State of Utah

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Division of Facilities Construction and Management
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Director

Addendum No. 1

Date:	July 3, 2014
To:	Contractors
From:	Kurt Baxter – Project Manager, DFCM
Reference:	Allied Health and Technology Building-Southwest ATC Utah College of Applied Technology – Design/Build DFCM Project No. 11342270
Subject:	**Addendum No. 1**

Pages	Addendum Cover Sheet	1	page
	General Items	62	pages
	Total	63	pages

Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to Disqualification.

1.1 SCHEDULE CHANGES: There are no Project Schedule changes.

1.2 GENERAL ITEMS: Please see the PROGRAM SUPPLEMENT #2, dated July 3, 2014.

FACILITIES PROGRAM UPDATE

SOUTHWEST APPLIED TECHNOLOGY COLLEGE
CEDAR CITY, UTAH

UTAH COLLEGE OF APPLIED TECHNOLOGY

PROGRAM SUPPLEMENT #2

JULY 3, 2014

Prepared by:

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2.0 PROGRAM CLARIFICATIONS, REVISIONS AND CORRECTIONS

2.2 PROGRAM CLARIFICATIONS, REVISIONS AND CORRECTIONS

PROGRAM SUPPLEMENT #2 UPDATES & CORRECTIONS

#49. Page 87: Delete Page 87 Adjacency Diagram and Replace with Attachments Health Sciences Adjacency Diagram.
See attached Diagram.

#69. Page 201 & 202: Culinary Adjacency Diagram: Delete pages 201 & 202 and replace with Attachments, Revised Page 201Culinary Adjacency Diagram.
See attached Diagram.

#71. Page 209: Kitchen: Revised as indicated on Sheet 209 Attached. Note door and room locations do not match from sheet 203 to sheet 209. See revised Adjacency Diagram.
See attached Diagram.

#95. Page 343 & 345: Delete pages 343 & 345 and replace with Attachments, Revised Pages 343 & 345 Multipurpose Room.
This Diagram has been updated and the descriptive notes corrected.

ATTACHMENT "E"

BUILDING REQUIREMENTS
3.4.1 Mechanical

3.0 BUILDING REQUIREMENTS

3.2 BUILDING DESIGN CRITERIA MINIMUM STANDARDS

3.4.1 MECHANICAL

CODES AND STANDARDS

- International Building Code, 2012
- International Mechanical Code, 2012
- International Plumbing Code, 2012
- International Fire Code, 2012
- International Energy Conservation Code, 2012
- International Fuel Gas Code, 2012
- NFPA 13
- Utah State Boiler Code
- National Electrical Code, 2009
- DFCM Design Criteria
- DFCM High Performance Building Standard
  - ASHRAE Std 55 2010: Thermal Environmental Conditions for Human Occupancy
  - ASHRAE Std 62 2010: Ventilation for Acceptable Indoor Air Quality
  - ASHRAE Std 90.1 2010: Energy Standard for Buildings

HIGH PERFORMANCE BUILDING REQUIREMENTS

This facility will conform to DFCM High Performance Building Standard and DFCM Design Requirements.

BASIC REQUIREMENTS:

- Fundamental Building Systems Commissioning. DFCM will engage a Commissioning Agent that is not an individual directly responsible for project design or employed by one of the designers. Commissioning Agent shall ensure that fundamental building components are installed and calibrated to operate as intended.

- CFC Reduction in HVAC and Refrigeration Equipment.
  Designer shall select HVAC and refrigeration equipment without chlorofluorocarbons (CFC) based refrigerants.

- Ventilation Systems. Designer shall provide mechanical ventilation system according to ASHRAE Standard 62. Mechanical ventilation system shall have the capability to operate continuously during occupancy and designed not to be easily shut-down or otherwise defeated.

- Drainage Systems. Designer shall design surface grades, storm drainage system, HVAC system, and other systems to avoid accumulation of standing water around in the building.

- Mold Prevention during Construction. Contractor shall ensure porous type building materials, insulation, and fabric, is kept dry to prevent the growth of mold and bacteria. Materials that have been affected by mold shall be abated or replaced. Building insulation that is damp or wet for 72 hours shall be replaced.

- Provide 2 stage filtration, MERV 8 and MERV 13. Filters shall be installed during construction. Change filters immediately prior to beneficial occupancy and provide one set of filters for attic stock. Provide list of air filters sorted by each piece of equipment.

- Thermal Comfort. Designer shall ensure that thermal comfort requirements are according to ASHRAE Standard
  55. Exceptions: Winter humidification is not required; Summer dehumidification is not required.

ENERGY EFFICIENCY REQUIREMENTS:

- Energy Performance: Facility shall reduce source energy consumption by at least 10% as compared to ASHRAE 90.1-2010 baseline, modeled in conformance with Appendix G.

MECHANICAL UTILITIES

Sanitary Sewer: The sanitary sewer shall extend to existing utilities.

Storm Drainage: The building and site drainage will be retained on site.

Water: The existing culinary water supply will be connected in the street and extended to the building mechanical room.

Gas Heating: Building heating and domestic water heating will be accomplished using natural gas.

DESIGN TEMPERATURES

	Winter	Summer
Outdoor Temperature	-5°F	95º DB/62º WB
Indoor Temperature - Typ.	68°F (+/-)2°F	72°F (+/-)2°F
Mechanical Rooms	60°F	105°F, outside air only, 10°F rise.
Phone/Data/Comm/Server	75°F	75°F
Unoccupied Spaces		95°F

ACOUSTICAL CRITERIA

HVAC related background sound in rooms will comply with the
2007 ASHRAE HVAC Applications Manual Table 42.

Offices	RC 25 to 35
Conference Rooms	RC 25 to 35
Open Plan Offices	RC 35
Corridors and Lobbies	RC 40 to 45
Classrooms	RC 25 to 30
Medical/Nursing Teaching Areas	RC 25 to 30

Larger Lecture Rooms	RC 25
Labs	RC 35
Cafeteria	RC 45
Technology/Welding Lab	RC 50
Kitchen	RC 45

HEAT SOURCE

The heat source will be gas fired high efficiency condensing boilers. There will be a minimum of two boilers for redundancy. Each boiler will be sized for 60% of the load. Peak design heating water supply temperature is limited to 150°F. Domestic hot water will be provided via a high efficiency domestic gas fired water heater.

COOLING SOURCE

The cooling source will be an air cooled chiller with evaporative cooled pre-cooler with integral control package.

VENTILATION

Ventilation will be provided in compliance with the ASHRAE Std 62 2010.

Classrooms –	10 CFM/person + 0.12 CFM/sq.ft.
Office Space –	5 CFM/person + 0.06 CFM/sq.ft.
Lecture Classroom –	7.5 CFM/person + 0.06 CFM/sq.ft.
Cafeteria –	7.5 CFM/person + 0.18 CFM/sq.ft.
Laundry -	30 CFM/person Labs - 6-10 AC/hr
Technology Labs -	1.75 CFM/sq.ft. + 100 CFM/vehicle
Welding Shop -	10 AC/hr + 200 CFM/welding-bench

An outside air flow measuring device will be provided at each air handler. A CO_2 sensor in each high occupancy space will reset the outside air flow between minimum and maximum value.

HVAC SYSTEM

Project intent is to minimize maintenance while providing energy efficiency. As such, central systems are preferred without the maintenance issues associated with condenser water or air filters spread throughout the facility. Cooling towers, multiple small fan coil units, ground source heat pumps, or Variable Refrigerant Flow systems and the like are not acceptable.

Classroom/Administration Functional Areas: Preferred system is a central station variable air volume (VAV) reheat system with air handling unit located on roof. Provide VAV boxes with hot water reheat coils for each zone. Provide 12” deep evaporative pre-cooler over economizer intake. Provide thermal zoning as indicated below and in conformance with DFCM Guidelines.

Thermal Zoning:

Corner Rooms	Individual Thermostat
Classrooms	Individual Thermostat
Teaching Labs	Individual Thermostat

Conference Rooms	Individual Thermostat
Offices	Offices with similar exterior exposure may be grouped together

High Outside Air - Technology Labs, Welding Labs, Etc.: Preferred system is a rooftop mounted make up air unit with direct fired natural gas burner and evaporative cooling section.

EXHAUST AIR SYSTEMS

Toilet Rooms: Provide exhaust air system for toilet room ventilation. Exhaust fans to be rooftop Automotive & Welding labs: Provide independent exhaust air system with outlets near the floor and ceiling. The use of exhaust snorkels to provide point exhaust will be considered.

AIR DISTRIBUTION

The ducts from the air handler to VAV boxes is medium velocity (2500 feet per minute maximum, duct downstream of VAV boxes and constant volume systems shall be run with maximum pressure loss of 1.0”/100 FT of duct.) The ceiling space will be a return air plenum.

HEATING HOT WATER PIPING SYSTEM

Constant flow primary loop; variable flow secondary loop, Primary and Standby pumps, each size at 100% flow. Variable Frequency drives on each variable flow pump.

REFRIGERATED CHILLED WATER PIPING SYSTEM

Constant flow primary loop; variable flow secondary loop, Primary and Standby pumps, each sized at 100% flow. Variable frequency drives on each variable flow pump.

AUTOMATIC TEMPERATURE CONTROLS

Installers shall be Johnson Controls, Utah Yamas Controls, or Atkinson Controls. Controller points are in accordance with DFCM HPBS.

FIRE SPRINKLING

Automatic wet-pipe sprinkler system. Piping will be standard weight black steel with mechanical couplings, threaded joints or welded joints.

PLUMBING

Provide high efficiency domestic hot water heater with domestic hot water storage tank. The domestic hot water system shall provide 140°F hot water to the building.

Water reduction will be utilized via dual flush water closets, low consumption urinal (quart/flush), and sensor faucets.

HIGH PERFORMANCE DESIGN

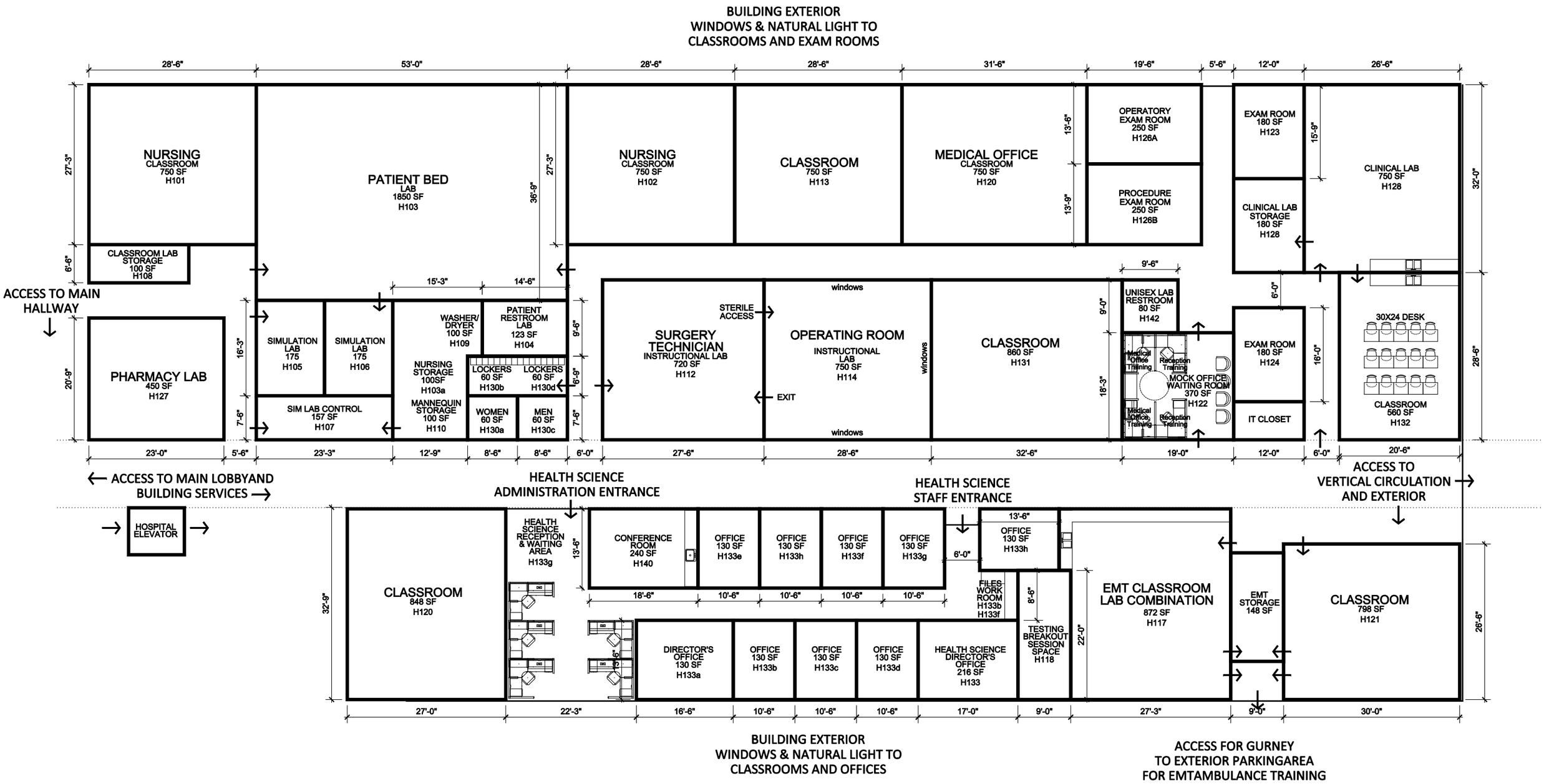
SEE ATTACHED DFCM HPBS.

MECHANICAL SYSTEM NARRATIVE

DFCM HPBS
Green Building: The HVAC and plumbing system must not only meet the varying demands of diverse occupancies, it must beat the 2010 ASHRAE 90.1 minimum energy requirements by 10% and meet DFCM HPBS Silver Requirements. The 2010 version represents a much higher performance standard than the previous 2004 version.

ATTACHMENT "F"

INDIVIDUAL AREA SPACE PLANNING REQUIREMENTS AND ADJACENCY DIAGRAMS

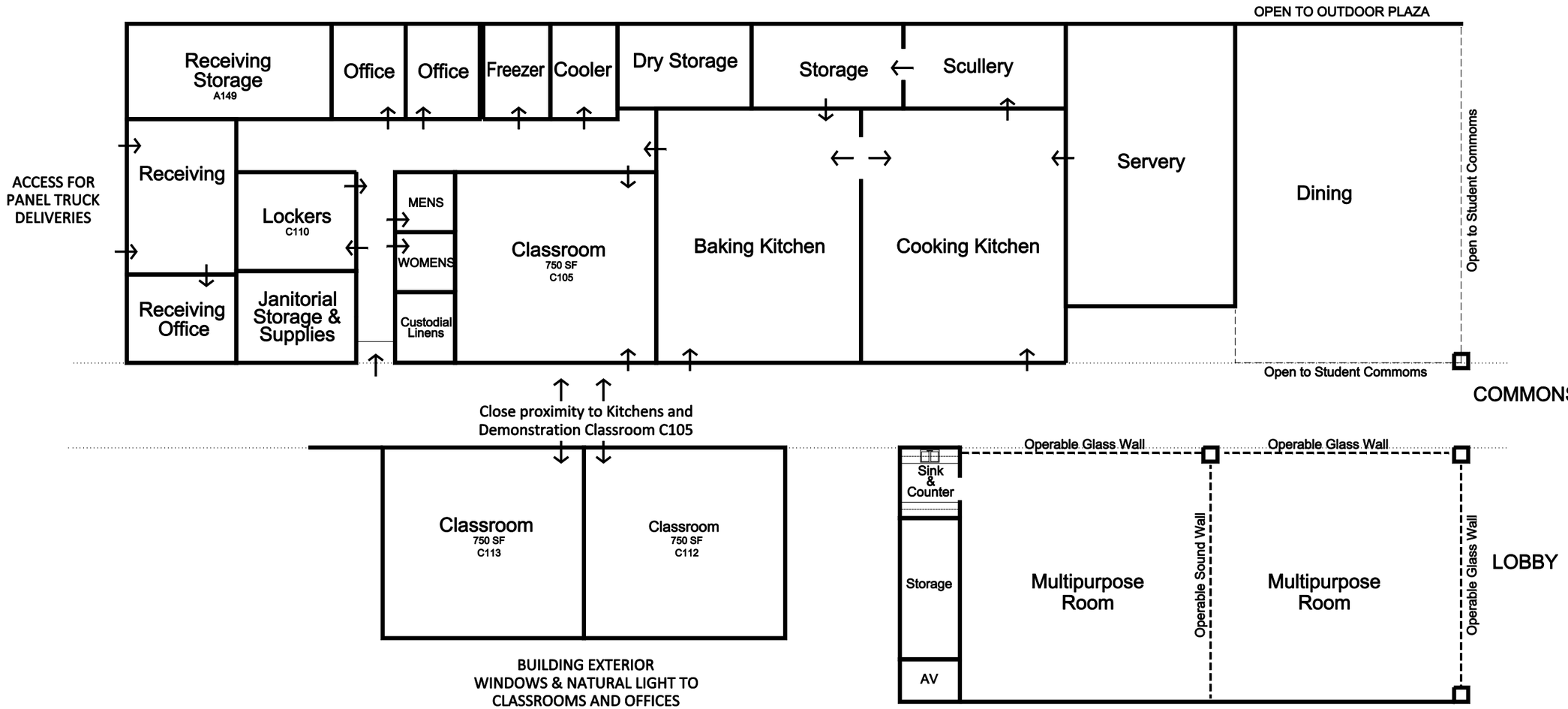


HEALTH SCIENCES ADJACENCY DIAGRAM

NEW SOUTHWEST APPLIED TECHNOLOGY COLLEGE
SCALE: 1/8" = 1'-0"

0 4' 8' 16' 32' 48'

Revised
Page 87



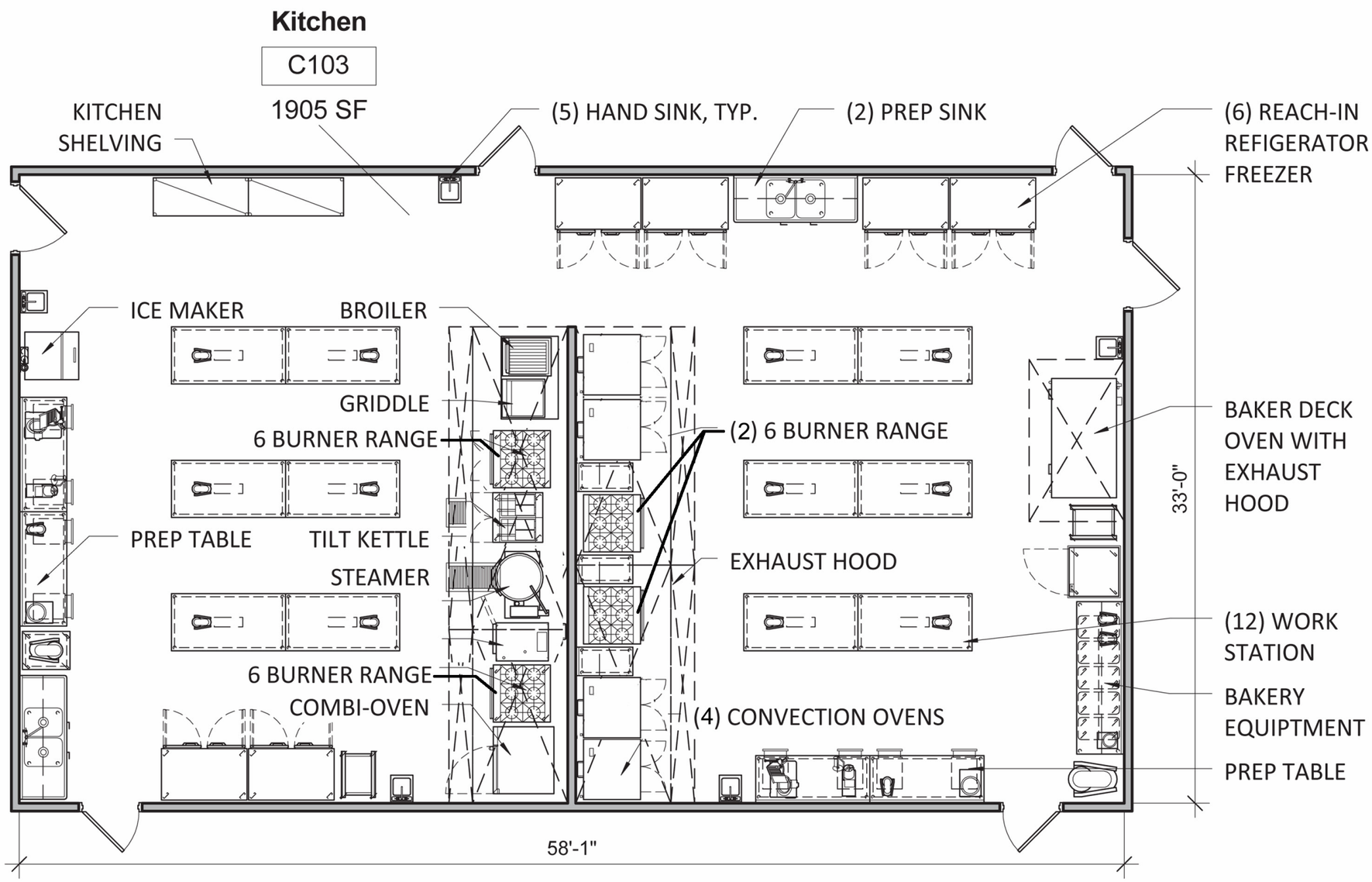
CULINARY - MULTIPURPOSE - RECIEVING ADJACENCY DIAGRAM

NEW SOUTHWEST APPLIED TECHNOLOGY COLLEGE
SCALE: 1/8" = 1'-0"

0 4' 8' 16' 32' 48'

Revised
Pages 201 & 202

The Kitchen equipment has bee reallocated to provide more Ovens and fewer Ranges on the Baking (right) side of the Kitchen and more Ranges and fewer Ovens on the Cooking (left) side of the Kitchen. All other equipment remains as Programmed.

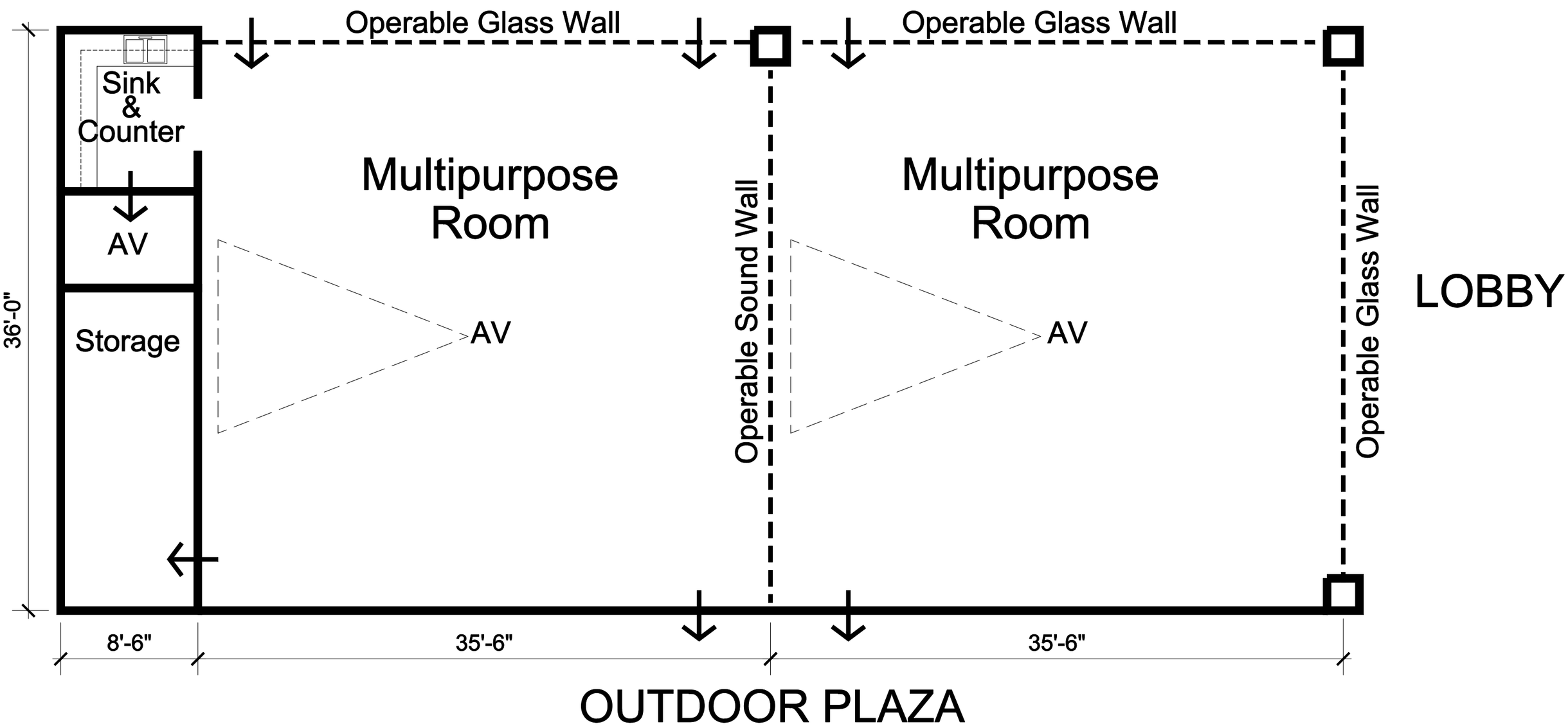


KITCHEN C103

NEW SOUTHWEST APPLIED TECHNOLOGY COLLEGE
SCALE: NA

Revised
Page 209

A large gathering area for special events such as Graduation Ceremonies has not been included as part of the Program. It is the desire of SWATC to have the Multipurpose Rooms open into large open common areas such as the Main Lobby and the Cafeteria / Dining to facilitate special events.



MULTIPURPOSE

NEW SOUTHWEST APPLIED TECHNOLOGY COLLEGE
SCALE: 1/8" = 1'-0"

0 2' 4' 8' 12' 16'

Revised
Page 343-R

ATTACHMENT "G"

HIGH PERFORMANCE BUILDING STANDARD & COMMISSIONING REQUIREMENTS

SWATC
DFCM
High Performance Building Standard

SWATC
Building Enclosure Commissioning Requirements

SWATC
Building Envelope Commissioning
Functional Performance Test Protocol

ATTACHMENT "G"

SWATC

DFCM
HIGH PERFORMANCE BUILDING STANDARD

5.0 High Performance Building Standard

A. The State of Utah Division of Facilities and Construction Management require each project meet a sustainable design standard. All projects must meet the following standards.

B. In the case were a conflict arises between different sections, the more stringent requirement should apply and the Department of Facilities and Construction Management (DFCM) should be notified about the conflict.

5.1 Integrated Design Process

A. General Intent

(1) The process and expectations outlined in section 5.1 includes certain activities and events that are required to happen during the project. Many of the activities are not required, but their inclusion is based upon the experience of DFCM and professionals that serve DFCM. The intent thereof is to inform the project team of what should happen over the course of a project to not only meet the requirements of the HPBS but also maximize the value of design and construction efforts to DFCM and the State of Utah.

(2) Adjustments to the process outline below, in order to best suit the needs of each project, are expected and should be discussed with the project team periodically through the project and recorded in the OPR.

a. The Owner shall directly hire the Energy Engineer, Building Envelope Commissioning Agent, and Commissioning Agent in the programming phase.

i. For Design Build projects the Energy Engineer shall provide the Energy Engineering over the course of the entire project as part of the design build team.

ii. Energy modeling and LCCA will be reviewed by the DFCM's third party reviewer.

b. The Owner, Energy Engineer, Commissioning Agent, and Building Envelope Commissioning Agent, shall provide timely input to the design team related to the OPR, BOD, and related HPBS documentation.

c. An updated BOD and OPR, including narrative of HPBS goals and strategies, shall be included in each design phase submittal to the owner. Changes from one phase to the next shall be documented as to provide a record of the development of the project.

d. An updated sustainable site plan shall be included in each design phase submittal to the owner

e. A HPBS Workshop must be completed during the first half of each phase of the project. Goals, strategies, and performance metrics must be documented in the OPR, BOD, and project documents accordingly. Additional informal HPBS Workshops shall be held to provide clear direction to the project in regards to the requirements of the HPBS

i. As coordinated by the design team and DFCM Energy Program Director, each HPBS Workshop shall include, but not limited to, the following project team members.

I. Design team members
II. Owner
III. Agency Project Manager
IV. DFCM Project Manager
V. Agency Energy Manager
VI. DFCM Energy Program Director
VII. Facilities Operators, if unknown at the time, it must be clearly identified who will be in attendance to represent the interests of facility operations
VIII. Energy Engineer
IX. Commissioning Agent
X. User group representative(s)

ii. For design build delivered projects, in lieu of this requirement during programming, it will be delayed until the winning proposal is selected. In

lieu of this meeting, it is expected that the design build proposals address to the extent possible the requirements of the HPBS.

f. The Owner, design team, Energy Engineer, Commissioning Agent, and Building Envelope Commissioning Agent shall review each design phase submittal for compliance to the HPBS. Appropriate design phase comments shall be provided to the design team within 10 business days.
    i. For design build delivered projects, in lieu of this requirement during programming, it will be delayed until the winning proposal is selected.

g. The design team shall conduct a building envelop systems meeting, during design development and construction documents phases, to review possible envelope strategies. Topics to review included, but are not limited to, air, thermal and moisture performance, functional performance requirements, constructability, energy efficiency, aesthesis, mock ups, and testing.
    i. For design build delivered projects, in lieu of this requirement during programming, it will be delayed until the winning proposal is selected.

B. Programming

(1) The following must be provided during the schematic design phase of the project.

a. The design team shall provide simplified modeling iterations of various conceptual design proposals including, but not limited to, massing, orientation, glazing orientation, and glazing amount for the Energy Engineer to assess.
    i. On an as needed basis, projects may be permitted an exception to this requirement, if approved by the DFCM Energy Program Director.
    ii. For design build delivered projects this requirement is optional.

C. Schematic Design

(1) The following must be provided during the schematic design phase of the project.

a. The design team shall conduct a building systems meeting to review the possible systems applicable to the project. Agenda items to include, but not limited to, performance, LCC, first costs, operations and maintenance, and existing infrastructure integration.
    i. The design team, appropriate Facilities Operators, Commissioning Agent, Agency Energy Manager and or DFCM Energy Program Director, General Contractor and appropriate subcontractors (if hired), and Energy Engineer must be in attendance.
    ii. For design build delivered projects, that have selected the building systems as part of their proposal, in lieu of the systems meeting,, the rationale behind the selections must be clearly presented.

b. DFCM Energy Program Director to sign Rocky Mountain Power's Incentive General Applications as provided by Architect

c. The Cost Estimator or General Contractor/Construction Manager must provide relevant supporting construction cost estimates to the Energy Engineer and Design Team in a timely manner.

D. Design Development

(1) The following must be provided during the design development phase of the project

a. The design team shall conduct a second building systems meeting to review the possible systems applicable to the project. Agenda items to include, but not limited to, performance, LCC, first costs, operations and maintenance, and existing infrastructure integration.
    i. The design team, appropriate Facilities Operators, Commissioning Agent, Agency Energy Manager and or DFCM Energy Program Director, General Contractor and appropriate subcontractors (if hired), and Energy Engineer must be in attendance.

E. Construction Documents

(1) The following must be provided during the construction documents phase of the project.

a. The design team shall conduct a building controls meeting to review the possible systems applicable to the project. Agenda items to include, but not limited to, metering, controls, points, analytics and operations and maintenance.

i. The design team engineers, appropriate Facilities Operators, Commissioning Agent, Agency Energy Manager and or DFCM Energy Program Director, General Contractor and appropriate subcontractors (if hired), must be in attendance.

b. The Design Team shall coordinate all incentives and rebates as outlined in section 5.14.

c. The Design Team shall submit all required documentation to DFCM as part of the CD submittal. The submittal shall include, but is not limited to the following.

i. Sustainable site plan
ii. HPBS Spreadsheet
iii. Any exceptions and appeals
iv. Owner's Project Requirements
v. Basis of Design

d. The Energy Engineer shall submit all required documentation, per section 5.5, to DFCM as part of the CD submittal

i. Energy Model Spreadsheet
ii. Life Cycle Cost Worksheet

e. The CxA shall submit all required documentation, per section 5.12, to DFCM as part of the CD submittal

i. Commissioning Plan

f. The BECxA shall submit all required documentation, per section 5.13, to DFCM as part of the CD submittal

i. Building Envelope Commissioning Plan

F. Bidding

(1) Value engineering efforts and substitution request must be evaluated in context of the HPBS, preferred operations and maintenance procedures and performance impacts over the life of the building.

(2) The General Contractor shall account for HPBS requirements including, but not limited to, functional testing, building envelope function performance testing, and building flush out, in the construction schedule.

G. Construction

(1) Submittals and shop drawings related to HPBS requirements shall be reviewed by the CxA, BECxA and Energy Engineer in the time period set forth in the construction documents. Their review does not relieve or supersede the responsibility of the design team to review the HPBS related submittals and shop drawings for compliance set forth in the construction documents.

(2) The Design Team shall provide the required incentive and rebate documentation to the DFCM Energy Program Director as outlined in Section 5.14 and related appendices

(3) BECx related performance tests shall be tracked in the weekly OAC meeting minutes.

(4) At a minimum, the BECxA shall attend, in person or via a conference call, OAC meetings monthly. Reasonable effort by other team members shall be made to discuss related issues at the beginning of each meeting

(5) A building envelope commissioning kick off meeting shall be coordinated by the general contractor and BECxA.

a. Required attendees include, but are not limited to the following: Architect, DFCM Energy Program Director. Subcontractors responsible for the following building components shall attend when applicable; masonry, insulation, air barrier, cladding, glazing, roofing and others as dictated by the envelop design.

(6) Testing of building envelope components, on the building mock up, shall be completed with acceptable results prior to installation of said components.

a. The general contractor and subcontractors responsible for the installation of the components shall attend the functional testing

b. The BECxA shall review deficiencies and possible causes of failed tests with each subcontractor prior to leaving the site on the day of the test(s).

(7) At a minimum the Commissioning Agent shall attend, in person or via a conference call, OAC meetings on a month basis.

(8) A building systems commissioning kick off meeting shall be coordinated by the general contractor and CxA

H. Substantial Completion and Project Closeout

(1) The CxA shall coordinate with the agency Energy Manager to set up the project for benchmarking in EPA ENERGY STAR Portfolio Manager.

a. The agency Energy Manger shall report the ECI, EUI, GHG emissions and water used per EPA ENERGY STAR Portfolio Manager in it's annual energy report to DFCM

(2) The CxA, Owner, and General Contractor shall conduct a Four Month Walk Through Performance Walk Through meeting.

(3) The CxA shall finalize the incentive and rebates per section 5.14

(4) The O&M manuals and As-Built documents must include, but is not limited to, the OPR, BOD, HPBS Worksheet, Energy Modeling Spreadsheet, Life Cycle Cost Worksheet, Controls As-Builts.

5.2 Context Sensitive Design

A. Site Design

(1) The Design Team shall conduct a review of the local and regional planning documents pertinent to the project. These documents may include, but are not limited to:

a. Municipal Master Plan or Land Use Plan

b. Applicable Open Space Plans, including trail and recreation plans, municipal open space plans…

c. Municipal, Regional or State Transportation Plan

d. Local or Regional Stormwater Plans or Guidelines

e. Applicable environmental regulations that may apply to the site

(2) The project design shall reflect the community vision for the site. The building site, open space design and access points shall reflect the goals of the regional and municipal planning documents.

B. Building Design

(1) The building shall be sited and oriented to reflect the community development patterns and vision, while responding to the site, solar access, and other climate considerations.

(2) The building design shall reflect the community vision and vernacular design patterns.

C. The facade design shall reflect the solar access and orientation of the site through the integration of shading devices, window location, and scale. Window to wall ratios that are appropriate based on building energy performance, orientation, and interior programming shall be integrated into the design.

D. Access

(1) Provide enhanced access from the project entry to the identified pedestrian and transit access points at the perimeter of the site.

a. Ensure pedestrian paths are safe, accessible and maintainable by facility staff

(2) Separate pedestrian paths from vehicular paths with landscaped barriers to the extent feasible.

(3) Identify key paths on a Sustainable Site Plan drawing submitted at the Schematic, Design Development, and Construction Document phases.

5.3 Transportation Management

A. Identify transportation management goals for the project to help reduce single rider vehicle impacts. This goal may be an overall percentage reduction in single-vehicle ridership, an increase in transit usage or the implementation of a carpooling program. Record these goal in the OPR.

B. Incentivize transit use through a reduction in parking stalls provided. This reduction should be based on a 10% reduction in comparison to municipal requirements or a 25% reduction based on the 4th Edition Parking Generation Guide by the Institute of Transportation Engineers.

C. Define clear, safe paths of access for pedestrians and cyclists from the public right-of-way to the building entry. Locate shower and changing rooms - as applicable - near these locations.

D. Provide a minimum of 10 secure bicycle storage locations.

(1) After the course of one year Facility Operators shall assess the need to for additional bicycle storage racks and provide as necessary.

(2) If the project cannot or should not meet the above requirements, provide a written justification in the OPR.

E. Provide a minimum of two reserved parking stalls for carpool vehicles and fuel-efficient, low emitting vehicles on each project.

F. Implement three of the following strategies to reduce single vehicle ridership to and from the project.

(1) Identify transit and alternative transportation options for the users and site. Identify strategies to encourage transit ridership, such as reduced or free pass offerings.

(2) Incentivize transit use through increased parking fees or paid parking lots.

(3) Provide telecommuting and / or reduced work week programs to minimize single vehicle ridership to the building.

(4) Provide shower and changing room(s) for cyclists and those who exercise mid-day.

(5) Designate 5% or more of the total parking provided as parking stalls for low emitting/fuel efficient - locate these stalls in preferred parking locations.

(6) Provide alternative fuel stations as applicable for the project.

(7) Designate 5% or more of the total parking provided as parking for carpool vehicles- locate these stalls in preferred parking locations.

(8) Demonstrate single-vehicle ridership or vehicle impact reductions through an alternative method.

G. The three strategies shall be identified in the OPR and included in to the Education and Outreach program for the building users and visitors.

5.4 Site Design

A. Open Space Design

(1) Create an open space plan that defines the usable site areas, designates open space, and identifies the landscape and hardscape areas. These specific areas shall be shown on the Sustainable Site Plan drawing, include a brief description of the anticipated level of use of each of the areas, and submit with each design review phase.

(2) Necessary pedestrian open spaces such as sidewalks, paths, and passive and active recreation areas, shall be designated. Include transportation management areas as indicated in section 5.3

a. Define active hardscape areas that will be used for pedestrian traffic or regular pedestrian or visitor use.

b. Define active landscape areas that will be used by building users and visitors regularly. Identify intended uses that may occur within this landscaped area.

i. Turf shall only be used at active landscape areas that are a minimum of fifteen feet in any direction and a minimum of 200 square feet. Exceptions to this shall be justified by local landscape and/or zoning standards. Any alternate use must be reviewed and approved by the DFCM Energy Program Director.

c. Define aesthetic and native or natural open-space areas, as applicable

d. Define active pedestrian hardscape areas that are used for emergency or non-active uses

(3) The Landscape Architect shall provide an estimated maintenance schedule for the landscaped areas, with an emphasis on the reduced maintenance and reduced water consumption of the native and adapted landscaped areas.

a. This maintenance schedule shall be included in the Operation and Maintenance Manuals for the project.

B. Landscape Water Consumption

(1) Create a site irrigation water use budget based on your location and site conditions, per the EPA Water Sense criteria.

a. Use the EPA WaterSense Tool[1] to identify the water allowance for the site after landscaped areas have been defined. A summary of the water allowance shall be included in the Operations and Maintenance Manuals for the project.

[1] http://www.epa.gov/WaterSense/water_budget/

(2) Landscape water consumption shall be at or below what is identified as the monthly water allowance for the site by the EPA WaterSense Tool. Justification for exceeding monthly water reviewed and approved by the DFCM Energy Program Director. Design and implement landscape materials and features that respond to the allocated water budget identified in section 5.4.B.1 and meet the native and adapted landscape material requirements.

(3) Landscape features shall align with the anticipated use areas defined in the in section 5.4.AIntegrate an EPA WaterSense Labeled irrigation controller into the irrigation system.

C. Storm Water Design

(1) Design, construct, and maintain storm water BMPs that manage rainfall on site and prevent the off-site discharge of precipitation from the first one inch of rainfall from a 24-hour storm preceded by 48-hours of no measureable precipitation.

(2) Implement at least two BMPs from the Best Management Practices for Storm Water[2]

a. Provide two BMP Information Sheets from the Guidance Document and a description of how the specific BMPs are implemented in the project.

b. Identify and describe the selected strategies in the OPR, and submit with the Design Development submission.

c. Implement one additional site performance standard as identified in items 2 through 5 on page 7-4 of the Storm Water Management Guidance Document.

D. Heat-Island Effect

(1) Plan exterior hardscape materials to reduce the urban heat island effect. Use materials with an SRI of 35 or greater for all pedestrian oriented paved surfaces and reduce the overall use of asphalt as feasible.

a. Reduce the dimensions of 25% of parking stalls to meet compact stall requirements of 8'-6" in width and 16'-0" in length. Provide either signage or striping to indicate the compact vehicles stalls on the site.

i. Indicate the compact parking on the Sustainable Site Plan drawing.

b. Use concrete at all pedestrian oriented hardscape areas. Colored concrete shall not have an SRI of less than 29.

(2) Use reflective roofing to reduce the urban heat-island effect at the building. Install a reflective roof with an SRI of 78 or greater over 75% of the low slope roof areas (slopes below or equal to 2:12) for all buildings in Climate Zones three and five.

i. Consider a tan colored, planted or ballasted roof at roofs that are visible from inside the building to reduce glare and increase occupant comfort.

ii. Darker roofs shall be considered in climate zone 6, where heat absorption may be beneficial to the overall energy use of the building.

b. Install roofing with an SRI of 29 or greater at steep-sloped areas (slopes above 2:12)

c. SRI values for roofing and hardscape must be included in the Sustainable Site Plan.

E. Light Pollution Reduction

(1) Use fixtures that as low in height as feasible, to ensure light is at the appropriate location for pedestrian safety and functionality..

(2) All exterior lamps shall be LED.

(3) Lighting values greater than 0.01 fc shall not extend beyond twenty feet over the defined site boundary, except as required by the municipality for pedestrian safety.

(4) Exterior lighting shall be controlled by a photocell sensor.

(5) All interior lighting systems shall be designed and controlled to shield interior light from the exterior of the building, or include a 50% reduction in lighting output between the hours of 11:00 pm and 5:00 am.

5.5 Energy

A. Energy Performance

[2] Salt Lake County Engineering and Flood Control – Guidance Document for Storm Water Management – January 2012; Chapter 7. http://www.pweng.slco.org/stormwater/pdf/longswplan.pdf

(1) All state agencies and institutions shall design new construction and major renovation, commercial and multi-family high-rise buildings (Proposed design) to achieve, if life-cycle cost-effective, an energy cost performance 13% below the energy cost performance of the corresponding Baseline design as determined by a DFCM hired Energy Engineer.

a. For the purpose of calculating the energy cost savings, include all fuel costs incurred for all systems normally specified as part of the Proposed design scope, regardless of specifying entity (interior & exterior), including receptacle and process load energy costs.

b. Energy costs for both the Baseline and Proposed designs shall be determined by using the Performance Rating Method as defined by Appendix G of *ANSI/ASHRAE/IESNA Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings* (with errata, without addenda).

c. The building/project Performance Rating percentage improvement shall be determined by use of the formula in paragraph G1.2 of *Standard 90.1-2010*, in terms of total energy cost, as follows.

$$\%\,Improvement = 100 \times \frac{(Baseline\ Utility\ Cost - Proposed\ Utility\ Cost)}{Baseline\ Utility\ Cost}$$

d. Buildings or projects with a conditioned floor area less than 30,000 FT^2, or less than $5,000,000 total project budget, or a projected EUI of less than 20 kbtu/FT^2/yr may, by discretion of the DFCM Energy Program Director, be exempt from section 5.5.A.1.

e. Projects exempted from section 5.5.A.1 by the DFCM Energy Program Director are required to incorporate qualitative design assist from a state hired Energy Engineer.

f. For Design Build Competitions, each shortlisted team may engage an Energy Engineer, at their own discretion and expense, to provide design assistance during the design competition phase, to demonstrate compliance with the HPBS. The winning team's life cycle cost analysis and subsequent energy efficiency strategies will be subject to review and approval by a DFCM hired third party reviewer and DFCM Energy Program Director. At any time during the competitive proposal phase, design teams may access DFCM's third party reviewer to answer questions concerning the LCCA and adherence to the energy modeling protocol set forth in the HPBS. Contact information will be provided by DFCM Energy Program Director.

(2) If no life-cycle cost effective package of measures can be found that meets the required energy cost savings, (cost effectiveness shall be measured in aggregate at the project level, rather than each measure individually), then the life-cycle cost effective package that comes closest to achieving the required energy cost savings may be substituted.

a. Life-cycle cost-effectiveness shall be determined using the FEMP procedure as described in 10 CFR 436 - *Subpart A - Methodology and Procedures for Life-Cycle Cost Analysis* and NIST Handbook 135 - *Life-Cycle Costing Manual for the Federal Energy Management Program.*

b. Utility incentives must be included in the life-cycle cost analysis where applicable.

c. Life-cycle cost-effectiveness may be demonstrated by using one of the following methods consistently throughout the project.

i. Life-Cycle Costs
ii. Net Savings
iii. Savings-to-Investment Ratio

d. At the discretion of the DFCM Energy Program Director, the life cycle cost analysis and subsequent Energy Efficiency Measures strategy will be subjected to review and approval by an appropriate third-party reviewer, selected by the DFCM Energy Program Director.

e. All life cycle costing estimations must be provided with supporting documentation including but not limited to unit pricing, source of pricing, and labor wages.

(3) Documentation demonstrating compliance with section 5.5.A.1 must be submitted through the DFCM Energy Program Director for review and acceptance by an appropriate Submittal Reviewer, selected by the DFCM Energy (or Energy Program) Director.

a. Appeals regarding extenuating circumstances related to demonstrating compliance with section 5.5.A.1 may be submitted to the DFCM Energy Program Director, for consideration on a project/building specific basis. Appeals can only be considered if made prior to the Construction Document design phase.

b. Minimum documentation requirements for demonstration of compliance with section 5.5.A.1 are as follows, and must be based upon the drawings and specifications referenced in the final construction document bid set, including the completion of value engineering, bid alternates, and addenda.

i. All relevant project information as required by *Standard 90.1-2010-G1.4* (Reference Appendix B - Project Energy Performance Statement (link to electronic copies)

ii. All energy model input values not specified by *Standard 90.1-2010-G1.4*. Examples include, but are not limited to thermostatic settings and occupancy & equipment schedules. Software output reports may be used to demonstrate compliance with this section.

c. Coordination regarding interpretation of Appendix G methodology and protocol can be discussed between the Energy Engineer and Submittal Reviewer on an as needed basis.

d. The Submittal Reviewer, shall review and discuss the energy modeling submittal with the Energy Engineer. Results of the discussion including clarifications and revisions shall be documented by the Submittal Reviewer with comments. Revisions to the energy model, and revised documentation shall be provided in response. A meeting will be held with the Energy Engineer, Submittal Reviewer, and DFCM Energy Program Director, as necessary, to reconcile any outstanding issues. Final acceptance will be granted by the DFCM Energy Program Director.

e. Projects seeking credit for Energy Efficiency Measures not addressed specifically by Appendix G, at the discretion of the DFCM Energy Program Director, may do so by demonstrating savings relative to a Baseline determined through collaboration between the Energy Engineer and Submittal Reviewer.

B. Appliances & Equipment

(1) As available, provide appliances, equipment, products, and/or furnishings that meet one of the following criteria[3].

a. ENERGY STAR Qualified.

b. EPACT Registered

c. Products that meet or exceed the US Department of Energy's FEMP Energy Efficiency Recommendations

d. Rocky Mountain Power incentive, Questar Gas rebate program, or local utility company incentive/rebate approved equipment.

(2) Credit for plug & process (unregulated) loads that are associated with products complying with section 5.5.B.1 may be given credit in the Proposed design energy model by following the exceptional calculation method described in *Standard 90.1-2010, G2.5*, or through use of the procedures described in section 6.4.5 of COMNET's *Commercial Buildings Energy Modeling Guidelines and Procedures*[4].

C. Minimum requirements for new construction

(1) The building envelope requirements in *Standard 90.1-2010 Tables 5.5.1-8* or code minimum, whichever is more stringent, are mandatory.

(2) Minimum efficiency requirements of *Standard 90.1-2010 section 6.8 and section 7.8* or code minimum, whichever is more stringent, are mandatory for all new equipment covered under the standard.

(3) The building envelope requirements of *IECC C402.3.1* are mandatory regardless if the project is complying with *ASHRAE 90.1* or *IECC*.

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[3] www.gsa.gov/eeproducts.

[4] http://www.comnet.org/mgp-manual.

(4) During design development the Electrical Engineer will provide a room-by-room count of installed and space-by-space allowed lighting power per *Standard 90.1-2010 Table 9.6.1*, as well as any lighting power exceptions taken per *Standard 90.1-2010 section 9.2.2.3.*

5.6 Water Efficiency

A. Meet the EPA WaterSense[5] requirements for high efficiency plumbing fixtures and appliances within the building.
B. Once-through process water systems are not permitted.
C. Identify water efficiency goals and system expectations into the OPR and BOD submitted at Design Development and Construction Documents phases.

5.7 Materials and Resources

A. Provide recycling containers and implement a recycling program in all new buildings.
    (1) Recycling contains shall be collocated with the garbage bins.
    (2) If co-mingled recycling is not permitted, bins must be clearly marked.
    (3) At a minimum, mixed papers, cardboard, mixed plastics, and mixed metals shall be recycled.
B. Integrate water bottle filling stations at a minimum of one drinking fountain in the building.
C. Implement a construction waste management plan to divert a minimum of 75% of construction waste, by volume, from the landfill.
    (1) Provide a narrative for exceptions to compliance with section 5.7.C. Narrative shall define the feasible diversion rate, by volume, and is subject to review and approval by DFCM Energy Program Director.
    (2) Contractor shall track recycled content, per the HBPS Worksheet, and provide a summary of construction waste at project construction meetings to be reviewed for compliance by the Architect.
D. Sustainable material sourcing.
    (1) Identify and specify building materials that are both extracted and manufactured within 500 miles of the project site.
        a. Only the value associated with the regional content, by percentage, shall contribute to the sustainable value of the product.
        b. Key materials include concrete, concrete masonry, brick, stone, gypsum board, steel joists, and regionally manufactured misc. metals.
    (2) Identify and specify building materials that contain recycled materials.
        a. Recycled content shall be tracked as both pre-consumer and post-consumer recycled content. Only 50% of the value of the pre-consumer recycled content shall contribute toward the sustainable value of the product.
        b. Only the value associated with the recycled content shall contribute to the sustainable value of the product.
        c. Key materials containing recycled content include concrete, all metal containing materials, plastic containing materials, carpet, and suspended ceiling systems.
    (3) 35% of building materials, by value, shall meet one or more of the above sustainable materials strategies.
        a. Provide the appropriate specification sections and documentation requirements in the construction document set to ensure the contractor understands the sustainable material requirements and expectations.
        b. Contractor shall track sustainable material sourcing values and product purchase verification, per the HPBS spreadsheet. The Architect shall review summary values for compliance at the project construction meetings.
    (4) Only use low mercury or LED lamps in new construction projects.

5.8 Indoor Environment Quality

A. Implement an indoor air quality management plan during construction. This plan shall meet the SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 2nd edition ANSI/SMACNA 008–2008.

[5] http://www.epa.gov/WaterSense/water_budget/

(1) The Contractor shall submit an Indoor Air Quality Plan to the CxA, outlining the implementation strategies to achieve the SMACNA requirements.
(2) Implementation of this plan shall be tracked on the weekly Construction Meeting Minutes.

B. Implement a pre-occupancy air quality plan.
(1) At the end of construction, prior to occupancy, conduct an air quality test per USGBC LEED v4 Construction Indoor Air Quality Assessment requirements.
(2) The Test and Balance sub-contractor shall provide documentation to the Commissioning Agent demonstrating the dates and air flows achieved during the building flush.

C. All interior paints and coatings shall meet the low emitting materials standards set forth by the South Coast Air Quality Management District Rule 1113, as adopted in January 2012.

D. All interior adhesives and sealants shall meet the low emitting materials standards set forth by the South Coast Air Quality Management District Rule 1168, as adopted in January 2005.

E. All flooring systems shall be low emitting, and meet the Green Label Plus program, FloorScore, Greenguard, or the Greenguard low emitting requirements.

F. All janitor's closets, print and copy rooms, and chemical storage spaces shall be directly exhausted and constructed with a hard ceiling or walls constructed and sealed to deck.

G. Provide permanently installed entryway systems, regularly maintained walk-off mats, or a combination of the two systems. All entry carpets shall be at least 10' in length at primary entryways.

H. Office environments shall be designed with task lighting at each individual workstation.

I. 65% of all regularly occupied spaces shall either have direct access to daylight and views or indirect access through shared glazing systems at interior partitions.
(1) Complete the HPBS Sustainability Worksheet to demonstrate compliance with Section 5.8.I.
(2) Daylighting and view strategies must be included in the OPR.

5.9 Education and Outreach Program

A. Develop and implement a Building Education and Outreach Program to inform the building users of the sustainable design strategies. This program shall include a minimum of two of the following:
(1) Digital or fixed signage describing the sustainable goals and strategies as well as behavior modifications to complement the sustainable design and construction efforts.
(2) A brochure or pamphlet on the sustainable strategies. This shall highlight the location of specific strategies and provide resources for additional information.
(3) Information on the building or department website highlighting the sustainable goals, strategies, and behavior modifications to compliment the sustainable efforts.
(4) Enhanced building training to ensure the building operators and users understand the systems and sustainable design strategies. This includes providing enhanced Operation and Maintenance information on the building systems and control strategies.

B. The outreach program shall address the following sustainable strategies:
(1) Context Sensitive Design
(2) Transportation Demand Management Plan and Programs
(3) Sustainable Site Design
(4) Energy Efficiency
(5) Water Efficiency
(6) Indoor Environment Quality
(7) Recycling and Material Management

C. Energy Star Tracking
(1) The Facilities Operator or Commissioning Authority shall register the building under the Energy Star Portfolio program and input and monitor energy and water consumption of the building.

5.10 Metering

A. Metering System Scope
(1) All state agencies and institutions shall incorporate the utility metering requirements of this section into new construction and major renovation projects. The scope of metering shall include at minimum:

a. Meters on each utility connected to the building, including but not limited to power, natural gas/propane, domestic water, irrigation water, chilled water, steam or condensate, and heating water, shall be provided as part of the construction project and shall be connected to an energy metering monitor network. If meters provided by utility companies can be connected to this network, these meters can serve to meet this requirement. Otherwise, separate meters will be required as part of the construction project that can connect to the meter monitoring network.
    i. Irrigation metering is only required on projects where irrigation system feeds from a building or is a standalone system as part of the project.
b. Monitoring network for utility meters shall be connected to each meter and submeter in the building. This network shall connect to the building controls network via a dedicated automation engine device such as a JACE, NAE, or equivalent as approved by DFCM. Communication protocol on the monitoring network shall be BACnet, LON, and/or Modbus RTU and shall be coordinated with the building automation network. All devices connecting to this network shall use the selected communication protocol as their standard means of communication and shall make all data points readily available for monitoring through the network. A schematic of the monitoring network shall be include in the construction drawings.
c. Meter the entire building electrical load at the main service entrance switchboard. For projects with budgets exceeding $5,000,000, or as directed by DFCM, provide submetering of electrical loads to HVAC systems, lighting, and plug loads. For Medium Voltage switchboards at 4160 volt or higher, provide metering at each branch circuit. Multi-relays that gather metering data may be used in place of a standalone meter on branch circuits of large switchboards. Provide additional submeters for large renewable energy projects that interconnect to the building electrical panels.
    i. Submeters shall connect to the monitoring network. Connection to the monitoring network shall be through one connection point through a dedicated Building Automation node. Do not mix HVAC monitoring and Electrical metering on the same BAS node. Allow the HVAC monitoring and control to continue during maintenance on the metering side
d. Provide additional submetering for any equipment or systems exceeding the following thresholds:
    i. Electrical load exceeding 100 kW
    ii. Natural gas/propane load exceeding 1,500,000 Btu/h
    iii. Cooling tower fill and drain for cooling towers on systems with over 150 tons cooling capacity. If this information is available from chemical treatment or other systems, these systems can be included in the metering network in lieu of separate meters.
    iv. Evaporative cooling system fill and drain for evaporative cooling systems sized for 50,000 CFM or more.
    v. If individual pieces of equipment do not cross these thresholds, but they are part of systems (e.g. chiller or boiler plant) that have demands above the threshold level, provide submetering for the entire system.
    vi. Verify with agency whether any additional submetering requirements exist (billable tenants, etc.)
e. If individual pieces of equipment have internal metering capabilities that meet the requirements of this section, these points can be mapped into the meter monitoring network in lieu of external submeters.
f. Where the project is part of a campus of other buildings, coordinate with campus personnel and design standard supplements for additional metering requirements. This may include matching existing head end equipment protocol, particular standards related to specifications of equipment, and requirements for programming on the head-end system to receive the new metering signals.

g. The meter monitoring network shall be provided with graphics pages available over the web and through the building controls head end system (if provided). The graphics page shall provide a summary of the instantaneous readings of each meter, provide hourly and daily peak kW trend graphics, as well as the monthly and annual peak kW and total kW-hr readings of each meter. Provide data to allow comparisons of each month and year of the building's operation. Trends shall collect data at 15 minute intervals coincident for each meter on the network.
h. The meter monitoring network shall be provided with export capabilities of a minimum of one year of data at hourly intervals, for all metered points, with trend data required, to either CSV or SQL format.
i. Construction documents shall include schedules and locations of meters, and require submittals of meters for review by the design team, DFCM, and commissioning agent. Commissioning agent will review installation, calibration, and operation of meter system.

B. Utility Meter Requirements

(1) Electric Power Meters:
a. Provide digital power meters on all buildings. If there is more than one building on the project, provide separate metering for each structure.
b. Provide power meter output in the communication protocol selected for the meter monitoring network.
c. For monitoring the submeters, connect all back to a central location for interface with the Building Automation system node. Provide riser, plans, and details of wiring and conduit connections. Carefully consider how meter wiring can be routed and connected through switchboards. Consider how meters and wiring can be serviced in live switchboards. An acceptable alternate to switchboard mounting is a separate bank of meters adjacent to the switchboard.
d. Meters shall meet the ANSI standard for billable type meters. Provide meters to monitor with true RMS metering, with 0.2% accuracy.
e. Power meters shall have on board clock with date and time, and be able to record the day and time of any maximum demands or other events.
f. Monitor shall include instantaneous demand for kW, kWh, power factor PF, and shall also include maximum demand kW and total kWh.
g. Power meters shall have an on board digital display that reports measured voltage, amperage, kW, kWh, and power factor. The digital display shall be programmed and calibrated against a portable meter. Verification and commissioning is required for the monitoring network and the on unit digital display.
h. For large switchboards exceeding 2000 amp, or for medium voltage exceeding 4160 volt, provide test blocks on the face of the switchboard for testing the CT's and PT's. For medium voltage application, provide three PT's, 3 phase 4 wire system, and multiple tap CT's.
i. For main service meters, additional meter functions may be considered at the main service such as Total Harmonic Distortion, waveform capture, high speed event capture, and power analysis data. Do not provide these features for submetering unless requested by the agency or user group.
j. Where application calls for netmetering, provide this function.
k. Metering and submetering data shall be coincident, with trending available independently for each individual metering point.

(2) Natural Gas/Propane Meters:
a. Provide diaphragm type flow meters for sizes up to 1,000,000 Btu/h. Provide rotary type flow meters for sizes above 1,000,000 Btu/h. Accuracy on diaphragm meters shall be +/- 3% over the published flow range of the meter. Accuracy of the rotary meter shall be +/- 2% over the published flow range of the meter. Verify that maximum and minimum flow requirements for the project are suitable

for the meter selected. Include requirement in the contract documents to correct meter multiplier for project gas pressure.

b. Provide a strainer upstream of all meters. Provide a bypass around meters. If meter is installed outside, route output wiring to local display inside building mechanical room. Orient pipe horizontally where meter is installed. Meter installation shall be in accordance with manufacturer's specifications. Show straight pipe requirements on contract drawings (12 pipe diameters upstream and 7 pipe diameters downstream, unless more is required by manufacturer). Strainers and bypass fittings are not to be included in the straight pipe length.

c. If the meter is provided with a dry-contact pulse output, a 4-20 mA output, or a proprietary protocol, require a controller/convertor be provided to convert the signal to the communication protocol used in the meter monitoring network.

d. Meter output to the monitoring network shall provide instantaneous flow rate as well as totalized flow rate. A local display shall be provided that shows these flow rates at the meter. Units shall be in CFH for instantaneous flow rate and 100's of cubic feet (CF) for the totalized flow rate.

(3) Domestic/Irrigation Water Meters:

a. Provide positive displacement type flow meters for sizes up to 2" and direct coupled turbine type flow meters for sizes up to 20". Insertion turbine type flow meters are acceptable in sizes from 2 1/2" to 8". Accuracy on all meters shall be +/- 2% over the published flow range of the meter. Verify that maximum and minimum flow requirements for the project are suitable for the meter selected.

b. Provide a strainer upstream of all meters. Provide a bypass around meters that are installed inline. Bypasses are not required for insertion turbine meters that can be removed from the pipeline for maintenance without interrupting flow. Provide a test port downstream of meters.

c. Install meter in well-lit and easily accessible area (irrigation meters may be installed in underground meter boxes, but display shall be located inside adjacent buildings). Orient pipe horizontally where meter is installed. Meter installation shall be in accordance with manufacturer's specifications. Show straight pipe requirements on contract drawings (12 pipe diameters upstream and 7 pipe diameters downstream, unless more is required by manufacturer). Strainers and bypass fittings are not to be included in the straight pipe length.

d. If the meter is provided with a dry-contact pulse output, a 4-20 mA output, or a proprietary protocol, require a controller/convertor be provided to convert the signal to the communication protocol used in the meter monitoring network.

e. Meter output to the monitoring network shall provide instantaneous flow rate as well as totalized flow rate. A local display shall be provided that shows these flow rates at the meter. Units shall be in GPM for instantaneous flow rate and Gallons, or 10's of Gallons, or 100's of gallons for the totalized flow rate as applicable to the project size.

(4) Steam Meters:

a. Provide a vortex type mass flow meter with integral density compensation. Accuracy to be +/-2% over the published range of the meter. Verify that maximum and minimum flow requirements for the project are suitable for the meter selected.

b. Provide a strainer and drip leg upstream of all meters. Provide a bypass around meters.

c. Install meter in well-lit and easily accessible area. Orient pipe horizontally where meter is installed. Meter installation shall be in accordance with manufacturer's specifications. Show straight pipe requirements on contract drawings (12 pipe diameters upstream and 7 pipe diameters downstream, unless more is required by manufacturer). Strainers and bypass fittings are not to be included in the straight pipe length.

d. If the meter is provided with a dry-contact pulse output, a 4-20 mA output, or a proprietary protocol, require a controller/convertor be provided to convert the signal to the communication protocol used in the meter monitoring network.

e. Meter output to the monitoring network shall provide instantaneous flow rate as well as totalized flow rate. A local display shall be provided that shows these flow rates at the meter. Units shall be in lb/hr for instantaneous flow rate and 1000's of lb for the totalized flow rate.

(5) Condensate Meters

a. Provide positive displacement type flow meters for sizes up to 2" and direct coupled turbine type flow meters for sizes up to 20". All condensate meters shall be rated for operation with fluids up to 230°F. Accuracy on all meters shall be +/- 2% over the published flow range of the meter. Verify that maximum and minimum flow requirements for the project are suitable for the meter selected.
b. Provide a strainer upstream of all meters. Provide a bypass around meters that are installed inline. Require that meter be installed in a low point in the piping system to ensure the pipe remains full of water. Provide a test port downstream of meters.
c. Install meter in well-lit and easily accessible area. Orient pipe horizontally where meter is installed. Meter installation shall be in accordance with manufacturer's specifications. Show straight pipe requirements on contract drawings (12 pipe diameters upstream and 7 pipe diameters downstream, unless more is required by manufacturer). Strainers and bypass fittings are not to be included in the straight pipe length.
d. If the meter is provided with a dry-contact pulse output, a 4-20 mA output, or a proprietary protocol, require a controller/convertor be provided to convert the signal to the communication protocol used in the meter monitoring network.
e. Meter output to the monitoring network shall provide instantaneous flow rate as well as totalized flow rate. A local display shall be provided that shows these flow rates at the meter. Units shall be in GPM for instantaneous flow rate and Gallons, or 10's of Gallons, or 100's of gallons for the totalized flow rate as applicable to the project size.

(6) Chilled Water or Heating Water (Below 200°F)

a. On buildings that receive chilled water or heating water from a remote plant, provide a BTU meter that consists of flow meter, supply and return temperature sensors (matched pair of RTDs), and local display that calculates GPM, Btu/h, and totalizes Btu readings. The flow meter shall be an insertion turbine meter for pipe sizes from 2 ½" to 8". For sizes larger than 8", the flow meter shall be an electromagnetic or ultrasonic flow meter. Accuracy to be +/-2% over the published range of the meter. Verify that maximum and minimum flow requirements for the project are suitable for the meter selected.
b. Provide a strainer upstream of all meters. Provide a bypass around meters that are installed inline. Bypasses are not required for insertion turbine meters or ultrasonic flow meters that can be removed from the pipeline for maintenance without interrupting flow. Provide a test port downstream of meters.
c. Install meter in well-lit and easily accessible area. Orient pipe horizontally where meter is installed. Meter installation shall be in accordance with manufacturer's specifications. Show straight pipe requirements on contract drawings (12 pipe diameters upstream and 7 pipe diameters downstream, unless more is required by manufacturer). Strainers and bypass fittings are not to be included in the straight pipe length.
d. Meter output to the monitoring network shall provide instantaneous flow rate, supply and return temperatures, instantaneous energy transfer rate as well as totalized flow and totalized energy transfer. A local display shall be provided that shows these values at the meter. Units shall be in GPM for instantaneous flow rate, Btu/h for instantaneous energy transfer rate, and 1,000,000's of Btu for the totalized energy transfer. If room temperature will exceed 85°F, move display to adjacent cooler room.

(7) High Temperature Heating Water (Above 200°F)

a. On buildings that receive high temperature heating water from a remote plant, provide a BTU meter that consists of flow meter, supply and return temperature sensors (matched pair of RTDs), and local display that calculates GPM, Btu/h, and totalizes Btu readings. The flow meter shall be an ultrasonic or flange to flange insertion type flow meter. Verify with DFCM or agency for each project. All components in this system shall be rated for temperatures up to 750°F. Accuracy to be +/-2% over the published range of the meter. Verify that maximum and minimum flow requirements for the project are suitable for the meter selected.
b. Provide a bypass around meters that are installed inline. Bypasses are not required for ultrasonic flow meters that can be removed from the pipeline for maintenance without interrupting flow.
c. Install meter in well-lit and easily accessible area. Orient pipe horizontally where meter is installed. Locate flow meter on return line. Meter installation shall be in accordance with manufacturer's specifications. Show straight pipe requirements on contract drawings (12 pipe diameters upstream and 7 pipe diameters downstream, unless more is required by manufacturer). Strainers and bypass fittings are not to be included in the straight pipe length.
d. Meter output to the monitoring network shall provide instantaneous flow rate, supply and return temperatures, instantaneous energy transfer rate as well as totalized flow and totalized energy transfer. A local display shall be provided that shows these values at the meter. Units shall be in GPM for instantaneous flow rate, Btu/h for instantaneous energy transfer rate, and 1,000,000's of Btu for the totalized energy transfer. If room temperature will exceed 85°F, move display to adjacent cooler room.

5.11 Data Points

A. Definitions

(1) The input/outputs points list as defined in Appendix A have the following definitions:
a. Digital Input: This term is defined as binary data flow into a controller or control function. These values are "on/off", alarm or normal, 0 or 1, etc.
b. Digital Output: This term is defined as binary data flow out of a controller or control function. These values are on/off, start/stop, open/close, etc. These values are typically shown as 0 or 1, True or False, On and Off, etc.
c. Analog Input: This term is defined as analog data flow into a controller or control function. These values are associated with thermostats, thermo wells, transducers, CO2 sensors, humidity sensors, flow sensors etc. These values are typically shown in incremental values.
d. Analog Output: This term is defined as analog data flow out of a controller or control function. These values are associated with speed, position, damper actuators, valve actuators, etc. These values are typically shown as 0-100%.
e. Hardwire Interlock: This term refers to physical wiring between two devices which prevents one device from operating until the other device confirms ability to operate. These types of interlock are typically associated with a damper confirming open before a fan may start, a valve confirming open until a pump may start, etc. This does not refer to any software interlock but an actual physical connection.
f. BAS Communication: This term refers to values sent from or sent to devices which communicate over a software communication protocol such as LonWorks, BACnet, Modbus, or other software communications. These are not physical points directly wired to controllers but are typically sent over a communications protocol.

(2) The graphics points list as defined in Appendix A have the following definitions:

a. Dynamic Flow Diagrams: This refers to graphics which have animation showing digital inputs operation. These are animations are typically fan status as shown as a moving fan, pump status as shown as a moving impeller on a pump graphic, a coil status as shown as a color change in the coil color, etc.
b. Start/Stop: This refers to a digital output value as shown in textual format. These values show open/close, start/stop, as physically shown on the graphic
c. Display Status: This refers to a digital input value as shown in textural format. These values show on/off, open close, as physically shown on the graphic.
d. Display Value: This refers to both analog inputs and outputs as shown in textural format. These values show percentage open, speed, gpm, cfm, etc.
e. Adjust Value: This refers to any value that can be manipulated though the BMS system. These values can be adjusted as an override from the BMS or an adjusted setpoint. All controlling setpoints will be shown on the graphic.

(3) The other points list as defined in Appendix A have the following definitions:
a. Alarm Local: This refers to an alarm that is shown only locally on the BMS and an alarm that does not require immediate attention by staff or an alarm that is generally not detrimental to the system if it does not function correctly. Different priorities will be defined in the project requirements.
b. Alarm Email: This alarm is reserved for failures in the system which could create a great monetary expenditure to resolve if not addressed immediately. The intent is to alarm offsite personnel during unstaffed time periods to immediately come to the site to resolve the issue before further damage could be done.
c. Trend 15 Minutes: This refers to trending that needs to be setup in the system to trend every 15 minutes. The cache for these trends needs to be at least 8 weeks in storage for review by the DFCM or user groups. Trend charts shall be setup by the contractor in direction of the Cx, Engineer, or User group. It is not the intent that all points listed in the "trend 15 min" be all shown on a single chart but be separated in relation to the control of the system and the command of the system . An example is an pumping system where the lead/lag or duty/standby is shown compared to the differential pressure in the system.

B. Implementation

(1) The points list shall only be implemented in buildings that require a BMS. If a BMS system is not required or requested by DFCM then the points list will not apply in its entirety.
a. This requirement is not to alleviate Design/Build applications from providing a BMS unless it is specifically stated in the program documents that it is not required.
b. If the program documents do not addressed a BMS then it will be inferred that a BMS is required in compliance with this section.

(2) Trending will be implemented for all pieces of equipment as defined in the points list. Individual charts shall be created at direction of the Cx, Engineer, or DFCM representative. These trend charts shall be able to be access through a web interface and a single point click. The intent is not to have these charts created each time an individual logs into the system. The intent is to have these charts access through a single click.

(3) Implementation of this section is not to be applied wholly to each individual building. The intent is only individual systems as applied to the project only be followed per the stated section.

(4) Any system that is not listed in the points list shall not alleviate the design or construction team from implementing a defined points list. In the event that a system is not defined a list shall be provided to DFCM to show which points shall be implemented. The points list shall be delivered to the DFCM, user groups, and Cx by the design team before 50% CDs are created in a Design-Bid-Build or CM/GC delivery system. The points list shall be delivered to the DFCM, user groups, and Cx by the design team before DDs are created in a Design/Build delivery system.

(5) A narrative shall be submitted to DFCM in the event compliance with section 5.11 is too stringent or costly for a given project that requires a BMS. Any waiver shall be approved

by the DFCM and the user group. The waiver shall be accompanied by a descriptive reason on why the standards are too stringent or costly for the project.

a. The waiver shall not be approved when finances are not in place, only when the implementation does not prove to have a reasonable use.

5.12 Commissioning

A. The following industry standards provide a minimum level commissioning in to determine the scope for capital development projects.
   (1) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) – ASHRAE Standard 202, Commissioning Process for Building and Systems
   (2) National Environmental Balancing Bureau (NEBB) - Procedural Standards for Whole Building Systems Technical Commissioning
   (3) Building Commissioning Association (BCxA) - New Construction Building Commissioning Best Practice
   (4) AABC Commissioning Group Guidelines (ACG) – ACG Commissioning Guideline

B. DFCM shall determine the systems and assemblies to be commissioned, per the OPR, in the project's team's scope. The following systems must be commissioned as a minimum.
   (1) Cooling systems
   (2) Heating systems
   (3) Steam systems
   (4) Air handling systems
   (5) Smoke controls systems including fans ductwork and interconnected air handling/supply systems
   (6) Plumbing systems
   (7) Emergency power systems
   (8) On-site renewable energy systems
   (9) Electrical systems
   (10) Building Automation Systems (BAS), including verification of correctly installed data points and meters

C. The below following duties only pertain to mandatory systems to be commissioned. Other systems that may be commissioned shall be defined per individual project. The following duties shall be performed by the commissioning project manager and not any other individual commissioning team member:
   (1) Review OPR at each design phase
   (2) Review BOD at each design phase
   (3) Review each design phase (Programming, SD, DD, CD) submittal for compliance to HBPS Sections
   (4) Attend Design Meetings as necessary, including design phase review meetings, systems meetings and HPBS Workshops
   (5) Conduct Commissioning Kick-off Meeting, attendees per Section 5.1
   (6) Review the Commissioning Plan (prepared by other commissioning team members)
   (7) Review submittals for main pieces of equipment and issue a report written by the project manager (main pieces of equipment include Boilers, Chillers, Cooling Towers, Heat Pumps, Air Handling Units (larger than 5,00 CFM), Pumps, VFDs, Lighting Controls, Building Management System, Roof Top Units, VRF, Chilled Beams, VAV, FCU)
   (8) Attend Construction Meetings (at least monthly at first install of MEP rough in)
   (9) Review first installed or mock-up items
   (10) Review Final Sequence of Operations as installed to ensure compliance with documentation.
   (11) Review Functional Acceptance Test final test records(as performed by other commissioning team members)
   (12) Review Test and Balance Report
   (13) Review Commissioning Report
   (14) Review Systems Manual
   (15) Review Trending data (at least four weeks) for major pieces of equipment and lighting controls

(16) Follow up on the project at 3,6,9,11 months to ensure the system is performing as intended.

D. The following duties shall be performed by the commissioning agent or may be performed by the commissioning project manager and not any other individual commissioning team member:
   (1) Review SD drawings
   (2) Prepare the commissioning plan
   (3) Review minor submittals (minor submittals include piping, valves, plumbing equipment, other electrical equipment not defined in project managers duties, and other pieces of equipment not defined in the project manager duties)
   (4) Conduct construction meetings
   (5) Verify Equipment on site matches items submitted
   (6) Prepare and execute PFAT checklist
   (7) Prepare and execute FAT checklist
   (8) Execute PT-PT checks on 100% of all of the points on the building management system
   (9) Calibrate all (100%) points on PT-PT checks on the building management system, occupancy sensors, and day lighting controls.
   (10) Attend Startup of major pieces of equipment and review startup reports from contractors.
   (11) Review issues logs.
   (12) Review Training Agendas
   (13) Prepare the Commissioning Report
   (14) Prepare the Systems Manual

E. The following duties <u>shall</u> be performed by the commissioning technicians or <u>may</u> be performed by the commissioning agents or <u>may</u> be performed by the commissioning project manager and not any other individual commissioning team member:
   (1) Review all installed pieces of equipment, piping, insulation, conductors, receptacles, switches, transformers, switchgear, panel boards, switchboards, MCC, VAV, VRF, Chilled beams, FCU, Exhaust Fans, Relief Fans, etc. that they meet OPR, CD, and Manufacturer recommended instructions
   (2) Assist in execution of PFAT checklist
   (3) Assist in execution of FAT checklist
   (4) Perform all other duties not defined in the commissioning project manager and commissioning agents responsibilities but defined in the Standards and Guidelines as defined in the Standards and Guidelines section.
   (5) Prepare issues logs.

5.13 Envelope Commissioning

A. High performance building shall be commissioned in general compliance with ASTM E2813-12 *Standard Practice for Building Enclosure Commissioning*. Where conflicts arise between ASTM E2813 and this Standard, this Standard shall supersede.

B. Standard performance buildings shall be commissioned through the design phase in general compliance with ASTM E2813-12,
   (1) Project budget will dictate commissioning activities beyond the design phase.

C. Building Components Included in Building Envelope Commissioning
   (1) Below-grade construction including foundations, basements, and slab-on-grade that functions as part of the exterior enclosure system with utilization of waterproofing and drainage systems, but excluding structural and fireproofing systems and components
   (2) Superstructure floor and roof construction that functions as part of the exterior enclosure system.
   (3) Exterior enclosure construction, above grade, including exterior opaque walls and claddings, fenestration, sheathing, framing, insulation, air barriers, vapor barriers, drainage control layers (or Water Resistive Barriers –WRB's), RF shielding materials, and additional components of the assembly that may impact the long term performance of the enclosure.
   (4) Roofing, including roofing system, roofing insulation, air barriers, vapor barriers, roofing membranes, skylights, hatches, and other roof openings/penetrations.

D. Building Envelope Commissioning – Phases and Tasks – Design-Bid-Build

E. The overall BECx process and scope of services shall be in general accordance with the following industry standards, but with emphasis placed on ASTM E2813:
   (1) NIBS Guideline 3-2012 Building Enclosure Commissioning Process
   (2) ASTM E2813 Standard Practice for Building Enclosure Commissioning
   (3) CSA Z320-11 – Building Commissioning Standard & Check Sheets

F. The following tasks shall be included in the BECx scope of work
   (1) Pre-Design Phase
      a. The Building envelope commissioning agent (BECxA) must be engaged during or prior to the pre-design phase for all High Performance projects and during the design phase for all Standard Performance Projects

      b. The OPR, relative to the building envelope components selected for commissioning, is documented in order to establish a baseline of performance expectations to which the actual installed performance is compared. The BECxA, with the assistance of the Owner, discusses the BOD Summary that documents the OPR for those building systems selected for commissioning. The BOD Summary reflects the underlying assumptions and requirements that become represented in the construction documents. The OPR is developed by the Owner and documented by the BECxA. Project schedule, design life, and project delivery method should all be included in the OPR. For Standard Performance projects, this task is complete in the design phase.

      c. Review of the design narratives to attain an understanding of the BOD. The Basis of Design (BOD) Document records the concepts, calculations, decisions, and product selections used in the design to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document generally includes both narrative descriptions and lists of individual items that support the design process. The BOD Document is developed by the Architect/Engineer of Record (A/E) through a series of design narratives. The BECxA reviews the BOD statement and design narrative documentation and provides written commentary to the A/E and other members of the Commissioning Team as required.
      d. Identify the scope of the BECx process. A BECx Scope Meeting will be conducted. Topics to be covered during the BECx Scope meeting include, but are not limited to, the BECx process, communication protocols, and development of OPR and BOD. The step is often accomplished with a conference call.
      e. Development of the initial BECx plan. The BECxA will develop the initial BECx plan, which can either be its own entity (common) or a part of the Master Commissioning Plan (uncommon). The plan shall include key elements including, but not limited to, project schedule inclusive of BECx tasks and milestones, systems to be commissioned, roles and responsibilities of commissioning team members, means of communication and reporting of conditions and progress throughout the BECx process, and the level of documentation expected throughout the BECx process. The plan is updated periodically throughout the BECx process to reflect changing project conditions or requirements until the end of the project, when it then becomes the Project Commissioning Record.
   (2) Design Phase
      a. The BECxA shall review the relevant project documents to assist with the development of a building envelope that provides environmental separation. The design concepts will be evaluated against the OPR and BOD. The review will include verification that all systems to be commissioned are addressed in the BOD and fulfill the OPR such that the systems are coordinated with each other. The review shall occur a minimum of two times, including a back-check of subsequent issuances. Deliverables typically consist of written mark-ups of the architectural drawings and project specifications to be shared and discussed with the project team. The A/E provides a written response to the BECA and

Owner as to how the comments will be reflected in the final bid documents. On a typical high performance project, there will be at least three in person meetings between the A/E and the BECxA

b. The BECx requirements are incorporated into the construction documents via a BECx specification sections provided by the BECxA and submitted to the A/E for review and approval. The functional performance testing requirements (including both mock-up and field testing) will be incorporated into the construction documents via a functional performance testing specification section. Both specification sections are created by the BECxA based on the requirements outlined in the OPR and BOD and submitted to the A/E for review and approval.

(3) Pre-Construction Phase

a. The A/E or Contractor shall provide all sub-contractor submittals, including material submittals, shop drawings, applicable substitution requests, and quality control documentation to the BECxA prior to commencement of building envelope construction. The BECxA will review all contractor exterior envelope submittals for compliance to the BOD, design documents, performance, and constructability, with concentration on transition details, sequencing concerns, and quality control contractual requirements. All concerns shall be forwarded, in writing, to the A/E for their review and formal response to the Contractor. All submittal and shop drawing reviews by the BECxA will occur prior to review by the A/E, when possible. When applicable, the BECxA will provide written mark-ups of the shop drawings to the A/E. Air barrier shop drawings are required on all projects.

b. In general, the Contractor will complete CCs for all assemblies and systems prior to formal performance testing of equipment or subsystems of the given system. These checklists will be reviewed by and as needed commented on by the BECxA

c. The Contractor will arrange and schedule a Pre-Construction Trade Orientation Meeting, prior to the commencement of the building envelope mock-up or building envelope construction, to be chaired by the BECxA. Topics covered during the meeting would include, but not necessarily be limited to, inspection and testing procedures, review of plans and specifications, review of shop drawings, construction schedule and sequencing, material selection and compatibility, and other installation concerns. This meeting may also serve as the building envelope commissioning kick-off meeting or they may be separate meetings.

d. Mock-ups of the critical envelope components shall be constructed and tested prior to the commencement of building envelope construction in order to verify the performance of the systems and to set construction standards and material selection for the duration of the project. Components required in the mock-ups will be as identified in the relevant sections of the Project Specifications and Architectural Drawings. Construction of the mock-up is to be observed and documented by the BECxA. Once completed, the Contractor will provide confirmation of completion to the BECxA and A/E. The completed mock-up will then be reviewed by the BECxA and A/E for compliance to the Contract Documents. Once the mock-up has been visually observed for compliance to the Contract Documents, the mock-up will be tested to ensure adherence to the performance requirements set forth in the Contract Documents. The testing protocol will be as identified in the Contract Documents in the Functional Performance Test Specification developed by the BECxA and approved by the A/E during the Design Phase. Should failures occur during mock-up testing, the Contractor shall investigate the source of the failure and propose a remediation strategy for review and comment by the BECxA and A/E, and install the approved repair work. The mock-up shall be retested until passing results are achieved, prior to full scale construction at the project site. Any repairs or remedial work performed on the mock-up must be documented by the BECxA.

(4) Construction Phase

a. The BECxA will participate in pertinent envelope performance/installation meetings and commissioning meetings as required.
b. The BECxA will participate, in person or via conference call, at least one OAC meeting per month.
c. Upon commencement of building envelope construction and continuing throughout the construction process, on-site inspections will be conducted by the BECxA to review the Work for compliance to Contract Documents and industry standards. Deficiency logs will be generated by the BECxA and repairs tracked with the goal of having a zero punch list project.
d. The BECxA will observe or perform functional performance testing of the building envelope. The field testing protocol will be as identified in the Contract Documents in the Functional Performance Test Specification developed by the BECxA and approved by the A/E during the Design Phase. Failed tests should be retested until satisfactory results are achieved. Additional testing may be performed as determined by the Owner, BECxA, and A/E as outlined in the functional performance test specification. Envelope components and systems shall not be installed on the building or beyond the in situ mock location until testing has demonstrated satisfactory results.
e. The BECx plan will be updated as needed, as this is a living document and may reflect new and/or reduced requirements as directed by the Owner.
f. The BECxA may participate in dispute resolution regarding exterior envelope components/systems and associated performance. The BECxA and the A/E may be relied upon during construction to evaluate compliance with the OPR; to provide and vet out alternative solutions; and to evaluate the associated risks.

(5) Post-Occupancy Phase

a. The BECxA will finalize the BECx plan and the final commissioning report with respect to the building envelope.
b. The BECxA provides appropriate training to the building maintenance personnel with respect to building envelope maintenance.
c. The BECxA will provide a site review and follow-up meeting 10 months post-occupancy. A written post-occupancy site visit report will be incorporated into the Building Envelope Commissioning Record.

G. Guidelines for performance criteria and associated functional performance testing commissioned systems/assemblies are as follows below. The BECxA may deviate from the general recommendations below to suit project needs. Section 5.16 lists Referenced Standards and Codes which can be applied to the building envelope functional performance testing plan.

(1) Water

a. In general, water testing on a façade surface shall be in accordance with ASTM E 1105 or AAMA 501.1. Project test pressures will be based on the wind load calculations per ASCE 7 in conjunction with the rated performance of specified products per AAMA 101 with a minimum 6.24 psf differential pressure. Water leakage shall be defined as any water that is interior to the primary plane of air tightness (whether visible or not from the interior) that is not positively drained to the exterior. Detailed water penetration resistance requirements are outlined in Appendix G.

(2) Vapor

a. A continuous vapor barrier (or vapor retarder) must be provided to all exterior opaque walls, roofing, below grade foundation walls and slabs, and slab-on-grade conditions as determined by appropriate hydrothermal analysis. This vapor barrier shall be sealed at all interfaces, fenestrations, penetrations, etc. A vapor barrier (or vapor retarder) is defined as materials with vapor permeability below 1.0 perm per ASTM E96 desiccant or dry cup method (Class I or Class II per 2012 IBC).

i. Testing is not required, but visual inspections of installed work are required. High Performance structures require vapor barriers to be included in the performance mock-up.

(3) Air

a. In general, air testing is performed in accordance with ASTM E 1186, ASTM E 783, and ASTM E 779. Detailed performance criteria are identified in Appendix G

5.14 Incentives and Rebates

A. Utility sponsored incentive and rebate programs when properly leveraged offer project additional cause to implement energy efficient strategies into the State's facilities. It is the intent of DFCM to obtain, in a timely manner, all possible gas and electric utility incentives and rebates for the *prescriptive or typical* measures included in their new building projects.

(1) *Prescriptive* energy efficiency measures are defined as those that propose equipment/systems that exceed existing building energy code and have incentives or rebates paid based on the type, size, and quantities of high efficiency equipment installed.

B. This section of the HPBS and its supporting appendices provide information about the incentive and rebate process as well as guidance to project teams on how to best navigate both Rocky Mountain Power (RMP) and Questar Gas Company's (QG) programs.

(1) As of July 1st, 2014 only RMP and QG are the only utility providers in Utah who offer whole building program incentives and rebates. Therefore this section is oriented towards the programs that they currently offer. If, at a later time, local municipal utility companies offer incentive and rebate programs, the DFCM will utilize those programs, when possible, to further energy efficiency in State's facilities.

C. Incentive and rebate opportunities shall be properly identified in the design phase of each project.

D. Possible incentive and rebate values for specific energy efficiency strategies shall be incorporated as a separate line item in the LCCA required in section 5.5.

E. In the case where the incentive and rebate program conflicts with the sections within the HPBS that conflict shall be made know to the DFCM Energy Program Director, who will then discuss the conflict with the project team.

F. The architect is ultimately responsible for the design team performing their assigned tasks and obtaining all utility incentives and rebates.

G. Custom energy efficiency measures (EEMs), are to be identified and handled by the design team by reporting them, as soon as they are identified, to the DFCM Energy Program Director who will coordinate with the proper utility.

H. Appendix H, and Appendix I provides a road map for how the project's prescriptive measure incentives are to be obtained. Deviations from the process outlined in this appendix must be approved by DFCMs Energy Program Director.

5.15 Owner's Project Requirements

A. A concise OPR must be developed by the design team and owner during the project programming phase, or by the midpoint of schematic design, for projects without a programming phase.

(1) For projects with a programming phase, the OPR is required to be complete and included in the project program.

(2) For projects without a programming phase the, the OPR is required to be complete and included in the schematic design review set.

B. Once the initial OPR and BOD are developed by the design team and the Commissioning Agent (CxA) has been integrated into the project, it is to be reviewed by the CxA at the SD, DD and CD submittal.
C. Changes to the OPR and BOD, from one design phase to the next, must be documented by the design team.
D. Sections that must be included in the OPR are detailed in Appendix F. Coordination with DFCM's Design Requirements[6] is required.

5.16 Referenced Standards

American Architectural Manufacturers Association

a. AAMA 101-2011 North American Fenestration Standard/Specification for Windows, Doors, and Skylights
b. AAMA 511-08 Voluntary Guideline for Forensic Water Penetration Testing of Fenestration Products
c. AAMA 501.1-05 Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

American Society of Civil Engineers

a. ASCE 7 Minimum Design Loads for. Buildings and Other Structures

American Society of Heating, Refrigerating and Air-Conditioning Engineers

a. ASHRAE Standard 90.1-2010 -- Energy Standard for Buildings Except Low-Rise Residential Buildings

ASTM International

a. ASTM C90-14 Standard Specification for Loadbearing Concrete Masonry Units
b. ASTM C91/C91M-12 Standard Specification for Masonry Cement
c. ASTM C144-11 Standard Specification for Aggregate for Masonry Mortar
d. ASTM C150/C150M-12 Standard Specification for Portland Cement
e. ASTM C207-06(2011) Standard Specification for Hydrated Lime for Masonry Purposes
f. ASTM C270-12a Standard Specification for Mortar for Unit Masonry
g. ASTM C370-12 Standard Test Method for Moisture Expansion of Fired Whiteware Products
h. ASTM C595/C595M-13 Standard Specification for Blended Hydraulic Cements
i. ASTM C794 Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
j. ASTM C1060 Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
k. ASTM C1153 Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging
l. ASTM C1157/C1157M-11 Standard Performance Specification for Hydraulic Cement
m. ASTM C1193 Guide for Use of Joint Sealants
n. ASTM C1258 Test Method for Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation
o. ASTM C1329/C1329M-12 Standard Specification for Mortar Cement
p. ASTM C1384-12a Standard Specification for Admixtures for Masonry Mortars
q. ASTM C1400-11 Standard Guide for Reduction of Efflorescence Potential in New Masonry Walls
r. ASTM C1498-04a(2010)e1 Standard Test Method for Hygroscopic Sorption Isotherms of Building Materials
s. ASTM C1715 Standard Test Method for Evaluation of Water Leakage Performance of Masonry Wall Drainage System
t. ASTM D5957-98(2013) Standard Guide for Flood Testing Horizontal Waterproofing Installations

[6] http://dfcm.utah.gov/downloads/design_manual/design_requirements.pdf

u. ASTM E783-02(2010) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
v. ASTM E1105-00(2008) Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
w. ASTM E1186-03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
x. ASTM E2357-11 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
y. ASTM E2112-07 Standard Practice for Installation of Exterior Windows, Doors and Skylights
z. ASTM E2178-13 Standard Test Method for Air Permeance of Building Materials
aa. ASTM E779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
bb. ASTM E2813 Standard Practice for Building Enclosure Commissioning

Canadian Standards Association
a. CSA Z320-11 – Building Commissioning Standard & Check Sheets

Institute of Transportation Engineers
a. 4th Edition Parking Generation Guide

International Code Council
a. AC38-2013 Acceptance Criteria for Water-Resistive Barriers
b. 2012 International Building Code
c. 2012 International Energy Conservation Code

National Institute for Building Sciences
a. NIBS Guideline 3-2012 Building Enclosure Commissioning Process

5.17 Definitions

Baseline – The performance level used for comparison to the above standard design.

Basis of Design – Formal documentation of the primary decision-making process and assumptions behind design decisions made to meet the OPR.

Building Analytics – Software programs that utilize data provided by building management systems (BMS) to deliver automated fault detection, diagnosis and real-time performance monitoring. Applications include building commissioning, equipment fault detection, energy analysis, load profiling, facility benchmarking, asset performance tracking, and carbon and greenhouse gas reporting.

Building Commissioning - A systematic and documented process of ensuring that the owner's operational needs and performance requirements are met. Additionally the process ensures that building systems perform efficiently and building operators are properly trained. Then intent of the process is to set the stage for facility operators to operate the building as intended in the building design. A Commissioning Agent (CxA) is generally responsible for implementing the building commissioning process.

Building Envelop Commissioning - Building Envelop Commissioning (BECx) is a process involving evaluation, verification, and documentation that a building's design and construction meet defined performance expectations. BECx begins at the project inception and continues through the start of the Operations and Maintenance Phase. A Building Envelop Commissioning Agent (BECxA) is generally responsible for implementing the building commissioning process.

Cost Estimator – Consultant responsible for providing a forecast of construction cost prepared on the basis of a detailed analysis of materials and labor for all items of work. Note that this is different

from preliminary estimates of construction costs based on area, volume or other conceptual estimating techniques often provided by the owner or architect.

Design Build – Design build is defined as the selection of the qualified design build entity through a competitive process which may require evaluation of the concept design and project cost, along with other criteria. The procurement of architect-engineer services and construction services by the use of a single contract with the design build provider.

Design Team – Consultants providing design services to the project, including but not limited to, Architects, Mechanical Engineers, Electrical Engineers, Civil Engineers, Landscape Architects, Acoustical Engineers, Kitchen Designers.

Direct/Site Emissions - Emissions from fuel that is directly burned at the building for heating, electricity generation or other facility operations.

General Contractor – Contractor providing construction management, cost estimating and general contracting services, including and not limited to supporting subcontractors.

High Performance Building Standard (HPBS) – The requirements and process outlined within DFCM's Design Requirements, section 5.0, that require State buildings to be designed and built in such a manner to optimize energy efficiency, durability, life-cycle performance, water efficiency, material resources, occupant comfort and productivity.

High Performance Building Standard Workshop – Formal collaboration and coordination meetings in which various goals and strategies related to the HPBS are identified and evaluated in the context of the project. See Appendix? – HPBS Workshop Suggested Agenda.

Indirect/Source Emissions - Emissions associated with energy purchased from a utility, such as emissions generated from the generation of electricity at a coal fueled power plant.

Life Cycle Cost Analysis - Life-cycle cost analysis (LCCA) is a method for assessing the total cost of facility ownership. It takes into account all costs of acquiring, owning, and disposing of a building or building system. LCCA is useful when project alternatives that fulfill the same functional requirements, but differ with respect to initial costs, operating costs and performance, have to be compared in order to select the one that maximizes net savings.

Owner – One or more of the following, DFCM Project Manager, Facility Operator, Facility Manager, DFCM Energy Program Director, Agency Energy Manager, DFCM, State Institution, State Agency, or other governmental entity that DFCM is providing project management services for.

Owner's Project Requirements (OPR) – A formal document created in the programming phase that provides a basis for the project's functional and performance requirements. This document is intended to provide an explanation of ideas, concepts and requirements that are important to the owner. It is to be initially completed by the Architect with input from the owner and other parties as necessary. See Section 5.15 – Owner's Project Requirements

State Agency - Any state agency, board, commission, department, or division

State Institution –Institutions referring to the University of Utah, Utah State University, Southern Utah University, Weber State University, Snow College, Dixie State University, College of Eastern Utah, Utah Valley University, Salt Lake Community College, Utah College of Applied Technology, and any other university or college which may be established and maintained by the state

5.18 Appendices

A. Data Points List – Section 5.11
B. Energy Modeling Spreadsheet – Section 5.5

C. Life Cycle Cost Worksheet – Section 5.5
D. HPBS Sustainability Worksheet – Section 5.6, 5.7, 5.8, 5.
E. HPBS Workshop Suggested Agenda – Section 5.1
F. OPR Required Sections – Section 5.15
G. Envelope Commissioning Matrix – Section 5.13
H. Incentives and Rebates Process Guidelines – Section 5.14
I. Incentives and Rebates Responsibility Matrix – Section 5.14

ATTACHMENT "G"

SWATC
BUILDING ENCLOSURE
COMMISSIONING REQUIREMENTS

SECTION 019115 BUILDING ENCLOSURE COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work under this Section is subject to requirements of the Contract Documents, including the Owner's General Conditions and articles of the Construction Manager's General Conditions.

B. This section includes the commissioning requirements for the Building Enclosure systems. Refer to Section 019117 for Building Enclosure Functional Performance Testing.

1. The commissioning requirements for the Building Enclosure systems given in this section are entirely separate from, and in addition to, the General Commissioning Requirements for this project. The General Contractor (GC), Subcontractors, and Suppliers are required to participate in both commissioning processes as required and any supplemental General Commissioning requirements.

1.02 DESCRIPTION

A. Building Envelope Commissioning (BECx) is a systematic process of ensuring all building enclosure systems responsible for environmental separation perform interactively according to the Owner's Project Requirements and the Architect's Basis of Design. The BECx process is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify and document proper installation and performance of building envelope materials and systems.

2. Provide Owner with functional building envelope systems with minimal performance problems at project completion.

B. Commissioning does not take away from, or reduce responsibility of, system designers or installing contractors to provide a finished and fully functioning product.

C. This section shall in no way diminish the responsibility of the Division 03, 04, 07, 08, and 09 Contractors, Sub-contractors and Suppliers in performing all aspects of work and testing as outlined in the Contract Documents. Any requirements outlined in this section are in addition to requirements outlined in Division 03, 04, 07, 08, and 09.

1.03 RELATED WORK

A. Specific building enclosure commissioning requirements are given in this specification. The following specification sections are related to the commissioning work specified in this section:

1. General Commissioning Requirements: Refer to 019113
2. Building Envelope Functional performance testing: Refer to 019117
3. Basic Concrete Requirements: Refer to Division 03
4. Basic Masonry Requirements: Refer to Division 04
5. Basic Waterproofing, Roofing, Air Barrier and Insulation Requirements: Refer to Division 07
6. Basic Fenestrations Requirements: Refer to Division 08
7. Basic Finishing Requirements: Refer to Division 09

1.04 ABBREVIATIONS

A. The following are common abbreviations used in the Specifications (definitions are found further in this Section):

1. A/E - Architect and Design Engineers
2. BECA – Building Enclosure Commissioning Agent
3. CxA - Commissioning Agent - Refer to Section 01 9100
4. CM - Construction Manager
5. CT - Commissioning Team
6. Cx - Commissioning
7. Cx Plan - Commissioning Plan
8. FPT - Functional Performance Test
9. OR - Owner's Representative
10. O&M - Operations & Maintenance
11. RFI - Request for Information

1.05 DEFINITIONS

A. Approval: Acceptance that a material or system has been properly installed and is functioning in tested modes according to the Contract Documents.

B. Architect/Engineer (A/E): Prime consultant (architect) and sub-consultants who comprise the design team, generally the Architect of Record and any Design Sub-consultants.

C. Basis of Design (BOD): Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to meet intent.

D. Building Enclosure Commissioning Agent (BECA): Contracted to Owner through the CxA. BECA directs and coordinates day-to-day building enclosure commissioning activities independently from CxA.

E. Commissioning Agent (CxA): Contracted to Owner. CxA directs and coordinates day-to-day commissioning activities excluding BECx activites. CxA reports directly to Owner.

F. Commissioning Plan: Overall plan developed after bidding that provides structure, schedule, and coordination planning for commissioning process. A specific building envelope section will be added into the project's commissioning plan.

G. Contract Documents: Documents binding on parties involved in construction of this project (drawings, specifications, change orders, amendments, contracts, etc.).

H. Construction Manager: Contracted directly to Owner.

I. Deficiency: Condition of a building envelope material or system that is not in compliance with Contract Documents (that is, does not perform properly or is not complying with design intent).

J. Functional Performance Test (FPT): Test of performance of building envelope materials and systems. Systems are tested under various simulated environmental conditions, such as air leakage under pressure differential and water leakage under pressure differential with water spray.

K. Simulated Condition: Condition created for testing component or system (e.g., applying pressure differential across the building envelope concurrent with water spray to simulate a wind driven rain).

L. Specifications: Construction specifications of Contract Documents.

M. Mock-up: The activities where systems or materials are initially constructed and tested.

N. Sub-contractor: Contractors of CM, and their Sub-contractors, who provide and install building envelope components and systems.

1.06 COORDINATION

A. Commissioning Team: Members of the Commissioning Team (CT) will consist of:

1. Commissioning Agent (CxA)
2. Building Envelope Commissioning Agent (BECA)
3. Building Envelope Testing Agent (BETA)
4. Owner's Representative(s) (OR)
5. General Contractor (GC)
6. Architect and Design Engineers (A/E)
7. Building Envelope Subcontractors

B. Management: Owner will contract services of the BECA through the CxA. The BECA will direct and coordinate commissioning activities and report to the OR. All members of the Commissioning Team shall cooperate to fulfill contracted responsibilities and objectives of the Contract Documents.

C. Scheduling:

1. BECA will work with commissioning team to establish required commissioning activities to incorporate in preliminary commissioning schedule. The GC will integrate commissioning activities into master construction schedule. Necessary notifications are to be made in a timely manner in order to expedite commissioning.

1.07 SUBMITTALS

A. A/E or General Contractor shall provide BECA with documentation required for commissioning work. At minimum, documentation shall include: General Commissioning Requirements and performance data and any performance test procedures. In addition, installation and checkout materials shall be submitted to BECA.

B. BECA shall review submittals concurrent with the A/E for conformance as it relates to commissioning.

PART 2 PRODUCTS – Part not used.

PART 3 EXECUTION

3.01 SYSTEMS TO BE COMMISSIONED

A. Building Enclosure

1. Below Grade Systems, Roofing Systems, Opaque Wall/Cladding Systems, Fenestration Systems responsible for providing the following functions:

a. Air barrier
b. Vapor barrier
c. Insulation
d. Waterproofing

3.02 RESPONSIBILITIES OF COMMISSIONING TEAM MEMBERS DURING CONSTRUCTION PHASE

A. Architect/Engineer (A/E)

1. Document design intent of systems.
2. Review and incorporate building envelope commissioning specification and functional performance test specification into the construction documents.
3. Provide construction documents electronically.
4. Review BECA comments on construction document and shop drawings

5. Assist in dispute resolution regarding building envelope items.
6. Review BECA reports

B. Building Enclosure Commissioning Agent (BECA)

1. Participate in an initial team conference call to identify/document the OPR.
2. Develop BECx plan.
3. Develop BECx Requirements specification.
4. Develop Building Enclosure Functional Performance Test specification.
5. Review one progress set of architectural drawings and specifications at 90% construction document development pertinent to the building enclosure and perform one back-check review of the design review comments.
6. Review shop drawings and submittals prior to or concurrent with the A/E reviews.
7. Observe and document the construction of the mock-up.
8. Attend the pre-construction/BECx meeting.
9. Finalize the commissioning plan.
10. Field monitor installation of exterior enclosure components against construction documents and manufacturer's instructions. Includes site visits to observe the testing of building enclosure components and assemblies.
11. Finalize commissioning records and close-out documents.

C. General Contractor (GC)

1. Attend commissioning kick-off meeting and other commissioning team meetings.
2. Incorporate commissioning activities into the construction schedule.
3. Periodically update commissioning activities in the construction schedule.
4. Facilitate cooperation of Sub-contractors in commissioning work.
5. Submit copies of initial and final A/E approved submittals for commissioned system equipment to BECA for review.
6. Review BECA submittal comments.
7. Verify building enclosure materials and assemblies are ready for functional testing.
8. Submit maintenance logs of all interim maintenance or repair tasks performed by Subcontractors.
9. Ensure resolution of non-compliance and deficiencies in construction or test results. Obtain written documentation of completion from the appropriate Sub-contractors.
10. Provide letters of compatibility for adjacent building enclosure materials and assemblies.
11. Facilitate all repairs and retesting of failed condition and pay for all associated costs.
12. Provide all warrantee information to BECA.

D. Sub-contractors/Vendors

1. Review Commissioning Plan and FPT specification.
2. Attend commissioning kick-off meeting and other commissioning team meetings.
3. Notify GC and BECA of work completion.
4. Attend all required material and systems testing.
5. Execute all periodic maintenance or repairs required on started systems from initial mock-up of equipment to final acceptance by Owner to prevent material warranties from being voided.
6. Ensure installation work is complete, is in compliance with Contract Documents, and is ready for Functional Performance Testing. Notify GC that equipment and systems are ready for Functional Performance Testing. FPT test results will be documented by BECA.
7. Provide all warrantee information to GC.

E. Building Enclosure Testing Agency (BETA)

1. Attend commissioning kick-off meeting and other commissioning team meetings.
2. Provide on-site technician and equipment to complete mock-up and field Functional Performance Testing.
3. Prepare and submit reports at the conclusion of all testing.

4. Perform retesting and prepare corresponding reports.

3.03 BUILDING ENVELOP COMMISSIONING TEAM (BECx) MEETINGS

A. BECx meetings will be held periodically as determined by BECA.

B. Discussions held in BECx meetings shall include, but not be limited to, system/materials, mock-up/field, progress, scheduling, testing, documentation, deficiencies, and problem resolution.

3.04 REPORTING

A. BECA will provide status reports to GC, CxA, A/E and Owner as needed.

B. BECA shall submit non-compliance and deficiency reports to GC, CxA, A/E and Owner as needed.

C. BECA shall provide a final summary report to CxA and Owner.

3.05 MOCK-UP AND FINAL CONSTRUCTION

A. GC and Sub-contractors shall verify completion of all assemblies compliant with project documents and deficiency log items prior to functional performance testing or concealment of functional performance layers within the building envelope.

3.06 FUNCTIONAL PERFORMANCE TESTING

A. Objectives and Scope

1. The objective of Functional Performance Testing is to demonstrate each system is operating according to documented design intent and Contract Documents. Functional Performance Testing facilitates bringing systems from a state of substantial completion to fully operational. Additionally, during Functional Performance Testing, areas of deficient performance are identified and corrected, improving operation and functioning of systems.

B. Development of Test Procedures

1. The purpose of a specific test is to verify and document compliance of the installed enclosure systems with the OPR. The BECA shall develop specific test procedures for inclusion in Specification Section 019117 – Building Envelope Functional Performance Testing

C. Coordination and Scheduling

1. GC will provide sufficient notice to BECA regarding completion schedule for materials and systems. GC will schedule Functional Performance Tests with CT. BECA shall witness and document functional testing of equipment and systems. BETA shall execute tests under direction of BECA. BETA may be the same entity as the BECA if deemed the best value to the project.

2. Successful completion of mock-up functional performance testing shall occur prior to full production installation of building envelope materials and systems.

3.07 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

A. Documentation

1. BECA will witness and document results of FPT.

B. Non-Conformance

1. BECA will record results of functional testing. Deficiency or non-conformance issues will be noted and reported to GC, CxA and Owner.

2. Corrections of minor deficiencies identified may be made during tests at discretion of BECA. In such cases, deficiency and resolution will be documented.

3. Every effort will be made to expedite testing and minimize unnecessary delays, while not compromising integrity of tests. BECA shall not overlook deficient work or loosen acceptance criteria to satisfy scheduling or cost issues unless directed to do so by the Owner.

4. Deficiencies are handled in the following manner:

   a. When there is no dispute on deficiency and Subcontractor accepts responsibility for remedial action:

      1) BECA documents deficiency and Sub-contractors response and intentions and they go on to another test or installation. BECA submits deficiency report to GC, CxA and Owner. Copy is provided to Sub-contractor by GC. Sub-contractor corrects deficiency and certifies that material or assembly is ready to be retested. GC informs CT of retesting schedule.

      2) GC reschedules test with BECA and BETA.

   b. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

      1) BECA documents deficiency and Contractor's response. BECA submits deficiency report to GC, CxA and Owner. Copy is provided to Sub-contractor by GC.

      2) GC facilitates resolution of deficiency. Other parties are brought into discussions as needed. Final interpretive authority is with A/E. Final acceptance authority is with the Owner.

      3) GC documents resolution process.

      4) Once interpretation and resolution has been decided, appropriate party corrects deficiency, GC reschedules test, and test is repeated until satisfactory performance is achieved.

C. Cost of Testing

1. Costs for the initial testing located within this specification sections shall be the responsibility of the owner. The contractor is to provide access to the test specimens to the CT.

D. Cost of Retesting

1. Costs for all retesting will be the full responsibility of the GC and Subcontractors. These costs include all access, equipment, labor, and materials required to complete the retesting including the BECA fees.

<u>3.08 COMMISSIONING DOCUMENTATION</u>

A. Final Report Details

1. Final commissioning report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, and general description of testing and verification methods. Report will contain evaluation regarding:

    a. Conformance to specifications and design intent
    b. Material/system installation
    c. Functional performance

2. All outstanding non-compliance items will be specifically listed.

3. Recommendations for improvement to system or operations, future actions, etc. will also be listed.

END OF SECTION

ATTACHMENT "G"

SWATC
BUILDING ENVELOPE COMMISSIONING FUNCTIONAL PERFORMANCE TEST PROTOCOL

SECTION 019116 - BUILDING ENVELOPE COMMISSIONING – FUNCTIONAL PERFORMANCE TEST PROTOCOL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section. Division 7 and 8 Specification Sections also apply to this section. Where conflicts arise regarding building envelope testing, this Section shall supersede other Sections where contradictions occur.

1.2 TESTING AGENCY

A. The Owner or MEP Commissioning Agent (CxA) shall retain a Building Envelope Testing Agency (BETA) to perform the testing identified below. The BETA may be, and is often, the same entity as the Building Envelope Commissioning Agent (BECA). BECA/BETA qualifications as identified in Building Envelope Commissioning Specification Section.

1.3 PERFORMANCE CRITERIA

A. All functional performance tests shall be conducted in conformance with project performance requirements as set forth in the Construction Documents and below:

B. Air and water performance criteria summary table according to each component:

Component	Performance Criteria	
	Air	**Water**
Curtain Wall/ Fenestrations	ASTM E 1186 (4.2.7) – No major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s)	AAMA 501.1/ ASTM E 1105 - No uncontrolled water leakage when tested under a pressure difference of 8.00 lbf/sq. ft
	ASTM E 783 – Maximum air leakage of .09 cfm/ft at an air pressure differential of 6.24 psf	
Skylights	ASTM E 1186 (4.2.7) – No major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s)	ASTM E 1105 - No uncontrolled water leakage when tested under a pressure difference of 8.00 lbf/sq. ft
Air Barrier / Carrier Panel Assemblies	ASTM E 1186 (4.2.6) – Pass/fail criteria shall be no bubbles observed in the leak detection liquid.	
	ASTM E 783 – Maximum air leakage of .04 cfm/ft at an air pressure differential of 1.57 psf	
	ASTM E 1186 (4.2.7) – No major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s)	

	ASTM E 779 – 0.10 cfm/sf at 1.57 psf	
Roofing Systems / Plaza Deck	ASTM E 1186 (4.2.6) – Pass/fail criteria shall be no bubbles observed in the leak detection liquid.	ASTM D5957 – No leaks through membrane/roof deck after 72 hours of 2” water pond exposure.

C. Unless specifically noted below, all costs to complete the initial testing shall be borne by the Owner and the costs of all retesting as a result of failed tests shall be borne by the Contractor.

D. Water leakage is only acceptable if all of the following conditions are satisfied:

1. Water is contained and drained to the exterior.
2. There is no wetting of a surface that is visible to the building occupants.
3. There would be no staining or other damage to the completed building or finishes.

E. Where testing indicates that performance requirements are not met, the contractor shall repair or replace the failed section and a re-test conducted. Any repairs should be conducted with inspection by the BECA. Re-testing shall be conducted by the BETA. All costs associated with the repair and re-testing shall be the responsibility of the contractor.

1.4 MOCK-UP TEST REQUIREMENTS

A. A building envelope mock-up shall be constructed and tested prior to commencement of installation of building envelope components responsible for providing environmental separation. Testing will be conducted on the installed fenestration, metal carrier panels, and representative penetrations through the carrier such as fasteners. This testing will occur prior to and after installation of the spray foam, but prior to the installation of any exterior claddings in both cases. Interior finishes, interior gypsum wall board, or insulation should not be installed prior to mock-up testing. The mock-up will be a four sided box with three of the four sides representing façade conditions and the remaining side being completed with studs, sheathing and air barrier to form a complete airtight envelope, but provide access (door or removable panel) to the interior of the mock-up. The mock-up roof including all interfacing with the facade will also be representative of the project details. For certain building components that are not included in the free standing mock-up, separate mini mock-ups that are the first installed on the building to remain are acceptable.

B. The coordination, construction and completion of the mock-up construction are the responsibility of the General Contractor. It is the responsibility of the General Contractor to construct and repair the test chamber as necessary to create an air-tight chamber. Mock-up test chambers are typically constructed of steel framing, exterior sheathing, and a sheet applied air barrier. Prior to testing, the BETA will pressurize the test chamber, while simultaneously supplying smoke to the chamber. Any voids in the chamber air barrier will be identified and sealed to create an air-tight chamber. The General Contractor shall permit inspections of the mock-up to the BECA and BETA and any member of the building envelope commissioning team throughout construction and testing as required.

C. It is left to the discretion of the O and/or A/E to have all exterior insulation, claddings, etc. installed after the completion of mock-up testing.

D. Water leakage is only acceptable if all of the following conditions are satisfied:

a. Water is contained and drained to the exterior.
b. There is no wetting of a surface that is visible to the building occupants.
c. There is / would be no staining or other damage to the completed building or finishes.

E. The following test protocol shall be completed after installation of air barrier/carrier panel including all flashings, fenestration assemblies, and all penetrations through the air barrier/panels, but prior to installation of exterior cladding and interior finishes and prior to installation of spray foam:

1. ASTM E 1186-03 method 4.2.7, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; Use pressurization and smoke tracers to identify leak locations through the mock-up chamber and the face of the mock-up. All leaks through the mock-up chamber must be sealed prior to commencing ASTM E 283 testing. Pass/fail criteria shall be no major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s).

2. ASTM E 1186-03 method 4.2.6, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; Use chamber depressurization and site detection liquid at penetrations through the air barrier (e.g. fastener penetrations). Pass/fail criteria shall be no bubbles observed in the leak detection liquid. A minimum of 5 locations at each type of fastener (fasteners at masonry anchors, girts, or other cladding receptors) shall be tested. Testing may require special installation of any continuous girts or cladding receptors such that dome can be placed completely around girt or receptor (Dome has diameter or approximately 18 in.) This is typically accomplished by installing and fastening a 12 in. portion of the girt or receptor.

3. ASTM E 283-04, Standard Test Method for Determining the rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; Measured air flow through fenestration assemblies shall not exceed 0.06 cfm/sq.ft. when tested under a pressure difference of 6.24 lbf/sq. ft.. Measured air flow through air barrier assemblies shall not exceed 0.04 cfm/sq.ft. when tested under a pressure difference of 1.57 lbf/sq. ft.

4. ASTM E 331-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; Pass/fail criteria shall be no uncontrolled water leakage when tested under a pressure difference of 8.00 lbf/sq. ft.

5. AAMA 501.1, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors using Dynamic Pressure; Pass/fail criteria shall be no uncontrolled water leakage when tested under a pressure difference of 8.00 lbf/sq.ft..

F. The following test protocol shall be completed after installation of the interior spray foam:

1. ASTM E 1186-03 method 4.2.7, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; Use pressurization and smoke tracers to identify leak locations through the mock-up chamber and the face of the mock-up. All leaks through the mock-up chamber must be sealed prior to commencing ASTM E 283 testing. Pass/fail criteria shall be no major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s).

2. ASTM E 1186-03 method 4.2.6, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; Use chamber depressurization and site

detection liquid at penetrations through the air barrier (e.g. fastener penetrations). Pass/fail criteria shall be no bubbles observed in the leak detection liquid. A minimum of 5 locations at each type of fastener (fasteners at masonry anchors, girts, or other cladding receptors) shall be tested. Testing may require special installation of any continuous girts or cladding receptors such that dome can be placed completely around girt or receptor (Dome has diameter or approximately 18 in.) This is typically accomplished by installing and fastening a 12 in. portion of the girt or receptor.

3. ASTM E 283-04, Standard Test Method for Determining the rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; Measured air flow through fenestration assemblies shall not exceed 0.06 cfm/sq.ft. when tested under a pressure difference of 6.24 lbf/sq. ft.. Measured air flow through air barrier assemblies shall not exceed 0.04 cfm/sq.ft. when tested under a pressure difference of 1.57 lbf/sq. ft.

6. ASTM E 331-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; Pass/fail criteria shall be no uncontrolled water leakage when tested under a pressure difference of 8.00 lbf/sq. ft.

7. AAMA 501.1, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors using Dynamic Pressure; Pass/fail criteria shall be no uncontrolled water leakage when tested under a pressure difference of 8.00 lbf/sq.ft..

8. ASTM D 4541-09, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; Measured air barrier adhesion strength shall not be less than 16 lbf/sq. inch. (Test only conducted after all other tests listed above have been successfully performed since test method is destructive).

G. In the event of water leakage through the test sample either during pre-testing or final testing; additional isolation testing shall be conducted to best determine the location of the water infiltration as required.

H. Where testing indicates that performance requirements are not met, the contractor shall repair or replace the failed section and a re-test conducted. Any repairs should be conducted with inspection and documentation by the BECA. Re-testing shall be conducted by the BETA. All costs associated with the repair and re-testing shall be the responsibility of the contractor.

1.5 FIELDTEST REQUIREMENTS

A. The following test methods shall be performed during the construction phase:

1. ASTM E 1186-03, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems, method 4.2.6 and 4.2.7.

2. AAMA 501.1, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors using Dynamic Pressure

3. ASTM E 1105-00, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

4. ASTM E 783, Standard test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

5. ASTM D 4541-09, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

6. ASTM D5957-98 (Reapproved 2005) Standard Guide for Flood Testing of Horizontal Waterproofing Installations – No leaks through membrane/roof deck after 72 hours of 2.5" (minimum of 1") water pond exposure.

7. ASTM E 779, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization

8. ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Wall by Uniform Static Air Pressure (+40 psf and -40psf, L/240)

B. The field testing should include each main type of claddings, fenestrations, waterproofing and roofing. Testing should include interfaces and be completed prior to finish claddings when possible.

C. Testing will be conducted on the installed building envelope components prior to the installation of any exterior claddings but after the installation of any penetrations, fasteners, etc. Interior finishes, interior gypsum wall board, or insulation should not be installed prior to testing.

D. Dynamic water testing per AAMA 501.1 requires the use of a rough terrain forklift. For all testing, contractor is required to provide necessary lifts, rough terrain forklift with outrigger and utilities (power and water).

E. The following test methods shall be performed as part of the small scale testing protocol as deemed necessary by the O, A/E, and/or BECA:

1. ASTM C 1193-09, Standard Guide for Use of Joint Sealants, Appendix X1 – Method A, Field Applied Sealant Joint Hand Pull Tab

2. ASTM E 1186-03, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems, method 4.2.6.

F. Failure of any tests listed above shall result in subsequent repair and retesting of the failed specimen and the Owner's option to test an additional specimen.

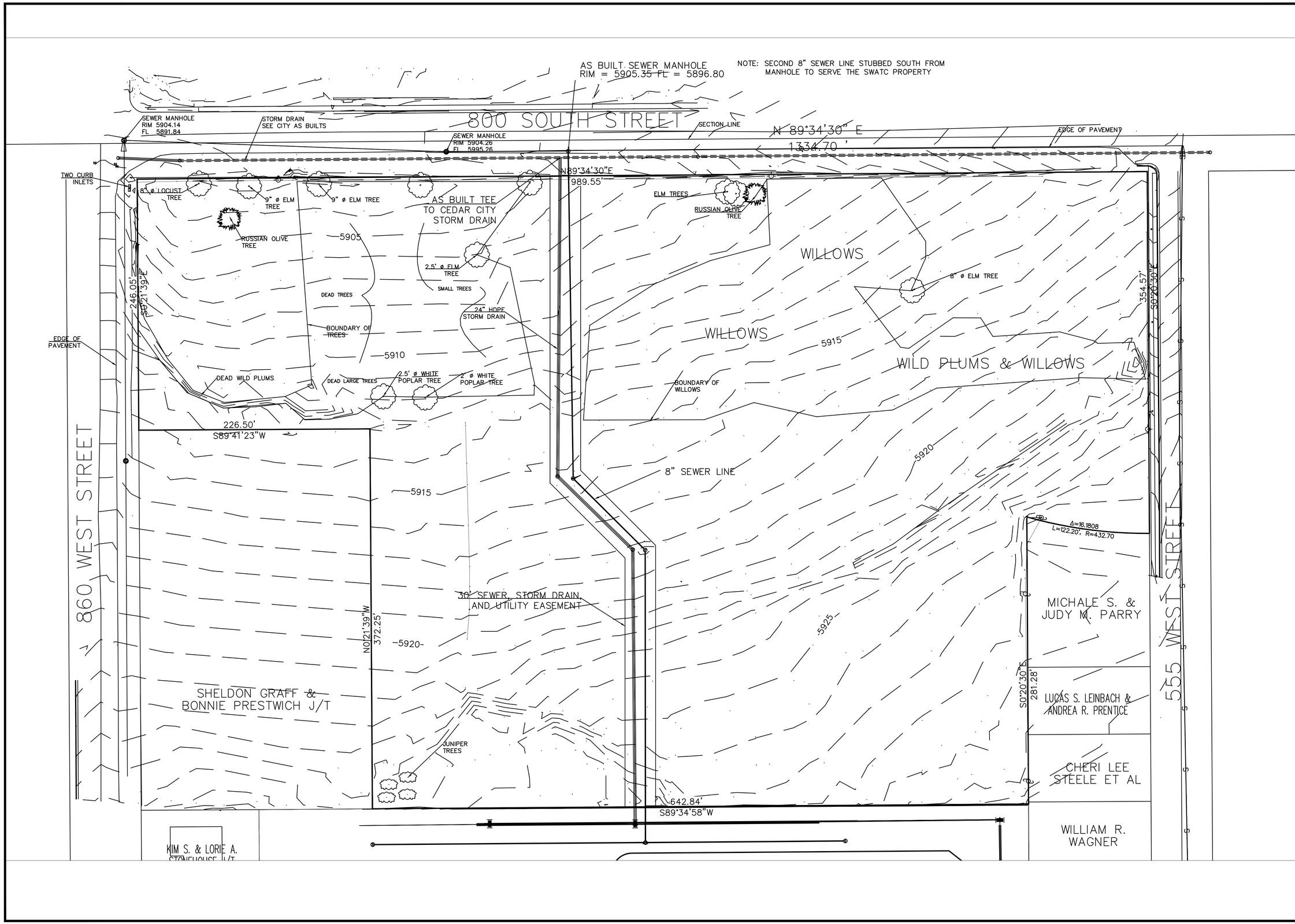
PART 2 – PRODUCTS (Not Used)
PART 3 – EXECUTION (Not Used)

END OF SECTION

ATTACHMENT "H"

SWATC SITE SURVEY DRAWING

PDF & DWG Files



REVISED:

DRAWN BY	DATE	SCALE
K.L. NELSON	JULY, 2014	1" = 40'

DRAWING NAME: C:\2014\SWATC SITE\ATLA SURVEY.dwg

BY: PLATT AND PLATT, INC.
CONSULTING ENGINEERS & SURVEYORS
195 NORTH 100 EAST, CEDAR CITY, UTAH 84720
P.O. BOX 398 CEDAR CITY, UTAH 84721-0398 PHONE: 435-586-6151

SITE SURVEY FOR
SWATC PROPERTY
WITHIN NE1/4 SECTION 22, T. 36 S., R. 11 W., S.L.B. & M.
800 S 750 W. CEDAR CITY, UTH

SHEET 1 OF 1

PROGRAM SUPPLEMENT #2

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