet & Dry Weather Monitoring
2. Record Keeping
3. Reporting

TABLE 1
MASTER BMP LIST

PUBLIC EDUCATION AND OUTREACH ON STORMWATER IMPACTS	1/14 - 12/14	1/15 - 12/15	1/16 - 12/16	1/17 - 12/17	1/18 - 12/18
RESIDENTS EDUCATION PROGRAM					
Water Quality Fair					
Media campaign					
Educational material/ Distribute					
Informational brochures/ Include new information/ Develop & distribute		4/15 New topics			
Educational Video					
Internet & social media					
Stream crossing identification	2/yr	2/yr	2/yr	2/yr	2/yr
BUSINESSES, INSTITUTIONS AND COMMERCIAL FACILITIES EDUCATION PROGRAM					
Business & commerical informational brochures/ Include new information		4/15 New topics			
DEVELOPERS AND CONTRACTOR EDUCATION PROGRAM					
Pre-construction conference stormwater information					
Website information	9/14				
MS4 INDUSTRIAL FACILITIES					
County employee information and training/ Include LID methods & IDDE Program	1/yr	1/yr	1/yr	1/yr	1/yr
PUBLIC SURVEY					
Conduct public survey				2/15	
SALT LAKE COUNTY STORMWATER COALITION					
Continue participation					
Represent SLCo Stormwater Coalition at JRWC & USWAC					
PUBLIC INVOLVEMENT/PARTICIPATION PROGRAM	**1/14 - 12/14**	**1/15 - 12/15**	**1/16 - 12/16**	**1/17 - 12/17**	**1/18 - 12/18**
PUBLIC INVOLVEMENT					
Draft & final SWMP and ordinance development website posting	3/14				
PUBLIC PARTICIPATION					
Storm drain inlet identifications/ Make available					
Used Oil program/ Promote					
Leaf Bag Collection program					
ILLICIT DISCHARGE DETECTION AND ELIMINATION	**1/14 - 12/14**	**1/15 - 12/15**	**1/16 - 12/16**	**1/17 - 12/17**	**1/18 - 12/18**
ORDINANCE					
Stormwater Quality ordinance/ Implement					
Escalating enforcement procedures					
AGENCY MOUs					
Develop & implement MOU with the Salt Lake County Health Department	9/14				
MAPPING					
Storm drain system map/ Update annually		3/14	3/14	3/14	3/14
Catchment basin map/ Update	8/14				
Land use map/ Update as necessary					
IDDE PLAN					
Dry weather screening/ Update plan, conduct screening	8/14 20%/yr	20%/yr	20%/yr	20%/yr	20%/yr
Priority Area Screening		3/3/15 Develop list	20%/yr	20%/yr	20%/yr
Tracing illicit discharge sources	9/14	3/3/15			
Characterize illicit discharge	9/14	3/3/15			
Eliminate illicit discharge	9/14	3/3/15			
Illicit discharge public education (Public Education & Outreach Program)					
Household hazardous waste/ Provide information					
Public reporting/ Flow chart for response/ Provide information					
PROGRAM EVALUATION AND ASSESSMENT					
Database for program evaluation & assessment/ Develop & maintain		3/3/15			
EMPLOYEE TRAINING					
Annual employee training					
CONSTRUCTION SITE RUNOFF CONTROL	**1/14 - 12/14**	**1/15 - 12/15**	**1/16 - 12/16**	**1/17 - 12/17**	**1/18 - 12/18**
ORDINANCE					
Implement Title 17, Chapter 17.22 - Stormwater Quality					
SOP for enforcement/ Develop & implement		3/3/15			
PRE-CONSTRUCTION REVIEWS					
SOP for review process/ Develop & implement		3/3/15			
Review checklist/ Develop & utilize during review process		3/3/15			
LID incorporated in review process		3/3/15			
Review & update priority list					
INSPECTIONS AND ENFORCEMENT					
SOP for inspection procedures/ Develop & implement/ Priority site inpsections					
Enforcement actions/ Document					
CONSTRUCTION SITE STORMWATER TRAINING					
Annual personnel training					
RECORDS KEEPING					
Maintain records for construction sites					
LONG-TERM STORMWATER MANAGEMENT IN NEW DEVELOPMENT & REDEVELOPMENT	**1/14 - 12/14**	**1/15 - 12/15**	**1/16 - 12/16**	**1/17 - 12/17**	**1/18 - 12/18**
LONG-TERM STORMWATER MANAGEMENT ORDINANCE					
Implement Title 17, Chapter 17.22 - Stormwater Quality					
Enforcement strategy/ Develop & implement		3/3/15			
IMPLEMENT LONG-TERM STORMWATER BMPs					
Non-structural BMPs		3/3/15			
Encourage LID approach		3/3/15			
Retrofit Plan		3/3/15			
Hydrologic method for BMP sizing		3/3/15			
SITE PLAN REVIEW PROCEDURES					
Long-term BMP plan review		3/3/15			
Preferred design specifications/ Maintain record of distribution		3/3/15			
LONG-TERM STORMWATER MANAGEMENT INSPECTIONS & ENFORCEMENT					
SOP for long-term inspections & enforcement procedures/ Develop & implement		3/3/15			
LONG-TERM STORMWATER BMP TRAINING					
Annual personnel training		3/3/15			
LONG-TERM STORMWATER BMP INVENTORY					
BMP inventory/ Develop & maintain		3/3/15			
POLLUTION PREVENTION/GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS	**1/14 - 12/14**	**1/15 - 12/15**	**1/16 - 12/16**	**1/17 - 12/17**	**1/18 - 12/18**
MUNICIPAL MAINTENANCE					
Storm drain system maintenance					
Detention/retention basin inspections					
Street sweeping					
Title 17 Flood Control Facilities maintenance					
Midvale SWPPP					
FACILITY INVENTORY					
Facility inventory/ Develop & update	12/14				
HIGH-PRIORITY FACILITY IDENTIFICATION & SOPs					
Identify high-priority facilities	12/14				
SOPS for high-priority facilities	12/14				
High priority building & facilities floor drain inventory	12/14				
High priority buildings & facilities storm drain map					
THIRD-PARTY MUNICIPAL MAINTENANCE					
Third-party maintenance agreements/inspections					
HIGH PRIORITY OPERATION & MAINTENANCE INSPECTION PROGRAM					
High priority facility weekly inspections					
High priority quarterly comprehensive inspections					
High priority quarterly visual observations					
WATER QUALITY ASSESSMENT OF FLOOD CONTROL PROJECTS					
Water quality review process/ Develop & implement		7/15			
COUNTY CONSTRUCTION PROJECTS					
Ensure compliance with UPDES Construction Site Permit					
EMPLOYEE TRAINING					
Annual personnel training					
INDUSTRIAL AND HIGH RISK RUNOFF PROGRAM	**1/14 - 12/14**	**1/15 - 12/15**	**1/16 - 12/16**	**1/17 - 12/17**	**1/18 - 12/18**
FACILITY INVENTORY					
Develop & maintain inventory					
INDUSTRIAL FACILITY STORMWATER BMPs					
Require implementation of BMPs			7/16		
INDUSTRIAL AND HIGH RISK PRIORITIZATION					
Prioritize high risk facilities/ Document process		7/15			
INDUSTRIAL AND COMMERCIAL FACILITY INSPECTIONS					
Develop & implement inspection program/inspection form					
INDUSTRIAL AND COMMERCIAL FACILITY ENFORCEMENT					
Conduct enforcement actions					
EMPLOYEE TRAINING					
Annual personnel training					
MONITORING, RECORDKEEPING AND REPORTING	**1/14 - 12/14**	**1/15 - 12/15**	**1/16 - 12/16**	**1/17 - 12/17**	**1/18 - 12/18**
WET & DRY WEATHER MONITORING					
Conduct representative sampling/Annual load & EMC calculations					
Relocate sample stations/ Submit revised sample plan to DWQ	9/14				
Notify DWQ of any modifications for approval					
Submit revised Dry Weather Plan to DWQ	6/14				
Notify DWQ of any modifications for approval					
Annual personnel training/ Include COC forms					
RECORDKEEPING					
Documentation Process/ Maintain records					
Co-permittee Identification & Accountability	2/14				
REPORTING					
Annual Report	10/1/14	10/1/15	10/1/16	10/1/2017	10/1/2018
Annual fiscal analysis of program	10/1/14	10/1/15	10/1/16	10/1/2017	10/1/2018
5-year Summary Report	5/14				

3.0 SPECIAL CONDITIONS

The UPDES permit requires the SWMP address potential impacts to impaired waterbodies, threatened and endangered species, and historic properties with regards to the discharge of stormwater. This section provides a discussion of these issues.

3.1 DISCHARGES TO IMPAIRED WATERS

In accordance with the Utah 2010 Integrated Report (Department of Environmental Quality, 2010), there are currently six impaired waterbodies in Salt Lake Valley. These waterbodies and information on the Total Maximum Daily Load (TMDL) studies are presented in Table 2.

Table 2 Impaired Waterbodies in Salt Lake County

Watershed Management Unit	Watershed Management Name	Location of Impairment	Beneficial Use[1]	Pollutant	TMDL Status
Jordan River/ Utah Lake	Big Cottonwood Creek	From the Jordan River to the Big Cottonwood Water Treatment Plant	3B	Temperature	TMDL required Low Priority
	Emigration Creek	From Foothill Blvd to headwaters	2B	E. Coli	TMDL in process
	Jordan River	From 2100 South to the Narrows	2B, 3A, 3B, 4	Dissolved Oxygen E. coli Temperature Total Dissolved Solids Benthic-Macroinvertebrate	TMDL in process for Segments 1-3
	Mill Creek	From I-15 to USFS Boundary	3A	Benthic-Macroinvertebrate	TMDL required Low Priority
	Little Cottonwood Creek	From the Jordan River to the Metropolitan Water Treatment Plant	3A, 4	Temperature Total Dissolved Solids	TMDL required Low Priority
	Parleys Canyon Creek	From 1300 East to Mountain Dell Reservoir	1C, 2B	E. Coli	TMDL required Medium Priority

[1] 1C – Domestic Water Supply
2B – Secondary Contact Recreation
3A – Cold Water Species of Game Fish
3B – Warm Water Species of Game Fish
4 – Agriculture

Salt Lake County currently discharges stormwater to Big Cottonwood Creek, Emigration Creek, Jordan River (2100 South to the Narrows), the lower section of Little Cottonwood Creek and Parley's Canyon Creek (the County does not have outfalls to City Creek).

Salt Lake County has been operating under a UPDES permit since 1992 and has implemented numerous BMPs with the intent to minimize the discharge of stormwater pollutants. Salt Lake County will continue to implement BMPs and will evaluate potential impacts to impaired waterbodies. The status of these waterbodies in relation to the County's stormwater discharges is as follows:

1. Big Cottonwood Creek – TMDL not complete; no specific requirements at this time.
2. Jordan River – TMDL in process for Segments 1-3; no specific requirements for stormwater at this time. Salt Lake County will continue to participate in the development of the TMDL.
3. Little Cottonwood Creek – TMDL not complete; no specific requirements at this time.
4. Parley's Canyon Creek – TMDL not complete; no specific requirements at this time.

3.2 THREATENED AND ENDANGERED SPECIES

Federally Threatened and Endangered Species and State Sensitive Species lists, located in Salt Lake County are available at:
http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=UT&s8fid=112761032792&s8fid=112762573902
and http://dwrcdc.nr.utah.gov/ucdc/ViewReports/sscounty.pdf. These lists are subject to change, therefore the most recent information should be obtained prior to initiating new stormwater projects. The County will coordinate with the appropriate state and federal offices when new stormwater projects are planned and the potential impact to these species will be evaluated. The State Department of Natural Resources, Division of Wildlife Resources and/or the U.S. Department of Fish and Wildlife will be contacted during the planning stages.

3.3 HISTORIC PROPERTIES

The County will ensure compliance with State Historic Preservation Office (SHPO) regulations when construction of a storm drain system is planned
(http://history.utah.gov/state_historic_preservation_office/index.html). The State SHPO will be contacted during the planning phase of the project and compliance with SHPO regulations will be maintained.

4.0 PUBLIC EDUCATION AND OUTREACH ON STORMWATER IMPACTS

The Public Education and Outreach on Stormwater Impacts Program is intended to increase public awareness of impacts associated with pollutants in stormwater runoff and illicit discharges. Salt Lake County (County), in conjunction with the Salt Lake County Stormwater Coalition, has implemented an education program over the years that include a multi-media approach. In this manner, the County is able to reach a wide audience which serves to make the stormwater management program more successful. This approach has included TV and movie commercials, educational brochures and flyers, a Water Fair and more. In addition, Salt Lake County has translated some of the educational materials into Spanish in order to reach a wider audience.

The BMPs in this program will target four audiences in accordance with Part 4.2.1. of the permit. These audiences are: 1) residents, 2) businesses, institutions and commercial facilities, 3) developers and contractors, and 4) MS4 industrial facilities. The information provided to these audiences include potential impacts of stormwater on receiving waters and methods for minimizing these impacts.

4.1 SUMMARY OF TASKS

This program integrates other facets of the SWMP to provide up-to-date information, including the Illicit Discharge Detection and Elimination, the Construction Site Stormwater Runoff Control, Long-term Stormwater Management and Good Housekeeping Programs. The following BMPs describe implementation and assessment tasks to be completed and responsible parties. Progress towards the measurable goals will be documented in the Annual Stormwater Report.

4.1.1 RESIDENTS EDUCATION PROGRAM

Objective: Reduce stormwater pollutants to receiving waters by increased public awareness of problems and solutions.

Permit Requirement: Part 4.2.1.1. & 4.2.1.2. - Public Education & Outreach on Stormwater Impacts
Part 4.2.3. - Illicit Discharges Detection & Elimination

Description of Tasks: Provide residents with educational materials, demonstrations and outreach activities regarding the impact of daily activities on stormwater quality. Information will include the types of stormwater pollutants and ways to reduce or eliminate these pollutants. Topics will include maintenance of septic systems, effects of outdoor and household activities, including vehicle maintenance on stormwater quality, benefits of on-site infiltration, proper disposal of swimming pool water and proper management of pet waste.

Water Quality Fair: With cooperation from the Stormwater Coalition and other interested and willing agencies, the water quality fair is held annually. The venue is currently at the Hogle Zoo, located in Salt Lake City. The fair consists of a series of booths and informational

demonstrations presented by individual agencies; topics include stormwater pollution and other water related issues. This fair is held for fourth grade students and coincides with the Water Cycle in the current school curriculum. Students from Salt Lake County are bused to the zoo and spend a morning visiting the booths. Printed stormwater materials and give-aways are distributed. The intent is not only to provide stormwater information to the students, but for this information to be received by the students' families as well; potentially reaching a larger audience.

Media Campaign: The Salt Lake County Stormwater Coalition conducts a mass media campaign to further educate residents about stormwater pollution and prevention. Salt Lake County has developed several commercials addressing stormwater issues over the years and continues to produce updated versions. The Coalition partners with top rated TV stations in the Salt Lake County market, reaching a large portion of Salt Lake County residents. These campaigns typically run for a two- to three-week period, and are also broadcast in movie theaters. Additional campaigns will be conducted as opportunities arise.

Educational Materials: Distribution of educational materials is designed to inform communities of the impacts of stormwater discharges on local waterbodies and ways in which people can reduce this impact. These materials include educational materials and give-aways such as tabloids, activity books, pencils, note pads, posters, etc. Many of the educational materials are developed through the Salt Lake County Stormwater Coalition (see Section 4.1.6). The materials are primarily distributed to 4th graders in the public and private schools within Salt Lake County and ties in with the Water Cycle curriculum. It is optimal to distribute the materials once a year when students can practice what they learn and more easily visualize stormwater runoff (i.e., spring and fall). The number and type of materials that are distributed will be documented. These materials will be updated as necessary.

Informational Brochures: Distribution of stormwater information brochures to the general public. Currently, these brochures cover the following topics:

- Landscaping, Gardening and Yard Maintenance
- Fresh Concrete and Mortar Application
- Erosion Control
- Paint and Household Hazardous Waste
- Pet Waste and Water Quality
- Household and Vehicle Maintenance
- Proper Disposal of Swimming Pool and Hot Tub Water
- Charity Car Washes

Additional information or brochures will be developed to include septic system maintenance and the benefits of on-site infiltration of stormwater. These will be available at the County offices and will be posted on the Salt Lake County Coalition website.

Educational Video: A stormwater educational video, *Dr. Strangewater and the Downstream Rangers* has been developed and is being distributed. This video is geared to 4th grade

students and educates students about stormwater in a fun way. Valuable tips on keeping stormwater clean are provided and they are empowered as Downstream Deputies to go out and educate others about stormwater. The County will continue to make this video available to interested parties.

Internet and Social Media: The Salt Lake County Stormwater Coalition has maintained a website for several years. This website not only provides stormwater information, but provides links to other sites for information, as well as member sites for more local information. This website will be updated as necessary. In addition, the Coalition has broadened its use of social media to include Facebook and Twitter, with the intent to reach a younger audience with the information.

Stream Crossing Identification: Salt Lake County is currently placing signs on roadways to identify stream crossings. The intent is to make the public more aware of the streams in the area and hopefully take more interest in protecting the waterway. The County will continue to place these signs in the County's jurisdiction. The County has made the template for these signs available to the co-permittees for placement in their jurisdictions.

4.1.2 BUSINESSES, INSTITUTIONS AND COMMERCIAL FACILITIES EDUCATION PROGRAM

Objective: Reduce the discharge of stormwater pollutants to receiving waters by providing information to businesses regarding illicit discharges and the potential impacts.

Permit Requirement: Part 4.2.1.3. - Public Education & Outreach on Stormwater Impacts
Part 4.2.3. - Illicit Discharges Detection & Elimination

Description of Task: Inform businesses and commercial entities about the impacts of stormwater discharges on receiving waters and steps that can be taken to reduce pollutants in stormwater runoff through outreach activities and/or educational materials. Provide information about the storm drain system and the consequences of illegal discharges and improper disposal of waste. Topics to be included in this education program include lawn maintenance, benefits of on-site infiltration of stormwater, building and equipment maintenance, use of salt or other deicing materials, proper management of waste materials and dumpsters, and proper management of parking lots. The County will utilize brochures that have been developed under the Residents Education Program and will develop new brochures discussing the topics identified above. In addition, the County will continue to distribute the Carpet, Building and Food Related Mobile Cleaning brochure. These brochures will be available at the County offices and will be posted on the Salt Lake County Stormwater Coalition website.

4.1.3 DEVELOPERS AND CONTRACTORS EDUCATION PROGRAM

Objective: Reduce pollutants to receiving waters by providing information to the construction industry with regards to construction activities and impacts to stormwater quality.

Permit Requirement: Part 4.2.1.4. - Public Education & Outreach on Stormwater Impacts
Part 4.2.4. - Construction Site Stormwater Runoff Control

Part 4.2.5.- Long-term Stormwater Management in New Development & Redevelopment

Description of Task: Provide engineers, construction contractors, developers, development review staff, and landuse planners with educational materials regarding stormwater regulations, including the requirement to develop Stormwater Pollution Prevention Plans (SWPPP) at construction sites one acre or greater in size. Information regarding stormwater regulations and the County's stormwater quality ordinance Title 17, Chapter 17.22., including the Land Disturbance Permit will be provided at a pre-construction conference, as well as the County's website. The requirements for developing a SWPPP and short-term and long-term Best Management Practices (BMPs) will also be provided.

4.1.4 MS4 INDUSTRIAL FACILITIES

Objective: Reduce the discharge of pollutants to stormwater by providing training to employees with regards to water quality impacts associated with illicit discharges, improper disposal of waste and Low Impact Development (LID) practices.

Permit Requirement: Part 4.2.1.5. & 4.2.1.6. - Public Education & Outreach on Stormwater Impacts
Part 4.2.4. - Construction Site Stormwater Runoff Control
Part 4.2.5. - Long-term Stormwater Management in New Development & Redevelopment

Description of Task: Provide MS4 engineers, development and plan review staff, land use planners and other employees as applicable, with educational materials regarding stormwater regulations, LID practices and the IDDE Program. County personnel will be provided annual training with regards to County stormwater regulations (Title 17, Chapter 17.22.), inspections and maintenance, and BMPs for businesses and commercial facilities, construction sites and MS4 industrial facilities. Training may include webcasts, training or distribution of information. Training topics will include the following:

- Equipment inspection and maintenance
- Proper storage of industrial materials
- Proper management and disposal of wastes
- Proper management of dumpsters
- Minimization of use of salt and other de-icing material
- Benefits of on-site infiltration
- Proper maintenance of parking lots
- Low Impact Development (LID) practices and green infrastructure practices

4.1.5 PUBLIC SURVEY

Objective: Evaluate the effectiveness of the public education and outreach program through use of a public survey. The survey will be used to evaluate the recognition of the stormwater message and the impact the information has on residential, commercial and industrial habits with regards to stormwater.

Permit Requirement: Part 4.2.1.7. - Public Education and Outreach on Stormwater Impacts

Description of Task: The County conducted public surveys associated with stormwater issues in 1993, 1998, 2003 and 2010. The purpose of the surveys was to determine what type of information needs to be conveyed to the public, what people do that may impact stormwater quality, and their knowledge of stormwater issues. The survey information is used to evaluate and modify the stormwater education program accordingly. The County will continue to conduct these surveys once every five years; consideration will be given to conduct a bilingual survey as appropriate to the County demographics.

4.1.6 SALT LAKE COUNTY STORMWATER COALITION

Objective: Increase public and professional awareness of stormwater quality concerns with consistent and combined marketing methods.

Permit Requirement: Part 4.2.1. - Public Education and Outreach on Stormwater Impacts

Description of Tasks: Continue coordinating and participating in the Salt Lake County Stormwater Coalition for the purpose of providing education and training for professionals and municipal employees with regards to stormwater quality. This coalition is open to the public and consists of co-permittee representatives whose purpose is reducing the load of pollutants entering the storm drains and receiving waterbodies, and enforcing the appropriate regulations. The Coalition meets monthly to coordinate new educational materials/programs, discuss stormwater program development and inform members of new regulations and conferences.

A budget for the educational program is established each year with the assistance of a consultant. Through interlocal agreements and voluntary contributions, the program is funded by participants. The County provides a base funding level each year, supplemented by additional funds. The types of media and timing for distribution are discussed so that the public can be targeted during the spring and the fall. Other factors that are taken into consideration in choosing the types of media are the average number of times that a person will see the advertisement. Examples of the types of educational materials that are developed through the Coalition are:

- Television commercials
- Theater commercials
- Tabloids
- Posters
- Leave behind items
- Activity books
- Public surveys
- Brochures

The County documents the number and type of all materials that are distributed. Current Salt Lake County Stormwater Coalition participants are listed below, however, new entities may participate at any time.

- Salt Lake County
- Salt Lake City
- Salt Lake County Health Department
- UDOT, Region 2

- Jordan Valley Municipalities Phase 2 Co-permittees (14)

Other public agencies that are not formal members of the Coalition, also participate in the funding of certain programs. For instance, the Davis and Weber Counties provide assist in funding of air time for commercials to fulfill some of their stormwater permit requirements.

The Coalition also serves as the Stormwater Subcommittee for the Jordan River Watershed Council (JRWC). A representative from the Coalition attends the JRWC Core Council meetings, ensuring that stormwater issues are addressed within the watershed aspect, and reports back to the Coalition.

The Coalition also provides a representative to the Utah Stormwater Advisory Committee (USWAC). USWAC was established to coordinate efforts to reduce stormwater pollution statewide and meets on a monthly basis. The committee consists of representatives from counties and stormwater coalitions, as well as DWQ personnel. The committee discusses implementation of stormwater regulations, training opportunities and best management practices.

4.2 GOALS AND ASSESSMENT

The table below represents measurable goals for this program to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Table 3 Public Education & Outreach Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/14-12/18	Residential Education Water Quality Fair	• Continue water quality fair for 4th grade students	Document number of students attending & information distributed	Engineering Dan Drumiler
1/14-12/18	Residential Education Media Campaign	• Continue media campaign • Update commercials as necessary	Document # of airings & # of people reached	Engineering Dan Drumiler
1/14-12/18	Residential Education Materials	• Distribute educational materials to co-permittees and during the Water Fair	Document types & quantity of materials distributed	Engineering Steve Burgon
1/14-12/18	Residential Education Brochures	• Distribute stormwater brochures • New topics to be developed by 4/15	Document types & quantity of materials distributed	Engineering Steve Burgon
1/14-12/18	Residential Education Video	• Make available to interested parties	Document number of videos distributed	Engineering Steve Burgon
1/14-12/18	Residential Education Internet & Social Media	• Update website as necessary • Update other media as necessary	Assess need for updating & document	Engineering Dan Drumiler

Year	Task	Goal	Assessment	Responsibility
1/14-12/18	Residential Educations Stream Crossing Signage	• Place at least 2 signs/year until completed	Document number & location of signs placed	Engineering Steve Burgon
1/14-12/18	Business & Commercial Brochures	• Distribute informational brochures • Develop new brochures by 4/15	Document types & quantity of materials distributed	Engineering Steve Burgon
1/14-12/18	Developers & Contactors Information	• Pre-construction Conference • Website posting of information by 9/14 • Distribute brochure	Document conferences held & information distributed	PD&S Greg Baptist
1/14-12/18	MS4 Industrial Facilities Employee Training	• Provide annual training for County employees	Document training & attendance	Engineering Steve Burgon
2/15	Public Survey	• Conduct survey to evaluate effectiveness of education program	Document results & modify program accordingly	Engineering Dan Drumiler
1/14-12/18	Salt Lake County Coalition	• Continue participation in the Coalition • Represent Coalition at JRWC & USWAC meetings	Document meetings, attendees & agendas	Engineering Dan Drumiler

5.0 PUBLIC INVOLVEMENT/PARTICIPATION

The Public Involvement/Participation Program section of the SWMP addresses the importance of public involvement with respect to protection of stormwater. Community participation provides for broader public support, shorter implementation schedules, a broader base of expertise and the development of important relationships with other community and government programs. The BMPs described in this section include opportunities for the public to play an active role in the County's stormwater program.

5.1 SUMMARY OF TASKS

This program complements the Public Education and Outreach Program, providing for public input into the stormwater program as well as some active community programs. The following BMPs describe implementation tasks and assessment tasks to be completed by Salt Lake County for the Public Education Involvement/Participation Program. Progress towards the measurable goals will be documented in the Annual Report.

5.1.1 PUBLIC INVOLVEMENT

Objective: Provide opportunities for public involvement in the development and implementation of the SWMP, as well as stormwater related ordinances.

Permit Requirement: Part 4.2.2.1., 4.2.2.2., 4.2.2.3. & 4.2.2.4. - Public Involvement/Participation

Description of Task: Provide opportunity for public to review and comment on the SWMP and other regulatory mechanisms for SWMP implementation. A draft of the revised SWMP was posted on the County's website in March 2014. Comments will be reviewed and incorporated as appropriate. The final document will be posted on the website for public review for the duration of the permit. Information on how the public can comment on the SWMP will be provided on the website. In addition, the development and adoption of various ordinances or other regulatory mechanisms will also be available for public review through the website.

5.1.2 PUBLIC PARTICIPATION

Objective: Provide opportunities for public participation with regards to reducing the discharge of pollutants to stormwater runoff.

Permit Requirement: N/A

Description of Tasks: Provide opportunity for public to participate in a stormwater activity and provide education with regards to related programs.

Storm Drain Inlet Identification Program: A program utilizing community groups to glue markers on storm drain inlets serves to discourage illicit dumping and littering. Typical groups that participate in the Storm Drain Inlet Identification program are Eagle Scouts, Girl

Scouts and school groups. The County supplies the curb markers, glue, and storm inlet locations, and documents the number of participants and storm drains that are marked. This program includes a public education component by educating the participating groups about illicit discharges, and leaving brochures in the neighborhoods where the inlets are marked.

Used Oil Program: The County assists in the distribution of information to the public regarding proper disposal of used oil. This program is administered by the State Department of Environmental Quality in conjunction with the Salt Lake County Health Department. The County helps to educate the general public regarding the requirements for disposing of used oil in the other educational materials (tabloid, activity book, etc.)

Leaf Bag Collection Program: Leaf bags are available for residents of unincorporated Salt Lake County for the purpose of composting leaves during the fall. The intent is to minimize the amount of leaves that enter the storm drain system. The public is instructed to taking filled bags to a central location in a park where they are transported to the Solid Waste Management Facility and composted. The County coordinates with the Salt Lake Valley Solid Waste Management Facility and the Salt Lake County Sanitation Department to document the number of leaf bags that are distributed.

5.2 GOALS AND ASSESSMENT

The table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Table 4 Public Involvement/Participation Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/14	Public Review of SWMP & Ordinance	• Post draft & final SWMP, stormwater ordinances on County website	Document, respond & incorporate comments into SMWP & ordinance as appropriate	Engineering Steve Burgon
1/14-12/18	Storm Drain Inlet Identification Program	• Make markers available	Document number of groups & catch basins identified	Engineering Steve Burgon
1/14-12/18	Used Oil Program	• Promote Used Oil Program in educational materials	Document materials that include the Used Oil Program information	Engineering Steve Burgon
1/14-12/18	Leaf Bag Collection Program	• Make leaf bags available to unincorporated County residents	Document number of leaf bags distributed & collected	Wasatch Front Pam Roberts

6.0 ILLICIT DISCHARGE DETECTION AND ELIMINATION

The Illicit Discharge Detection and Elimination (IDDE) Program addresses non-stormwater flows that are discharged to receiving waters via stormwater conveyance systems. This program includes implementation of BMPs to assist in the identification of illicit discharges and removal of these discharges. This program will also focus on prevention of new illicit discharges to the stormwater system by means of education, regulations, and through spill prevention and response.

6.1 SUMMARY OF TASKS

This program will also be integrated with the Public Education and Outreach and the Public Involvement/Participation Programs to promote awareness of the importance of protecting the stormwater system from illicit discharges and the resultant impact to receiving waters. Salt Lake County will continue coordinating and participating with other agencies for the purpose of enforcing against and reducing illicit discharges. The County will also provide support to federal, state, and other local entities in the efficient control of contaminants as required under appropriate regulations, such as the Stormwater Permit Program, Underground Storage Tank Program, Class V Well Inventory and Management Program, and municipal wastewater pretreatment program. Agencies commonly coordinated with include:

- Fire Department
- Landfills
- Salt Lake County Health Department
- Solid Waste Management Facility
- Utah Division of Water Quality
- Recycling Information Office
- All municipalities in Salt Lake County
- Wastewater Pretreatment Program

The following BMPs describe implementation tasks and assessment tasks to be completed by Salt Lake County for the IDDE Program. Progress towards the measurable goals will be documented in the Annual Report.

6.1.1 ILLICIT DISCHARGE DETECTION AND ELIMINATION PLAN ORDINANCE

Objective: Effectively prohibit illicit and illegal discharge through an ordinance.

Permit Requirement: Part 4.2.3.2. – Illicit Discharge Detection and Elimination

Description of Task: In 2010, Salt Lake County passed an ordinance designed to minimize stormwater pollution and establishes enforcement procedures (Title 17, Chapter 17.22 Stormwater Quality, Appendix C). Illicit discharges are defined as any discharge to the storm drain system that is not composed entirely of stormwater, with the exceptions as listed in Part 1.2.2.2. of the permit. Examples of illicit discharges include sanitary wastewater, improper disposal of waste oil, paint, household toxics and spills from roadway accidents. This ordinance provides for the legal authority to enter and inspect a facility to ensure compliance.

In addition, the Salt Lake County Health Department has adopted health regulations that include wastewater disposal and watershed regulations; these are provided in Appendix C. Health

Regulation #13 Wastewater Disposal prohibits such acts as placing or conducting "any sewage or wastewater into any storm drain system, street, alley…". Health Regulation #14 Watershed Regulation prohibits several acts, all with the intent to protect the watershed and prevent watershed pollution. The County Health Department also utilizes the Clean Water Act to prevent pollution of the County's waterways. The County Health Department has adopted the Civil Penalty Determination from the Utah Administrative Code (UAC R317-1.9) that provides guidance when assessing penalties. This consists of escalating penalties depending upon the severity of the violation as well as the history of the non-compliance.

6.1.2 AGENCY MOUs

Objective: Effectively prohibit illicit and illegal discharge through coordination with other agencies.

Permit Requirement: Part 4.2.3. – Illicit Discharge Detection and Elimination

Description of Task: Salt Lake County Engineering is responsible for the implementation of the IDDE program. Engineering works in conjunction with other divisions or departments who assist in this program, including the Salt Lake County Health Department. Salt Lake County is in the process of formalizing a MOU to clearly define the roles for this program. Additional MOUs will be developed as necessary.

6.1.3 MAPPING

Objective: Maintain a current map of the storm drain system in order to assist response agencies during spill events and conduct outfall screening. This map will include pipes, inlets, outfalls and BMPs. Additional maps utilized in load and Event Mean Concentration (EMC) calculations include land use and catchment basins.

Permit Requirement: Part 4.2.3.2. – Illicit Discharge Detection and Elimination

Description of Tasks: Update maps to assist in the IDDE and monitoring programs.

Storm Drain System Map: Update and maintain current County system map in order to determine the source and extent of dry weather flows and the particular water bodies these flows may be affecting. The County will update this map on an annual basis and will crosscheck maps with Operations and Planning and Development Services. The map will include information specific to each outfall, including size, type and receiving waters. The map will include the names and location of all receiving water bodies.

Catchment Basin Map: Update the facility map to include catchment areas. This map will be of use for maintenance and enforcement purposes. In addition, this information is important to the evaluation of pollutant loading and EMCs.

Land Use Map: The land use map is important for use in tracing dry weather flows and for calculating the annual stormwater loads. Follow-up action on dry weather flows will be documented. The map will be updated as necessary, but at least with each new population

census.

6.1.4 ILLICIT DISCHARGE DETECTION AND ELIMINATION PLAN (IDDE)

Objective: Implement a comprehensive plan designed to reduce illicit discharges to the County's storm drain system. This plan will encompass many of the components in this SWMP (e.g. ordinance, public education, agency cooperation), as well as investigation and enforcement procedures.

Permit Requirement: Part 4.2.3. - Illicit Discharge Detection and Elimination
Part 4.2.1 - Public Education and Outreach on Stormwater Impacts
Part 4.2.2 - Public Involvement/Participation

Description of Tasks: Develop and implement a comprehensive IDDE plan that includes adequate ordinances that provide for County access and enforcement activities. Storm drain system mapping, dry weather screening, agency coordination and public education are all components of an effective IDDE plan.

Dry Weather Screening: Dry weather screening consists of inspecting each of the outfalls (greater than 12" in diameter) that discharge to Salt Lake County facilities at least once during the permit term. The Dry Weather Screening Program provides a framework for field screening the outfalls to identify suspected outfalls as a basis for initiating more detailed drainage area investigations and enforcement procedures. In addition, this program requires annual training for municipal employees. This plan is part of a larger IDDE Plan that includes an education program. The plan is provided in Appendix D and includes the Dry Weather Screening Field Data Sheet to be used during dry weather screening. Salt Lake County is currently updating this plan; to be completed by August 2014.

Priority Area Screening: Develop and implement written procedures for locating and listing the priority areas listed below. Document the basis for each selection, and update priority area annually to reflect change priorities. Field assessment of at least 20% of these priority area outfalls will be conducted each year, utilizing the form in Appendix D.

- Areas with older infrastructure
- Industrial, commercial or mixed use areas
- Areas with a history of past illicit discharges
- Areas with onsite sewage disposal systems
- Areas upstream of sensitive waterbodies

Tracing Illicit Discharge Source: Implement screening investigations to trace the source of an illicit discharge, including visual inspections, use of mobile cameras, field test kits, and collection and analysis of water samples. These procedures will be implemented and appropriate enforcement actions will be taken in order to prevent such discharges. Documentation of these efforts will be maintained in Appendix D of this SWMP.

Characterizing the Illicit Discharge: Implement procedures to characterize illicit discharges

when found. These procedures will include instructions for containment. Documentation will include:

- Date of report of illicit discharge
- Date of investigation initiation
- Date discharge was observed
- Location and description of discharge
- Method of discovery
- Date of removal, repair or enforcement action
- Date and method of removal verification
- Decision process for analytical monitoring

Eliminating Illicit Discharge: Implement procedures for ceasing the illicit discharge. Immediate cessation of the discharge is required. Procedures will include the following:

- Notification of appropriate authorities
- Notification of the property owner
- Technical assistance for removing the source of the discharge
- Follow-up inspections
- Enforcement and legal actions as appropriate

IDDE Education: Salt Lake County will include information regarding stormwater quality and illicit discharges in the education program identified in Section 4.0 of this SWMP.

Household Hazardous Waste Program: The County assists in distributing information to the public regarding proper disposal of household hazardous wastes. This program is administered by the Salt Lake County Health Department and the Salt Lake Valley Solid Waste Management Facility. The County helps to educate the general public regarding the requirements for disposing of household hazardous wastes by including this information in other educational materials (tabloid, activity book, etc.)

Public Reporting: In association with the public education program (Section 4.0), Salt Lake County will continue to provide information on public reporting of spills or other illicit discharges. Reports may be called into phone number (801) 313-6600. Calls can also be made to the State Department of Environmental Quality, to EPA or to 911. This information is included in the educational and informational materials, and is also available on the Coalition's website. Procedures for formal complaints are in place; Salt Lake County works in conjunction with the Salt Lake County Health Department to investigate the source of the pollution through a Memorandum of Understanding (Appendix D). Investigations and enforcement measures, including any fee penalties are documented by the County.

The Salt Lake County Health Department has written procedures for responding to public reports of spills or illegal dumping, including a flow chart that shows actions to be taken for responding to public complaints, the various responsible agencies and personnel who will be involved in a response. This chart will be maintained in the SWMP (Appendix D) and will

be updated as necessary.

6.1.5 PROGRAM EVALUATION AND ASSESSMENT

Objective: Conduct an assessment of the program to determine effectiveness and any necessary modifications in order to minimize illicit discharges.

Permit Requirement: Part 4.2.3. - Illicit Discharge Detection and Elimination

Description of Task: Salt Lake County currently maintains stormwater program documents on the computer network. The County will investigate the development of a database-type program to expand on the current method of documentation and record keeping. The County will include maintaining a database for mapping and tracking the number and type of spills or illicit discharges identified and inspections conducted.

6.1.6 ILLICIT DISCHARGE DETECTION AND ELIMINATION TRAINING

Objective: Provide employee training to minimize illicit discharges.

Permit Requirement: Part 4.2.3. - Illicit Discharge Detection and Elimination

Description of Task: Salt Lake County will provide annual employee training (including field workers) with regards to the IDDE program, including identification, investigation, termination, clean-up and reporting. Training will include office and field personnel.

6.2 GOALS AND ASSESSMENT

The table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Table 5 Illicit Discharge Detection & Elimination Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/14-12/18	Ordinance	• Implement Chapter 17.22	Document activities conducted	Engineering Dan Drumiler
1/14-12/18	Agency MOUs	• Develop MOU with SLCoHD by 9/14 • Implement MOU with SLCoHD	Document MOU development & implementation	Engineering Dan Drumiler

Year	Task	Goal	Assessment	Responsibility
1/14-12/18 8/14 1/14-12/18	Storm Drain System Maps	• Maintain storm drain system map by adding outfalls, pipe & BMPs as installed or discovered • Update catchment map to include changes in catchment areas • Update Land Use Map for unincorporated County as necessary	Update storm drain system map annually/ document Update catchment map/ document Update land use map/ document	Engineering Steve Burgon
12/14 1/14-12/18	IDDE Plan	• Complete update of plan • Screen all outfalls in unincorporated Salt Lake County once during the permit term	Document process Document findings of screening program, number of outfalls visited & number of outfalls with suspected conditions	Engineering Steve Burgon
1/15 - 12/18	Dry Weather Screening Priority Areas	• Identify priority areas • Screen 20%/year	Document procedure Conduct screening	Engineering Steve Burgon
9/14 - 12/18	Trace Illicit Discharge Sources	• Implement screening investigations to trace the source of an illicit discharge	Document investigation efforts	Engineering Steve Burgon SLCo HD
9/14 - 12/18	Characterize Illicit Discharges	• Implement procedures to characterize illicit discharges when found	Document investigation efforts	Engineering Steve Burgon SLCo HD
9/14 - 12/18	Eliminate Illicit Discharges	• Implement procedures for ceasing the illicit discharge	Document investigation efforts	Engineering Steve Burgon
1/14-12/18	Education	• Provide education regarding illicit discharges, household hazardous wastes	Document materials distributed & recipients,	Engineering Dan Drumiler
1/14 - 12/18	Public Reporting	• Provide public information, include contact information for public reporting • Develop flow chart for response to public reports	Document materials distributed & recipients Document development & implementation chart	Engineering Steve Burgon SLCo HD
1/14-12/18	Database	• Develop & maintain a database for program evaluation & assessment	Maintain tracking database & evaluate program	Engineering Steve Burgon

Year	Task	Goal	Assessment	Responsibility
1/14-12/18	Employee Training	• Provide annual employee training with regards to the IDDE program	Document training dates and attendees	Engineering Steve Burgon

7.0 CONSTRUCTION SITE STORMWATER RUNOFF CONTROL PROGRAM

The Construction Site Stormwater Runoff Control Program section of the SWMP addresses water quality concerns for construction sites greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development. Polluted stormwater runoff from construction sites often flows to storm drains and into receiving waters. This runoff can contribute more sediment to receiving waters than would otherwise naturally infiltrate into the ground, and can cause physical, chemical and biological harm to receiving waters. The BMPs described in this section of the SWMP includes a construction site program designed to reduce pollutants in stormwater runoff from construction site activities.

7.1 SUMMARY OF TASKS

This program will also be integrated with the Public Education and Outreach Program and the Long-term Stormwater Management Program to provide stormwater information and permit compliance information to the public, contractors and developers. The following BMPs describe implementation tasks and assessment tasks to be completed by Salt Lake County for the Construction Site Stormwater Runoff Control Program. Progress towards the measurable goals will be documented in the Annual Report.

7.1.1 CONSTRUCTION SITE STORMWATER RUNOFF CONTROL ORDINANCE

Objective: Reduce erosion, sediment transportation and other pollution caused by construction activities, and establish enforcement procedures to minimize the occurrence of violations.

Permit Requirement: Part 4.2.4.1. & 4.2.4.2. - Construction Site Stormwater Runoff Control

Description of Tasks: Implement Title 17, Chapter 17.22 Stormwater Quality Ordinance (Appendix C) which requires a Land Disturbance Permit for construction activities from Salt Lake County Public Works Department.

Ordinance: The Salt Lake County ordinance applies to sites affecting one or more acres of land, or less than one acre if it is a part of a larger common plan of development. These sites must obtain a Land Disturbance Permit prior to obtaining a Building Permit. The applicant for a Land Disturbance Permit must submit a Stormwater Pollution Prevention Plan (SWPPP), including a sediment and erosion control plan, as well as evidence of a General Permit for the Discharge of Stormwater Associated with Construction Site Activities issued by the Utah Division of Water Quality. The ordinance grants County personnel the authority to access the site for inspections of construction stormwater BMPs.

Enforcement SOP: Salt Lake County will implement the enforcement provisions of the ordinance and develop an SOP to establish enforcement procedures. Enforcement actions will be documented.

7.1.2 PRE-CONSTRUCTION REVIEWS

Objective: Reduce stormwater pollution by construction activities by conducting SWPPP reviews.

Permit Requirement: Part 4.2.4.3. - Construction Site Stormwater Runoff Control

Description of Tasks: Establish a SWPPP review process through the development of an SOP that includes encouraging LID methods and addresses priority areas.

Pre-construction Review SOP: Salt Lake County will develop an SOP that establishes a review process of SWPPPs, planned operations, planned BMPs during and following construction. This review will include consideration of potential water quality impacts and procedures for pre-construction review.

Checklist: Salt Lake County will develop a checklist for use during the pre-construction reviews to ensure stormwater quality issues are addressed and to ensure consistency of these reviews.

Low Impact Design: Salt Lake County will incorporate the use of low impact design and green infrastructure into the SWPPP review process.

Priority Sites: Salt Lake County identified priority construction sites based upon direct discharges to impaired waterbodies, areas with severe and very severe erosion potential and the FCOZ Canyons Overlay Zone (Appendix E). Additional oversight is required in these areas; inspections are conducted at the frequency noted in Section 7.1.3 below. The County will review and update this list as necessary.

7.1.3 CONSTRUCTION SITE INSPECTIONS & ENFORCEMENT

Objective: Reduce stormwater pollution by construction activities through inspections and enforcement actions.

Permit Requirement: Part 4.2.4.4. - Construction Site Stormwater Runoff Control

Description of Tasks: Develop an SOP to clearly define procedures to be implemented during inspections of construction sites and take enforcement actions as necessary.

Construction Site Inspection SOP: Salt Lake County will develop and implement a SOP that indicates who is responsible for site inspections. These procedures and regulatory authorities will be documented in this SWMP. Inspectors will utilize the DWQ Construction Stormwater Inspection Form (http://www.waterquality.utah.gov/UPDES/stormwatercon.htm and Appendix E). Qualified personnel will conduct site inspections on a monthly basis. All phases of construction will be inspected (prior to land disturbance, during active construction, and following active construction). The SOP will include a procedure for being notified by construction operators/owners of the completion of active construction so that

verification of final stabilization and removal of temporary BMPs can be conducted.

Inspections of priority construction sites as defined by the County (Appendix E) will be conducted at the frequency listed below, using the DWQ form.

- Once every two weeks during active construction
- Once a month if the site has been temporarily stabilized or runoff is unlikely due to winter conditions
- Within 24 hours of a storm event of 0.2 inches or greater
- Frequency may be reduced upon the judgment of the inspector that BMPs are well maintained and the site has a low probability of causing stormwater pollution

Records for construction projects will be maintained for five years, or until the project is complete, whichever is longer.

Construction Site Enforcement SOP: Salt Lake County will develop an SOP that indicates who is responsible for enforcement procedures and sanctions with regards to stormwater violations at construction sites. These procedures and regulatory authorities will be documented in this SWMP. Salt Lake County will take necessary follow-up actions to ensure compliance with Title 17, Chapter 17.22. Enforcement actions may include warnings, notices of violation, stop work orders and fines. All actions will be documented.

7.1.4 CONSTRUCTION SITE STORMWATER TRAINING

Objective: Provide training to personnel to minimize stormwater pollutants from construction sites.

Permit Requirement: Part 4.2.4.5. - Construction Site Stormwater Runoff Control

Description of Task: Salt Lake County will provide or make available annual training for personnel whose primary job duties are related to implementing the construction stormwater program. This training will be extended to third-party inspectors and plan reviewers as appropriate. Records of training will be maintained.

7.1.5 RECORDS KEEPING

Objective: Maintain records of construction sites in order to ensure permit compliance.

Permit Requirement: Part 4.2.4.6. - Construction Site Stormwater Runoff Control

Description of Task: The County is in the process of updating the computer tracking system to document all construction site stormwater information. Records for site plan reviews, SWPPPs, inspections and enforcement actions will be maintained. These records will be kept for at least five years or until construction is complete, whichever is longer.

7.2 GOALS AND ASSESSMENT

The table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Table 6 Construction Site Runoff Control Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/14-12/18 3/3/15-12/18	Ordinance	• Implement Title 17, Chapter 17.22 • Develop & implement enforcement SOP	Document & maintain records Document development & enforcement actions	PD&S Greg Baptist
3/3/15-12/18	Pre-construction Reviews	• Develop SOP for review process • Develop checklist for reviews • Incorporate LID design in reviews • Review priority list and update as necessary	Document development & maintain records Document development & maintain records Document use of LID methods Document procedure and revisions	PD&S Greg Baptist
3/3/15-12/18	Inspection & Enforcement	• Develop & implement SOPs for inspection & enforcement procedures • Conduct inspections at priority sites in accordance with the frequency identified • Take enforcement actions as necessary	Document development & conduct inspections Document Document enforcement actions	PD&S Greg Baptist
1/14–12/18	Training	• Provide annual training for personnel regarding construction site stormwater issues	Document training & attendees	PD&S Greg Baptist
1/14–12/18	Records Keeping	• Maintain records of construction sites	Assess compliance	PD&S Greg Baptist

8.0 LONG-TERM STORMWATER MANAGEMENT IN NEW DEVELOPMENT AND REDEVELOPMENT PROGRAM

The Long-term Stormwater Management in New Development and Redevelopment Program addresses the importance of stormwater runoff management following the completion of construction activities. This program applies to areas with land disturbances of greater than or equal to one acre and projects less than one acre that are part of a larger common plan of development or sale or areas known to have sensitive soils and watershed issues. Post-construction stormwater management in areas undergoing new development or redevelopment is necessary because runoff from these areas has been shown to significantly affect receiving waterbodies. There are two forms of impacts associated with post-construction runoff; one is caused by an increase of pollutants in stormwater runoff; the second type occurs by the increase in the quantity of stormwater. Prior planning and design for the minimization of pollutants in post-construction stormwater discharges is an effective approach to stormwater quality management. The BMPs described in this section include the development of structural and non-structural stormwater runoff strategies and the development of programs that consider water quality impacts of new development and redevelopment projects.

8.1 SUMMARY OF TASKS

This program will be integrated with the Construction Site Stormwater Runoff Control Program of the SWMP to provide information and up-to-date BMPs to the end user. The intent of the tasks described below is to mimic pre-development hydrology of a previously undeveloped site, or to improve the hydrology of a redeveloped site. The following BMPs describe implementation tasks and assessment tasks to be completed by Salt Lake County for this program. Progress towards the measurable goals will be documented in the Annual Report.

8.1.1 LONG-TERM STORMWATER MANAGEMENT ORDINANCE

Objective: Reduce the discharge of pollutants from areas of new development and redevelopment after construction is completed through implementation of an ordinance.

Permit Requirement: Part 4.2.5.1., 4.2.5.2. & 4.2.5.5.1. - Long-term Stormwater Management in New Development and Redevelopment

Description of Tasks: Implement Title 17, Chapter 17.22 Stormwater Quality Ordinance which establishes requirements for post-construction stormwater management.

Ordinance: The Salt Lake County ordinance sets requirements for new development and redevelopment with the intent to minimize impacts to stormwater quantity and quality. These requirements include submittal of as-built plans, proper landscaping and stabilization, site access for inspections, and enforcement actions against violations.

Enforcement Strategy: Implement enforcement policies under Title 17, Chapter 17.22. This strategy will include specific processes and sanctions with the intent to minimize the discharge of stormwater pollutants. Maintain the following records with regards to how this

ordinance provides protection of stormwater quality:

- How long-term BMPs were selected
- Pollutant removal expected from the selected BMPs
- Technical basis which supports the performance claims for selected BMPs

8.1.2 IMPLEMENT LONG-TERM STORMWATER BMPs

Objective: Reduce the discharge of pollutants from areas of new development and redevelopment following construction activities through implementation of non-structural and structural BMPs.

Permit Requirement: Part 4.2.5.3. - Long-term Stormwater Management in New Development and Redevelopment

Description of Tasks: Require implementation of BMPs for the purpose of minimizing impacts to stormwater quality.

Non-structural BMPs: Salt Lake County will implement non-structural BMPs as part of the review process for the Land Disturbance Permit. Examples of non-structural BMPs include the following:

- Minimize development in areas susceptible to erosion and sediment loss
- Minimize the disturbance of native soils and vegetation
- Preserve areas that provide important water quality benefits
- Implement measures for flood control
- Protect the integrity of natural resources and sensitive areas

Encourage Low Impact Design: Salt Lake County will encourage the use of low impact design (LID) when reviewing projects for the Land Disturbance Permit. Examples of the LID approach include rain gardens, permeable pavement and vegetated swales. These systems will be reviewed for proper design in winter climates.

Retrofit Plan: Salt Lake County will develop a plan to retrofit existing developed sites that are adversely impacting water quality. This plan will emphasize controls that infiltrate, evapotranspire or harvest and use stormwater discharges. The plan will include a ranking of control measures to determine those best suited for retrofitting. The plan will include the following criteria:

- Proximity to waterbody
- Status of waterbody (e.g. impaired, high quality)
- Hydrologic condition of the receiving waterbody
- Proximity to sensitive ecosystem or protected area
- Other sites that could benefit from stormwater retrofitting

Calculating Runoff Volumes: Salt Lake County will develop specific hydrologic methods for calculating runoff volumes and flow rates to ensure consistent sizing of structural BMPs. This method will be utilized when conducting plan reviews and documented in the SWMP (Appendix F).

8.1.3 SITE PLAN REVIEW PROCEDURES

Objective: Ensure post-construction BMPs are part of the review process for construction sites in order to minimize impacts to stormwater quality.

Permit Requirement: Part 4.2.5.4.1., 4.2.5.4.2. & 4.2.5.4.3. - Long-term Stormwater Management in New Development and Redevelopment
Part 4.2.4.3.1 – Construction Site Stormwater Runoff Control

Description of Tasks: Require implementation of post-construction BMPs during review phase of construction projects that meet the criteria for the Land Disturbance Permit.

Long-term BMP Plan Review: Salt Lake County will require implementation of long-term BMPs when reviewing construction SWPPPs. This will include proposed long-term BMP maintenance plans.

Preferred Design Specifications: Salt Lake County will develop and provide developers and contractors with preferred design specifications for stormwater controls for different development types (e.g. industrial parks, commercial strip malls, gasoline outlets, etc.), including projects near environmentally sensitive areas (Appendix F). Salt Lake County will maintain a record of distribution of the design specifications.

8.1.4 LONG-TERM STORMWATER MANAGEMENT INSPECTIONS AND ENFORCEMENT

Objective: Ensure adequate ongoing long-term operation and maintenance of stormwater control measures.

Permit Requirement: Part 4.2.5.5.1., 4.2.5.5.2. & 4.2.5.5.3. - Long-term Stormwater Management in New Development and Redevelopment

Description of Tasks: Develop an SOP for site inspection and enforcement of post-construction BMPs.

Long-term Stormwater Management Inspection and Enforcement SOPs: Salt Lake County will develop SOPs that establish procedures to be implemented when inspecting BMPs and enforcing the stormwater quality ordinance (Title 17, Chapter 17.22). The SOPs will establish procedures for inspections, including those on private property to ensure proper BMP operation, and for enforcement of long-term BMP implementation and operation. County personnel will inspect and maintain BMPs or enter into an agreement with the owner/operator or third parties. In this case, the County will require a maintenance agreement as specified in the permit and submittal of annual certifications that adequate

maintenance has been performed and the BMPs are operating properly.

Permanent structural BMPs will be inspected at least once during installation; inspections and maintenance will be conducted on an annual basis thereafter. Salt Lake County personnel will inspect the BMPs at least once every five years on sites where the owner/operator or third party is conducting the maintenance. The following inspection documentation will be maintained:

- Inspection date
- Name and signature of inspector
- Project location
- Current ownership information
- A description of the condition of the BMP including the quality of: vegetation and soils; inlet and outlet channels and structures; catch basins and other control structures; sediment and debris accumulation
- Specific maintenance issues or violations that require correction with deadlines and reinspection dates

8.1.5 LONG-TERM STORMWATER BMP EMPLOYEE TRAINING

Objective: Training for employees regarding long-term stormwater management BMPs will serve to minimize impacts to stormwater quality following construction activities.

Permit Requirement: Part 4.2.5.6. - Long-term Stormwater Management in New Development and Redevelopment

Description of Task: Salt Lake County will provide annual training for personnel with regards to stormwater management, plan reviews, inspections and enforcement. Training records will be maintained.

8.1.6 LONG-TERM STORMWATER BMP INVENTORY

Objective: Maintaining a BMP inventory will provide the County with information necessary in the implementation of this stormwater management program.

Permit Requirement: Part 4.2.5.7. - Long-term Stormwater Management in New Development and Redevelopment

Description of Task: Salt Lake County will maintain a long-term stormwater BMP inventory for all sites of new development and redevelopment of the applicable size and will update this inventory when changes occur in property ownership or BMPs (Appendix F). The inventory will include the following information:

- Project name
- Owner name and contact information
- Location

- Start and end date
- Description of each BMP including design or performance specifications
- Description of maintenance requirements
- Inspection information and follow-up activities

8.2 GOALS AND ASSESSMENT

The table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Table 7 Long-term Stormwater Management Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/14 – 12/18 3/3/15 - 12/18	Ordinance	• Implement Title 17.22 • Develop & implement enforcement strategy	Document activities relating to implementation of the ordinance Document development & implementation of enforcement strategy	Engineering Dan Drumiler PD&S Greg Baptist
3/3/15 - 12/18	Long-term Stormwater BMPs	• Require non-structural BMPs • Encourage use of LID methods • Develop retrofit plan • Establish hydrologic method for BMP sizing	Document implementation of BMPs Document implementation of LID methods Document development & implementation of plan Document development of hydrologic sizing method	Engineering Dan Drumiler Andrea Pullos PD&S Greg Baptist
3/3/15 - 12/18	Site Plan Review Procedures	• Conduct review of long-term BMP maintenance plans • Develop preferred design specifications & maintain record of distribution	Document reviews Document materials distributed	Engineering Andrea Pullos PD&S Greg Baptist
3/3/15 - 12/18	Long-term Stormwater Management	• Develop SOPs for inspections & enforcement	Document development & implementation of SOPs	Engineering Dan Drumiler Flood Control Rich Judson Operations Kevin Smeltzer

Year	Task	Goal	Assessment	Responsibility
3/3/15 - 12/18	Long-term Stormwater Training	• Provide annual training	Document training	Engineering Dan Drumiler PD&S Greg Baptist Operations Kevin Smeltzer
3/3/15 - 12/18	Long-term Stormwater Inventory	• Develop & maintain inventory	Document development of inventory Update as necessary	Engineering Dan Drumiler Kade Moncur Flood Control Rich Judson PD&S Greg Baptist Operations Kevin Smeltzer

9.0 POLLUTION PREVENTION & GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS

The Pollution Prevention & Good Housekeeping Program of the Stormwater Management Plan addresses routine activities in the operation and maintenance of drainage systems, roadways, parks and open spaces, and other municipal operations to help ensure a reduction in pollutants entering the storm drain system. This Program includes the development of SOPs for implementation at municipal facilities, inventories of facilities and floor drains, training, inspections and visual monitoring requirements.

9.1 SUMMARY OF TASKS

This program will also be integrated with the Illicit Discharge Detection and Elimination Program to promote awareness of water quality concerns in performing routine roadway maintenance and operation and other practices. The following BMPs describe implementation tasks and assessment tasks to be completed by Salt Lake County for the Pollution Prevention/Good Housekeeping Program. Progress towards the measurable goals will be documented in the Annual Report.

9.1.1 MUNICIPAL MAINTENANCE

Objective: Conduct routine maintenance of the storm drain system and roads in a manner that minimizes stormwater pollution.

Permit Requirement: N/A

Description of Tasks: Continue routine maintenance of municipal facilities and document activities.

Storm Drain System Maintenance: Salt Lake County Public Works will continue routine maintenance of the storm drain system, including cleaning and repair. Catch basins are cleaned at least once a year. All activities will be documented and the amount of material collected and disposed of will be noted.

Detention/Retention Basin Inspections: Salt Lake County Public Works will continue conducting inspections of detention and retention basins approximately every 3 months and following major storm events. Maintenance will be conducted as necessary. Records will be maintained.

Street Sweeping: Salt Lake County Public Works will continue routine street sweeping at least three times a year. Activities will be documented including the amount of material collected.

Title 17 Flood Control Facilities: Salt Lake County Flood Control will continue routine maintenance of flood control facilities that includes vegetation removal and dredging of creeks, canals and debris basins. Vegetation removal is conducted on an as-needed basis;

dredging is conducted on an annual basis.

Midvale SWPPP: The Salt Lake County Midvale Public Works Facility will continue to implement the SWPPP developed for this site. The SWPPP will be updated as necessary. All stormwater activities conducted at this site will be documented.

9.1.2 FACILITY INVENTORY

Objective: Maintenance of a County facility inventory will serve to minimize the discharge of stormwater pollutants by addressing the stormwater issues at the facilities identified.

Permit Requirement: Part 4.2.6.1. & 4.2.6.2. - Pollution Prevention & Good Housekeeping for Municipal Operations

Description of Task: Develop and keep current an inventory of municipal facilities and stormwater controls at these facilities. This inventory will include the types of facilities identified in Section 4.2.6.1 of the permit. This inventory will include a review of the materials kept on-site, the potential to discharge stormwater pollutants and on-site stormwater controls for these materials/activities. The inventory will be reviewed and updated on an annual basis. The inventory/assessment process will be documented; the process and inventory will be maintained in this SWMP (Appendix G).

9.1.3 HIGH-PRIORITY FACILITY IDENTIFICATION & SOPS

Objective: Identification of high-priority facilities with the intent to implement procedures to reduce the discharge of stormwater pollutants at these facilities will serve to minimize stormwater pollutant discharges.

Permit Requirement: Part 4.2.6.3., 4.2.6.4. & 4.2.6.5. - Pollution Prevention & Good Housekeeping for Municipal Operations

Description of Tasks: Salt Lake County Department of Engineering and Flood Control will identify high-priority facilities whose potential for discharge of stormwater pollutants warrants additional procedures or measures to reduce or eliminate impacts to stormwater quality.

Identify High-priority Facilities: Facilities identified with the potential to generate stormwater pollutants will be identified as “high priority” facilities. Consideration will be given to the amount of materials stored at each site, improperly stored materials, activities that occur outside, proximity to waterbodies, poor housekeeping practices and the discharge of pollutants to impaired waters.

High-priority Facility-specific SOPs: Facility-specific SOPs and operation and maintenance procedures will be developed for those facilities identified as high-priority facilities. The SOPs will include BMPs with the intent to reduce the discharge of stormwater pollutants and will include consideration for implementing low impact design techniques. High-priority facility SOPs will be developed for the following facilities or activities:

- Buildings and Facilities – SOPs will be developed and implemented for those high-priority buildings and facilities that include buildings, pools, parking garages, utilities, etc. The SOPs will address the use, storage and disposal of chemicals and include employee training. Spill prevention control and countermeasure plans (SPCC) will be developed and maintained as necessary. SOPs will address dumpsters and other waste management including cleaning, washing, painting and other maintenance activities. SOPs will also include schedules and procedures for sweeping parking lots. An inventory of all floor drains inside these buildings/facilities and where these drain to, will be developed and kept current. An inventory, including a map, of all storm drains located at these buildings/facilities will be developed and kept current. The County will ensure that these drains only convey stormwater and will remove any non-stormwater discharges if identified. Appropriate stormwater BMPs will be implemented in these buildings/facilities.

- Material Storage, Heavy Equipment Storage and Maintenance Areas – SOPs will be developed and implemented at these facilities to protect water quality.

- Parks and Open Space – SOPs will be developed to include the proper application, storage and disposal of fertilizers, pesticides and herbicides, sediment and erosion control, lawn maintenance and landscaping activities. The management of trash containers at parks and open spaces with be included, as well as signage for pet waste. The SOPs will also address proper cleaning of maintenance equipment, building exterior, trash containers and the disposal of the associated waste and wastewater.

- Vehicle and Equipment – SOPs will be developed and implemented that addresses vehicle maintenance and repair activities. Fueling and wash areas will be included and appropriate BMPs will be implemented, including providing cover, drip pans, indoor storage, etc.

- Roads, Highways and Parking Lots – SOPs will be developed and implemented for street and parking lot sweeping, procedures for removal of trash and debris from these areas, road and parking lot maintenance, cold weather operations, right-of-way maintenance, and municipally-sponsored events. Appropriate stormwater BMPs will be implemented.

- Stormwater Collection and Conveyance System – SOPs will be developed and implemented to address inspections, cleaning and repair of the stormwater system including catch basins, pipes, ditches and canals, culverts and structural BMPs. Schedules for these activities will be included in the SOPs. Structural BMPs will be inspected on an annual basis. More frequent inspections and maintenance will occur in those areas deemed as higher priority based on water quality concerns and the amount and type of material that typically accumulates in an area. Proper disposal of waste and wastewater removed during storm drain maintenance is currently implemented at the Midvale Operations Facility. This facility currently implements a Stormwater Pollution Prevention Plan (SWPPP) and a SPCC plan to minimize the discharge of stormwater

pollutants.

- Other Facilities and Operations – SOPs for other facilities not listed above that may be identified as high-priority will be developed and implemented to protect water quality.

9.1.4 THIRD-PARTY MAINTENANCE

Objective: Ensure BMPs under third-party maintenance agreements are operated properly.

Permit Requirement: Part 4.2.6.5. – Pollution Prevention & Good Housekeeping for Municipal Operations

Description of Task: If the County contracts with a third-party for municipal maintenance or for private developments, the County will require contracts to ensure compliance with the UPDES permit and this SWMP. The County will require proper documentation or conduct site visits to ensure stormwater BMPs are maintained appropriately.

9.1.5 HIGH PRIORITY FACILITY OPERATION AND MAINTENANCE INSPECTION PROGRAM

Objective: Implementation of a high priority facility operation and maintenance (O&M) program will serve to minimize the discharge of stormwater pollutants.

Permit Requirement: Part 4.2.6.6. - Pollution Prevention & Good Housekeeping for Municipal Operations

Description of Tasks: Salt Lake County Department of Engineering and Flood Control will conduct routine inspections of high-priority facilities and activities, including visual inspections of the sites and stormwater discharges, and comprehensive inspections of BMPs.

Weekly Visual Inspections: Weekly visual inspections of high-priority facilities will be conducted as part of the SOPs and will include stormwater BMPs, evidence of spills, etc. Records of these inspections will be maintained in this SWMP.

Quarterly Comprehensive Inspections: Comprehensive inspections will be conducted as part of the SOPs on a quarterly basis at the high-priority facilities. These inspections will include stormwater controls for waste storage areas, dumpsters, vehicle and equipment maintenance/fueling areas, material handling areas, etc. Any deficiencies identified will be corrected and documented in the inspection report. Records of these inspections will be maintained in this SWMP.

Quarterly Visual Observation of Stormwater Discharges: Quarterly visual observations of the quality of stormwater discharges will be conducted during the wet season at the high-priority facilities as part of the SOPs. Observations will be conducted and will be documented. Efforts will be made to remedy any observed problems as appropriate. Reports of these observations will be maintained in this SWMP.

9.1.6 WATER QUALITY ASSESSMENT OF FLOOD CONTROL PROJECTS

Objective: To minimize the impacts to water quality and hydrology through the review process of new flood management structural controls.

Permit Requirement: Part 4.2.6.7. - Pollution Prevention & Good Housekeeping for Municipal Operations

Description of Task: Develop and implement a process that considers potential impacts to water quality and hydrology when evaluating new flood control projects. Consideration will be given to implementation of stormwater BMPs to meet the objectives of this task. This process will be developed and maintained in Appendix G of this SWMP.

9.1.7 COUNTY CONSTRUCTION PROJECTS

Objective: To ensure public construction projects comply with state stormwater regulations to minimize impacts to stormwater quality due to construction activities.

Permit Requirement: Part 4.2.6.8. - Pollution Prevention & Good Housekeeping for Municipal Operations

Description of Task: Salt Lake County Department of Engineering and Flood Control will ensure that all County construction projects meeting the criteria for the UPDES Stormwater General Permit for Construction Activities will obtain and comply with said permit.

9.1.8 EMPLOYEE TRAINING

Objective: Provide training to County employees with regards to stormwater for the purpose of minimizing impacts to stormwater quality.

Permit Requirement: Part 4.2.6.9. - Pollution Prevention & Good Housekeeping for Municipal Operations

Description of Task: Salt Lake County Department of Engineering and Flood Control will provide annual training on protecting water quality, permit requirements, operation and maintenance requirements, inspection procedures and ways to prevent or minimize impacts to stormwater quality, SOPs for County facilities and procedures for reporting stormwater problems and illicit discharges.

9.2 GOALS AND ASSESSMENT

The table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the scheduled identified.

Table 8 Pollution Prevention/Good Housekeeping Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/14 - 12/18	Storm Drain Maintenance	• Conduct routine maintenance	Document activities & material removed	Operations- Kevin Smeltzer
1/14 - 12/18	Detention/ Retention Basin Inspections	• Conduct inspections following storm events	Document inspections and follow-up activities	Operations- Kevin Smeltzer
1/14 - 12/18	Street Sweeping	• Conduct routine street sweeping	Document activities & material removed	Operations- Kevin Smeltzer
1/14 - 12/18	Title 17 Flood Control Facilities Maintenance	• Conduct routine maintenance	Document activities	Flood Control Rich Judson
1/14 - 12/18	Midvale SWPPP	• Implement	Document activities Update as necessary	Operations- Kevin Smeltzer
12/14 - 12/18	Facility Inventory	• Develop inventory of County facilities	Document process & results	Engineering- Steve Burgon
12/14 - 12/18	High-Priority Facilities & SOPs	• Prioritize facilities • Develop floor drain inventory • Develop storm drain map • Develop SOPs • Third party maintenance agreements	Document process Develop inventory Develop & update map Develop & implement Develop & document	Engineering- Steve Burgon Operations- Kevin Smeltzer Parks & Recreation- Wayne Johnson Facilities- Wayne Marion
1/15 - 12/18	High-Priority Operation & Maintenance Inspection Program	• Conduct weekly visual inspections • Conduct quarterly comprehensive inspections • Conduct quarterly visual observations	Document results Document results Document results	Engineering Steve Burgon Operations Kevin Smeltzer Parks & Recreation Wayne Johnson Facilities Wayne Marion
1/15 - 12/18	Third-party Maintenance Agreements	• Conduct site inspections • Document	Document activities & findings	Operations- Kevin Smeltzer

7/15 - 12/18	Water Quality Assessment of Flood Control Projects	• Include stormwater quality issues in review of flood control projects	Develop & document	Engineering Dan Drumiler Steve Burgon
1/14 - 12/18	County Construction Projects	• Ensure compliance with UPDES Construction Site Permit	Document process & projects	Engineering Dan Drumiler Steve Burgon
1/14 - 12/18	Employee Training	• Provide annual training	Document training, attendees, topics	Engineering Dan Drumiler Steve Burgon PD&S Greg Baptist Operations Kevin Smeltzer

10.0 INDUSTRIAL AND HIGH RISK RUNOFF

The Industrial and High Risk Runoff Program addresses the need to develop and implement an inspection and oversight program to monitor and control the discharge of stormwater pollutants to the County's storm drain system from industrial and commercial facilities. The BMPs described in this section of the SWMP include development of an inventory, implementation of appropriate BMPs, routine inspections and staff training.

10.1 SUMMARY OF TASKS

The Industrial and High Risk Runoff Program will also be integrated with the Illicit Discharge Detection and Elimination Program to reduce the impacts from industrial discharges on stormwater quality. The following BMPs describe implementation tasks and assessment tasks to be completed by Salt Lake County for the Industrial and High Risk Runoff Program. Progress towards the measurable goals will be documented in the Annual Report.

10.1.1 FACILITY INVENTORY

Objective: Update the inventory of industrial facilities and include commercial facilities to evaluate potential for the discharge of pollutants into the storm drain system.

Permit Requirements: Part 4.3.1. - Industrial and High Risk Runoff

Description of Task: Salt Lake County Engineering and Flood Control will update and maintain an inventory of all industrial and commercial facilities that are connected to the County's storm drain system. This inventory will include the following information:

- Name
- Address
- Physical location of the storm drain receiving discharge
- Name of receiving water
- Pollutants potentially generated by the site/source
- Identification of whether the site/source is discharging to an impaired waterbody, and whether there is the potential to discharge pollutants for which the waterbody is impaired.
- A narrative description including the Standard Industrial Classification (SIC) codes which best reflects the principal products, services or activities by each facility (see http://www.naics.org/)

This inventory will include at a minimum the sites/sources listed in Part 4.3.1.2., 4.3.1.3. and 4.3.1.4. of the permit. This includes facilities that discharge stormwater pollutants to an impaired waterbody that may contribute to the impairment and those facilities that have a history of past water quality problems. This inventory will be updated on an annual basis.

10.1.2 INDUSTRIAL FACILITY STORMWATER CONTROL MEASURES

Objective: To ensure that minimum control measures are implemented at these facilities to

minimize the discharge of stormwater pollutants.

Permit Requirements: Part 4.3.2. - Industrial and High Risk Runoff

Description of Task: Salt Lake County will require the facilities identified in the inventory to implement and maintain the stormwater control measures. Salt Lake County will notify owner/operators of the facilities identified in the inventory of the required minimum stormwater control measures. The owner/operators will be required to select, install, implement and maintain stormwater BMPs. Additional stormwater BMPs may be required for facilities that discharge to impaired waterbodies.

10.1.3 INDUSTRIAL AND HIGH RISK FACILITY PRIORITIZATION

Objective: Identifying high priority facilities will serve to minimize the discharge of stormwater pollutants from activities associated with these facilities. More frequent inspections will be conducted at these facilities to ensure BMPs are properly maintained.

Permit Requirements: Part 4.3.3. - Industrial and High Risk Runoff

Description of Tasks: Salt Lake County will identify high priority facilities based upon the potential for water quality, including pollutants of concern, proximity to a waterbody, violation history. The program will prioritize facilities into high, medium and low categories. This prioritization process will be developed and maintained in this SWMP (Appendix H).

10.1.4 INDUSTRIAL AND COMMERCIAL FACILITY INSPECTIONS

Objective: Conducting inspections will serve to ensure BMPs are properly maintained in order to reduce the discharge of stormwater pollutants associated with these facilities.

Permit Requirements: Part 4.3.4. - Industrial and High Risk Runoff

Description of Tasks: Salt Lake County will develop and implement an inspection program for the facilities identified in the inventory. Inspections will be conducted at least once during the permit term, with more frequent inspections conducted on the high priority facilities. Inspection of these facilities will include the following:

- Evaluation of the facility's stormwater management program, including appropriate BMP selection, installation and maintenance.
- Visual observation for evidence of unauthorized discharges, illicit connections and the potential to discharge stormwater pollutants.
- Determine whether the facility has or should be covered under the UPDES General Multi-Sector Industrial Stormwater Permit.

An inspection form will be developed for the purpose of these inspections and will include the items listed below. Inspections will be tracked to ensure they are conducted at the proper frequency and to identify problem areas.

- Inspection date and time
- Name and signature of inspector(s)
- Weather information and a description of any discharges during the inspection
- Any previously unidentified discharges from the site
- Any control measures needing maintenance or repairs
- Any failed control measures that need replacement
- Any incidents of non-compliance observed
- Any additional control measures needed to comply with the permit

10.1.5 INDUSTRIAL AND COMMERCIAL FACILITY ENFORCEMENT

Objective: Conduct enforcement actions as necessary to maintain compliance with the UPDES permit.

Permit Requirements: Part 4.3.5. - Industrial and High Risk Runoff

Description of Task: Salt Lake County will conduct enforcement actions as necessary to require implementation and maintenance of stormwater BMPs and to minimize the discharge of stormwater pollutants from these facilities. Salt Lake County will maintain documentation of enforcement actions.

10.1.6 STAFF TRAINING

Objective: Provide training to ensure effective inspections are conducted and appropriate enforcement actions taken.

Permit Requirements: Part 4.3.6. - Industrial and High Risk Runoff

Description of Task: Salt Lake County will provide training opportunities for staff responsible for conducting industrial facility inspections. The training will include the permit, stormwater BMPs, the Multi-Sector Industrial Stormwater Permit, inspection and enforcement protocol and documentation. Training will be conducted on an annual basis.

10.2 GOALS AND ASSESSMENT

The table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Table 9 Industrial/High Risk Runoff Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/15 - 12/18	Facility Inventory	• Update & maintain an inventory	Document the facilities	Engineering Steve Burgon PD&S
7/16 - 12/18	Facility Notification	• Notify facilities of minimum stormwater control measures	Document notifications & any actions taken	Engineering Steve Burgon SLCo HD
7/15 - 12/18	Facility Prioritizing	• Prioritize high risk facilities	Document prioritization process	Engineering Dan Drumiler Steve Burgon
1/16 - 12/18	Facility Inspections	• Develop & implement inspection program • Develop inspection form • Conduct inspections	Document development of program, including inspection form Document inspections	Engineering Steve Burgon PD&S Steve Szemerey SLCo HD
1/16 - 12/18	Facility Enforcement	• Take enforcement actions	Document enforcement actions	PD&S Steve Szemerey SLCo HD
1/16 - 12/18	Employee Training	• Provide annual training	Document training & attendees	Engineering Steve Burgon SLCo HD

11.0 MONITORING, RECORDKEEPING AND REPORTING

Stormwater monitoring, program recordkeeping and reporting is required under the UPDES permit, Part 5.0. Stormwater monitoring is an important component in an assessment of stormwater quality and the effectiveness of a stormwater management plan. Monitoring and tracking progress towards measurable goals provides the opportunity to evaluate the stormwater management plan and make modifications as necessary. This enables the County to comply with the permit terms and will serve to protect water quality in the watershed.

11.1 SUMMARY OF TASKS

Wet and dry weather monitoring will be conducted as part of the stormwater program to evaluate trends in stormwater quality and to identify illegal discharges. In addition, this section describes DWQ recordkeeping and reporting requirements. This section will be integrated with the rest of the SWMP to ensure proper record keeping and reporting requirements are maintained. The following BMPs describe implementation tasks and assessment tasks to be completed by Salt Lake County. Progress towards the measurable goals will be documented in the Annual Report.

11.1.1 MONITORING

Objective: Conduct wet weather monitoring to assess potential stormwater impacts. An estimate of annual pollutant loadings and event mean concentrations may serve to identify problem areas, and water quality improvements or degradation. Conduct dry weather screening to detect and eliminate illicit discharges to the storm drain system. Conduct annual employee training with regards to sampling and screening.

Permit Requirements: Part 5.2. – Monitoring, Recordkeeping and Reporting

Description of Tasks: Continue wet weather monitoring and dry weather screening in accordance with the Sampling Plan for Representative Storm Monitoring and the IDDE Plan (Appendix III of the permit). Provide employee training.

Representative Storm Sampling: Salt Lake County has implemented a stormwater sampling program in accordance with the UPDES permit since 1992. Representative storm sampling is conducted in accordance with the Sampling Plan for Representative Storm Monitoring, which includes criteria for representative storms. Sampling is currently conducted at four locations representing various land uses. The intent is to evaluate trends in stormwater quality and modify the SWMP accordingly. Annual pollutant loadings and event mean concentrations are calculated using the sample data. The raw data and estimates are provided in the Annual Reports.

Sampling is conducted twice/year, during the spring and fall. Weather data is maintained for use in tracking storms, and is compiled and submitted with the Annual Reports. Modifications to this sampling plan will be submitted to DWQ for approval.

In accordance with direction from EPA and DWQ, SLCo is in the process of relocating the sampling stations. Identifying new station locations will require an analysis of land use and catchment basins in order to determine which land uses need to be represented. This process will be initiated in 2014 with assistance from DWQ. Once the new locations are established, the Representative Storm Sampling Plan will be revised. The County intends to establish new stations and revise the plan by the fall 2014 sample season.

Dry Weather Screening: Continue to conduct the dry weather screening in accordance with the screening plan. Dry weather screening is a task described under the Illicit Discharge Detection and Elimination Program (Section 6.1.3). Modifications to this screening plan will be submitted to DWQ for approval.

Employee Training: Salt Lake County will provide annual training for staff responsible for conducting representative sampling and dry weather screening. Training will include proper completion of Chain-of-Custody forms.

11.1.2 RECORDKEEPING

Objective: Recordkeeping is an important component of this SWMP and will serve to assess the permit compliance as well as meeting the goals and objectives of this plan.

Permit Requirements: Part 5.5 – Monitoring, Recordkeeping and Reporting

Description of Task: The County currently maintains stormwater program documents in an electronic format to comply with the permit requirement. This will also be used to conduct planning, set priorities and evaluate permit compliance. Salt Lake County will maintain records of all activities associated with implementation of this SWMP for at least five years. Supplementary documents to the permit will be kept current; any modifications will be submitted to DWQ in accordance with the permit (supplementary documents are the appendices to the permit).

The Co-permittee Identification and Accountability statement will be kept current during the term of this permit.

11.1.3 REPORTING

Objective: Provide reports on activities conducted during the past year and prior years to determine permit compliance and success in meeting the goals of the SWMP. Revise SWMP as necessary.

Permit Requirements: Part 5.6 – Monitoring, Recordkeeping and Reporting

Description of Tasks: Develop an annual report that describes the past year's activities, a description of SWMP effectiveness and planned activities and changes. Conduct a fiscal analysis of program to ensure adequate funding to implement this plan. Conduct a review of wet weather monitoring over five years to evaluate any trends in stormwater quality. Update and

submit a SWMP to DWQ in accordance with the time frame established in the permit.

Annual Report: Salt Lake County will submit an annual report to DWQ by October 1 of each year using the DWQ Annual Report Form (Appendix I). This report will summarize stormwater activities conducted during the past year and will include results from the wet and dry weather monitoring. This report will be signed in accordance with Part 6.8 of the permit.

Annual Fiscal Analysis: Salt Lake County will conduct an annual analysis of the capital and operation and maintenance expenditures needed, allocated and spent, as well as the necessary staff resources needed and allocated to meet the permit requirements. This will be included in the Annual Reports.

Technical Water Quality Report: Salt Lake County will submit a technical stormwater quality report every five years, providing a five-year summary of wet weather monitoring data. The report will attempt to assess trends in stormwater quality.

SWMP Update, Review and Modifications: The 2008 SWMP is currently posted on the Salt Lake County website to solicit comments during the SWMP update. The revised SWMP will be posted on this website and submitted to DWQ in August of 2014. The County will conduct an annual review of the SWMP to assess program implementation and permit compliance. In addition, the stormwater monitoring data will be evaluated to identify any drainage basins that may require additional controls. Any modifications to this plan will be submitted to DWQ in accordance with Part 4.5 of the permit.

Goals and Assessment: The table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Table 10 Stormwater Monitoring & Reporting Program Goals and Assessment

Year	Task	Goal	Assessment	Responsibility
1/14 - 12/18	Wet weather monitoring	• Conduct representative storm sampling	Document results, calculate loads & EMC	Engineering Steve Burgon
9/14 9/14	Wet weather monitoring	• Relocate sample stations • Revise Representative Sampling Plan	Document landuse & catchment basin analysis Document sample station location process Submit revised plan to DWQ	Engineering Steve Burgon Dan Drumiler
1/14 - 12/18	Wet weather monitoring	• Submit plan modifications to DWQ for approval	Document modification rationale & response from DWQ	Engineering Steve Burgon
1/14 - 12/18	Dry weather screening	• Conduct dry weather screening	Document results & follow-up actions	Engineering Steve Burgon

Year	Task	Goal	Assessment	Responsibility
6/14	Dry weather screening	• Update Dry Weather Screening Plan	Submit revised Dry Weather Screening Plan to DWQ	Engineering Steve Burgon
6/1 4 - 12/18	Dry weather screening	• Submit plan modifications to DWQ for approval	Document modification rationale & response from DWQ	Engineering Steve Burgon
1/14 - 12/18	Employee training	• Provide annual training for stormwater monitoring, including COC form	Document training & attendees	Engineering Steve Burgon
1/14 – 12/18	Documentatio n process	• Maintain documentation process for all stormwater program documents	Maintain records	Engineering Steve Burgon
2/14 - 12/18	Co-permittee Identification & Accountability	• Keep current	Document	Engineering Steve Burgon Dan Drumiler
1/14 - 12/18	Annual Report	• Compile & submit an annual report of the year's activities and monitoring results	Submit reports to DWQ	Engineering Steve Burgon Dan Drumiler
1/14 - 12/18	Fiscal analysis	• Conduct a fiscal analysis of program	Assess program Submit to DWQ w/ Annual Report	Engineering Dan Drumiler
5/14	5-year monitoring summary	• Compile & submit a 5-year stormwater quality report	Assess any trends	Engineering Steve Burgon Dan Drumiler
9/14 1/14 - 12/18 1/14 - 12/18	SWMP	• Update SWMP • Annual review of program implementation • SWMP modifications	Submit to DWQ Include in Annual Report Submit to DWQ	Engineering Steve Burgon Dan Drumiler

APPENDIX A

SWMP MODIFICATIONS

APPENDIX B

SALT LAKE COUNTY GUIDANCE DOCUMENT FOR STORMWATER MANAGEMENT

APPENDIX B

SALT LAKE COUNTY GUIDANCE DOCUMENT FOR STORMWATER MANAGEMENT

Refer to CD for Guidance Document

APPENDIX C

SLCO ORDINANCES
Title 17, Chapter 17.22
SLCo HD #13 & #14
UAC R317-1.9

APPENDIX D

ILLICIT DETECTION & ELIMINATION PROGRAM

IDDE Plan w/ Dry Weather Screening Plan

Public Reporting Procedures Flow Chart

Salt Lake County Health Department MOU

IDDE Plan

In process

Salt Lake County Health Department MOU

In process

APPENDIX E

CONSTRUCTION SITE STORMWATER RUNOFF CONTROL PROGRAM

Priority Site Identification
Plan Review SOP & Checklist
DWQ Construction Stormwater Inspection Form
Construction Site Inspection SOP
Construction Site Enforcement SOP

Plan Review SOP & Checklist

In process

Construction Site Enforcement SOP

In process

APPENDIX F

LONG-TERM STORMWATER MANAGEMENT PROGRAM

Design Specifications
Inspection SOP
Enforcement SOP
BMP Inventory
3rd Party Maintenance Agreement

Design Specifications

In Process

Long-term Stormwater Management Inspection SOP

To be developed

Long-term Stormwater Management Enforcement SOP

To be developed

APPENDIX G

MUNICIPAL STORMWATER PROGRAM

Municipal Facility Inventory
Municipal Facility Assessment
Municipal Facility Prioritization
High Priority Facility SOPs
Floor Drain Inventory (High Priority Buildings & Facilities)
Storm Drain Map (High Priority Buildings & Facilities)
Weekly Visual Inspection Report Form
Quarterly Comprehensive Inspection Report Form
Quarterly Visual Observation Report Form
Water Quality Component of Flood Control Projects Review Form

Municipal Facility Assessment

In process

Municipal Facility Prioritization

In process

Floor Drain Inventory (High Priority Buildings & Facilities)

In process

Storm Drain Map (High Priority Buildings & Facilities)

In process

Weekly Visual Inspection Report Form

In process

Water Quality Component of Flood Control Projects Review Form

To be developed

APPENDIX H

INDUSTRIAL & HIGH RISK RUNOFF PROGRAM

Facility Inventory
Facility Prioritization

Industrial & High Risk Facility Prioritization

In process

APPENDIX I

MONITORING, RECORDKEEPING & REPORTING

2006 Representative Sampling Plan
Annual Stormwater Report Form
Annual Report Review Form
Annual SWMP Review Form