

MEETING NOTES

Construction Documents Meeting 3 (CD 3)

Project:

FCPS - ES Prototype: Waverley ES (WAVES)

GWWO Project #18045

Meeting Date: November 14, 2019 Report Date: December 8, 2019

In Attendance:

Name	Initials	Organization	Email	
Brian Staiger	BS	FCPS	Brian.staiger@fcps.org	
Adnan Mamoon	AM	FCPS	Adnan.mamoon@fcps.org	
Bob Wilkinson	RW	FCPS	robert.wilkinson@fcps.org	
David Davenport	DD	Lutz Engineering	g ddavenport@lutz-engr.com	
Zaira Martinez 🖀	ZM	ECS Ltd.	zmartinez@ecslimited.com	
Dave Toth	DT	Oak Contracting	dtoth@oakcontracting.com	
Jason Hearn	JH	GWWO	jhearn@gwwoinc.com	

The purpose of this meeting was to discuss open action items needing resolution for the project, as well as to review the Building Envelope Commissioning Plan (ECP) drafted by ECS Limited.

- JH asked ZM if the design narratives provided to the State, in their original form or abbreviated, would be sufficient to serve as the Basis of Design document noted in the ECP. ZM confirmed they were and asked JH to send the latest version.
- JH noted that Item 7.2.4 in the Roles and Responsibilities matrix (Appendix II), should be clarified. The Owner's Project Requirements (OPR) is provided by the Owner and reviewed/supplemented by the Architect and BECxA. ZM confirmed that line item would be updated.
- DT led discussion on scope conflicts in the Roles and Responsibilities matrix:
 - Item 7.2.11: Commissioning Meeting Record; meetings that include the BECxA should be documented by the BECxA to avoid information being lost in translation.
 - Items 7.2.12 & 7.2.16: Site Visit Record & Issues Log & Report; site visits by the BECxA should be documented by the BECxA to avoid information/observations being lost in translation.

- Items 7.2.14 & 7.2.16: Training Plans & Systems Manual Update; instructions to the Owner of how to maintain/commission the building envelope should be provided in tandem by the trade contractor(s) and BECxA.
- Items 8.2.1 & 8.2.4: OPR Compliance Update & Deferred Training Record; these items should be provided by the Owner and reviewed/confirmed by BECxA.
- ZA noted that these items are usually handled by a "Prime Agent" hired by the Owner; ECS Ltd. Is currently contracted to serve as an Advisor during Design.
 - BS prefers ECS Ltd. To serve as Advisor during Design and as the Prime Agent during Construction. ZA requested a separate call with BS and DT to discuss scope of work and an agreement to serve as the Prime Agent. BS will set up a meeting/conference call with ZM and Keith Nelson.
 - If ECS Ltd. Is contracted as the Prime Agent, the responsibilities in question will be updated to reflect the impending scope of work. ECS Ltd. will craft minutes and field reports, while Oak will distribute the documents.
- JH provided draft specifications for review prior to the meeting. ZM requested a full table of
 contents so sections subject to review by ECS Ltd. could be highlighted. JH to send the table of
 contents.
- DT questioned where testing and documentation requirements for the CM and trade contractors will be located. Assuming ECS Ltd. is contracted to be the Prime Agent, BS, DT and JH prefer all testing requirements be in the BECxA-crafted Division 1 specification.
- ZM asked the group if the envelope portion of the Enhanced Commissioning LEED credit in v4 was being pursued. JH confirmed it was as most of the tasks ECS Ltd. was undertaking as the BECxA are required for the credit.
- DD asked JH to provide the specification template for the General Commissioning specification sections. JH to send the template.
- JH provided the following updates on WAVES action items.
 - Playground Surfacing:
 - Game Time does offer an extended warranty to 10 years for their poured-in-place rubber surfacing.
 - DT asked about the other distributers/manufacturers on the list. Game Time is usually high on apparatus prices; competition will be affected if others cannot meet the surfacing warranty.
 - o BS asked JH to reach out to the other manufacturers for their extended warranty offerings, if any.

- GWWO has reviewed the security camera markup provided by FCPS and confirmed via e-mail that dedicated cameras are not required in calming rooms, just the seclusion room.
- Jim Barto (ADTEK) has requested information from BS re: demolition of the portables on-site.
 BS confirmed that this had been addressed and that a follow-up meeting with the City about its adjacent lot is pending.
- DT asked about the location of the Limit of Disturbance (LOD) line in the site plans submitted
 to the City. JH explained that ADTEK/Mike Norton (landscape architect) jogged around existing
 specimen trees as a forestation waiver from the City is required prior to including them in the
 project. Jim Barto confirmed that the LOD is subject to change during design/review; DT
 disagreed. JH to follow-up with ADTEK for more clarification on the matter.
- JH asked if there was a specific numbering method or sequence for interior rooms and associated doors. JH confirmed that previous direction re: exterior doors was being followed.
 BS asked JH to submit a floor plan and Excel spreadsheet for markup by FCPS Security.
- JH asked if FCPS has any concerns with access doors from the second level to low roofs. BS and DT confirmed that these doors are permitted, and hardware will match that of penthouse doors.
- Restroom accessibility research is ongoing to ensure FCPS is not open to any potential liability.
- JH requested guidance on a few site plan items:
 - o BS recommends placing the fence closing off the rear triangle of the property 6' to 8' from the bus lane curb to allow for passage of a mower.
 - Does FCPS want a second, static school sign at the Schaffer Drive entrance? BS did not see a need, plus it may not be permitted by the City.
 - O JH asked RW about maintenance issues with trees. ADTEK received guidance from Paul Lebo on other projects to remove trees close to the building, which is why they were omitted from the site plan. RW has no objection with trees if (1) they are required for forest conservation or another functional purpose, and (2) a 10'-20' buffer is provided along the building at maturity. Root growth and species type have not been issues to date. JH explained that trees at the inner courts were intended to provide natural solar protection to south-facing facades, and pedestrian protection from the elements during weather events. JH will markup a plan and send to Brian for review/approval with Paul Lebo and RW.
- JH will be meeting with BS, DT and Kim Day during the next week to review Division 0 specification requirements. JH will confirm receipt of the section outline from DT.

The foregoing represents the writer's interpretations of what transpired at the meeting. Please forward any changes or corrections within five (5) days to jhearn@gwwoinc.com. Otherwise these notes will stand as the final record of the meeting.

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Respectfully submitted, GWWO, Inc./Architects

son T. Hearn, AIA, LEED AP BD+C

Project Manager

Attachments: Building Envelope Commissioning Plan (Draft)

CC: All Attendees

Tammie Smith Keith Nelson Paul Hume

BUILDING ENVELOPE COMMISSIONING PLAN WAVERLEY ELEMENTARY SCHOOL REPLACEMENT

SEPTEMBER 24, 2019
ENGINEERING CONSULTING SERVICES

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I. Vision of the Building Envelope Commissioning Plan

Building Envelope Commissioning (BECx) is a team endeavor that requires detailed planning and leadership. Throughout the Waverley Elementary School building project planning, design, construction, and occupancy phases, the focus is to provide evidence to all stakeholders that the project team has achieved the defined standard for building envelope performance. Due to the integration and connectivity of the elements intended to provide environmental separation within a building, a performance deficiency in one system can result in less than optimal performance in other systems. As stated in the National Institute of Building Sciences (NIBS) Guideline 3, "a successful whole building commissioning process will carefully document and validate interfaces and possible interfaces between interdependent building systems. Even if the building enclosure is the singular focus of this process, coordination among disciplines is essential for success."

To achieve the necessary synergies in between trades, the building envelope commissioning (BECx) process begins at project inception and continues throughout the life of the facility, and includes specific tasks to be conducted during each project phase to verify that design, construction, occupancy, and training meet or exceed the owner's project requirements. The Building Envelope Commissioning (BECx) Provider will draft a BECx plan early in the process as well as update and refine the plan throughout the life of the project as stipulated in the contract documents.

CX HISTORY

Derived from the British naval custom, the origins of commissioning stem back to 1775 when the U.S. Navy commissioned the first ship of the Continental Navy named the Alfred in Philadelphia. This marked the point at which a Navy ship entered active duty service with it's country's military forces. Prior to commissioning, Navy ships *like the Alfred would* undergo "sea trials" to identify any deficiencies needing correction and observe evidence that the ship is meeting its stringent operational performance targets. This overarching team endeavor culminated with intensive familiarization training to the prospective commanding officer and his crew as the project team shared the lessons learned via verification that systems operate as intended.



¹ National Institute of Building Sciences (NIBS) Guideline 3 has been superceeded by ASTM E2813-18a Standard Practice for Building Enclosure Commissioning and ASTM E2947-16a Standard Guide to Building Enclosure Commissioning and is no longer referenced in LEED v4.1.

II. Goals of the Building Envelope Commissioning Plan

In general, the Building Envelope Commissioning Plan describes the framework that the BECxA uses to verify, document and communicate that the performance of the building envelope systems and assemblies meet the project team defined objectives and criteria. The BECx plan should maintain the focus on achieving the owner's operational requirements. This document guides the design team in understanding the impact of BECx in developing and communicating the design intent. The construction manager's roles and responsibilities for executing the construction phase activities of the BECx Plan are captured in the BECx Specification, Section 019100: Exterior Enclosure Commissioning.

The goals as related to Building Commissioning for the Waverley Elementary School construction project are:

- 1. Verify that applicable systems and assemblies are installed according to the contract documents, manufacturer's recommendations, and industry accepted minimum standards to achieve the targeted performance;
- 2. Verify and document the achieved performance of systems and assemblies;
- 3. Satisfy the requirements for obtaining the Energy and Atmosphere Building Envelope Prerequisite for Fundamental Commissioning and Verification of LEED-NC v4; and
- 4. Satisfy the requirements for obtaining the Energy and Atmosphere Credit for Enhanced Systems Commissioning, Option 2 for Building Envelope Commissioning (2 points) of LEED-NC v4.

Section III of this plan lists the activities to be completed as part of this project to meet the aforementioned requirement.

The goals (outcomes) of the BECx Plan in response to identified BECx project goals described above are:

A. Goal #1: Identify Key Roles and Responsibilities

i. Key Team Member Roles

SEPTEMBER 24, 2019

The BECx Team is comprised of the project team members that will be performing BECx tasks included in the project objectives in section III. The typical roles of the BECx team members are summarized below:

BECx Team Role	Contact Name	Title	Organization
Owner	Brian Staiger	Senior PM	Frederick County
			Public Schools
Construction Manager (CM)	Dave Toth	PM	Oak Contracting, LLC
MEP Commissioning Provider	David	Senior Machanical	Lutz Engineering
(CxA)	Davenport	Engineer	
Building Envelope Commissioning	Keith Nelson	Principal	ECS Mid-Atlantic, LLC
Provider (BECxA)	Zaira Martinez	Project Manager	
Architect	Jason Hearn	Architect/Project	GWWO Architects
	* * * * * *	Manager	Y Y Y Y Y Y Y Y
Structural Engineer	Brittany Pavelko	Project Manager	Carney Engineering Group
MEP Engineer	Jeff Alban	President	Alban Engineering
Civil Engineer	Jim Barto	Senior Project Manager	Adtek Engineering
Y			



ii. Key Team Member Responsibilities:

Key responsibilities include but are not limited to the following [KPN1]:

a. Owner:

Owner	
0	Approve the OPR document.
0	Assist the BECxA [KPN2] with the review and finalization of the OPR document.
0	Review and approve the BECx Plans.
0	Participate in BECx meetings.
0	Review and approve OPR, BOD, and BECx Plan modifications through design and construction
0	Review functional performance test procedures as they are developed.
0	Review the Commissioning Issue Logs and assist the BECxA in resolving non-compliance issues
	with third-party contractors.
0	Witness functional performance testing to demonstration of compliance with the functional
	performance testing (FPT). Provide copies of relevant contract change orders or changes to
	the design documents to the BECxA to resolve non-conformances.
0	Grant access to the necessary areas of the building as needed for site investigations and
	testing.
0	Provide final acceptance systems and assemblies.
0	Address warranty issues throughout the project and the warranty period.
0	Coordinate testing that may result in a disruption to building services.

b. Construction Manager (CM):

Construction Manager

- o Coordinate and direct the participation of all contractors in the commissioning process.
- o Submit Construction Checklists for Review by the Owner, Design Team, and CxA.
- o Inform the BECxA of significant changes to the contract documents.
- o Integrate the BECx process into the construction schedule and updates.
- o Attend all BECx meetings during construction.
- o Address any design/construction-related non-conformance issues, documented in the Commissioning Issues Logs, in an expeditious manner.
- Review submittals of commissioned systems for compliance with the contract documents and submit approved copies to the CxA.
- Coordinate building envelope testing as it pertains to the commissioning process, including notification to the CxA/BECxA. It is expected that the contractor will contract for the BECxT.
- o Coordinate static and dynamic testing of systems with ample notice to all parties required including the Owner, CxA/BECxA, and subcontractors.
- o Provide the BIM to the CxA.
- o Provide access to the job site.
- o Coordinate access to areas of the building as needed for site investigation and testing with the owner.
- o Coordinate testing needed by the CxA with the appropriate parties.
- o Coordinate with the owner any testing that may result in disruptions to building services.
- Review Cx testing records and training records.



- Hire third party testing agency as necessary for Building Envelope Commissioning per appropriate specs.
- o Provide access to the job site.
- o Coordinate access to areas of the building as needed for site investigation and testing with the owner.
- o Coordinate testing needed by the CxA with the appropriate parties.
- o Coordinate with the owner any testing that may result in disruptions to building services.
- o Review Cx testing records and training records.
- Hire third party testing agency as necessary for Building Envelope Commissioning per appropriate specs.

c. Building Envelope Commissioning Provider

Building Envelope Commissioning Provider

- Conduct a workshop with the architect/engineer (A/E) and owner to develop the OPR. Review
 the OPR and BOD for coordination between the Owner's operational needs and the design
 intent. Establish standards for measurement and verification for the testing of commissioned
 systems.
- o Conduct commissioning reviews of the design at the 35% design development, 65% design development and 95% construction documents, and 100% final design document.
- o Participate in the building enclosure scoping meeting and develop the building envelope commissioning (BECx) plan.
- o Provide BECx input for the BOD during the, contract document and construction Phases.
- o Provide a BECx specification based on the OPR and BOD developed during the design phases.
- Update commissioning plan based on the OPR and BOD developments during the design phases.
- o Provide pre-bid conference commissioning briefing.
- o Provide commissioning milestone schedule and incorporate into construction schedule.
- Conduct BECx meetings throughout construction.
- o Witness construction methods, materials, and techniques employed on-site.
- o Review documentation developed by the CMc QA/QC program to ensure that construction materials and methods are tested appropriately and frequently to assure consistent quality.
- o Develop the Cx specifications for incorporation into the Project Manual.
- Witness applicable building envelope tests as performed by the Building Envelope Commissioning Testing Agency (BECxT below) and coordinated under the CMc's QA/QC program.
- o Prepare, update and implement the Commissioning Plan.
- o Conduct a Cx process scoping meeting with the contractor and its installing subcontractors to review the commissioning process.
- o Maintain the project issues and opportunities log.
- o Provide input for building envelope systems training.
- o Obtain submittals of commissioned equipment. Submittals shall include:
- Coordination drawings
- Shop drawings, product data
- o O&M manuals
- o Training manuals
- o Equipment suppliers' start-up procedures



- Automatic temperature control sequence of operations
- Review submittals of commissioned equipment to provide review comments and develop Pre-functional Checklists (PFCs).
- Perform periodic site observations.
- o Provide and maintain meeting and site visit records.
- o Provide construction phase commissioning process report and construction checklist.
- o Review warranty items throughout each sequence during Cx meetings.
- Participate in Cx-related activities necessary to fulfill the enhanced commissioning scope per LEED requirements.
- o Review training and update training plan to reflect changes from BOD or deferred training.
- o Coordinate and witness FPT performed by the installing contractors. Report findings and track all deficiencies.
- o Review the Operations and Maintenance (O&M) Manuals for compliance with LEED.
- o Perform the 10-month warranty visit and review building operation with the facility staff to identify and make recommendations to SI.
- o Provide update on OPR and BOD upon building occupancy.
- o Produce the Cx Final Report and Systems Manual.
- o Provide continuous commissioning plan and training update during the building occupancy and operations phase.
- O Conduct a workshop with the architect/engineer (A/E) and owner to develop the OPR. Review the OPR and BOD for coordination between the Owner's operational needs and the design intent. Establish standards for measurement and verification for the testing of commissioned [KPN3]systems.
- o Conduct commissioning reviews of the design at the 35% design development, 65% design development and 95% construction documents, and 100% final design document.
- Participate in the building enclosure scoping meeting and develop the building envelope commissioning (BECx) plan.
- o Provide BECx input for the BOD during the, contract document and construction Phases.
- o Provide a BECx specification based on the OPR and BOD developed during the design phases.
- Update commissioning plan based on the OPR and BOD developments during the design phases.
- o Provide pre-bid conference commissioning briefing.
- o Provide commissioning milestone schedule and incorporate into construction schedule.
- o Conduct BECx meetings throughout construction.
- Witness construction methods, materials, and techniques employed on-site.
- Review documentation developed by the CMc QA/QC program to ensure that construction materials and methods are tested appropriately and frequently to assure consistent quality.

d. A/E Design Team:

A/E Design Team

- o Provide input on OPR and Cx plan.
- o Provide Basis of Design (BOD) document to the BECxA.
- o Review the BECx Plan
- o Review construction checklist submittals during design phase.
- o Update owner's project requirements during design and construction phase, as needed



- Attend BECx design review and construction coordination meetings.
- o Review and provide comments on the commissioning milestone schedule, test procedures, mockups, training, and system manual update during the construction phase.
- o Provide a basis of design update during the construction phase.
- Witness start up of major equipment if required by the Owner.
- O Provide timely response to the BECxA[KPN4] for Requests for Information including clarification of system design, control, or intent.
- o Review owner's project requirements, testing record, training record, and Cx reports during the occupancy and operations phase.
- Provide input for the system manual update, continuous commissioning plan and training update during the occupancy and operations phase.

e. Building Envelope Commissioning Testing Agency (BECxT)

It is anticipated that the BECxT will function as part of the CMc quality control/quality assurance (QC/QA) program. The responsibilities of the BECxT during the Cx process are included in the contract documents and include, but are not limited to:

Building E	Envelope Commissioning Testing Agency
1.	Attend all BECx meetings during construction.
2.	Participate in pre-construction and pre-installation meetings as necessary to review schedules, installation techniques, trade coordination, and required documentation.
3.	Participate in review of construction submittals.
4.	Review the contractor's proposed QA/QC plan and documentation requirements
5.	Provide project specific off-site (if required) and on-site testing utilizing methods prescribed within the contract documents.
6.	Submit observations, and acceptance testing documentation to all concerned parties for review.

B. Goal #2: Facilitate the Exchange of Information (TBD)

The Building Enclosure Commissioning Team uses the communication protocol established in the project specification section XXX – *Administrative Requirements* when communicating with the project team. It is the intent of the BECxA to comply with the Project Coordinator's (in this case, Oak Contracting) procedures for intra-project communications and always resolve action items at the lowest level possible, only escalating issues when direct and substantial response from the responsible party is not attained.

All communication related to the project is considered confidential, and is only shared with individuals who have a direct and necessary influence in the project development, administration, or execution.

ECS

The following table summarizes the BECx method and frequency of communication as interpreted from the project specifications:

	BECxA Communica	tion Protocol during	the Construction Phase			
Activity or Deliverable	When	How	Frequency	Duration		
Requests for Interpretation (RFIs) reviews	As submitted for BECxA review	Procore and/or e- mail	As submitted for BECxA review	Allow seven working days for response[zem5]		
Submittal Reviews	As submitted for BECxA review	Procore and/or e- mail	As submitted for BECxA review	Allow 21 working days for response [ZEM6]		
BECx Kick-off meeting	Before the start of building envelope activities	On-site	Once	Three hours		
Pre-construction meetings	Before the start of building envelope trade activities	On-site	Once per BE system	Four hours		
Construction Checklists	with submittals	Procore and/or e- mail	Once per BE system	N/A		
Schedule site observations	As needed	Telephone and/or e-mail	Estimated 2 site observations per week during building envelope activities or as directed by the Owner	Four hours per field site visit		
Observation reports	After building envelope observation site visit	Automatic e-mails from BECxProvider electronic field reporting tool	Once per building envelope observation site visit	Allow 48 hours for submittal		
Bi-weekly progress meeting	Per project meeting schedule	Remotely	Every two weeks (if needed)	One hour		
Performance testing observations	As established in the performance testing plan	On-site, electronic report to follow via e-mail	Per Pre-functional testing plan	Four hours		
Final Inspection site observations	After completion of building envelope trade activities	On-site, electronic report to follow via e-mail	Once per BE system	Four hours		
10-month site observation	Ten months after substantial completion	On-site, electronic report to follow via e-mail	Once for complete building	Eight hours		



C. Goal #3: Monitor Risks and Opportunities

The Waverley Elementary School construction project does not require the creation of a risk management plan as part of the project specifications. Nevertheless, the BECxA will identify, assess, and mitigate risks that have an impact on overall building life-cycle cost, schedule, and/or performance. The findings will be presented to the Owner and the BECx Team to define the approach to capture and manage root causes. It will be based on the activities on the baseline master schedule, as it will be looking at the tasks in the Project Schedule and other factors for potential risk items.

D. Goal #4: Facilitate the Integration of BECx Activities

The BECxA will manage the Commissioning Process on behalf of the Owner. This process facilitates the owner transfer of their expectations for the building to the design and construction team. The following tasks associated with the Commissioning Process are geared towards serving the Owner's needs and adding value to the project, not least of which is ensuring that all stakeholders are kept in alignment with the OPR.

i. Pre-Design

Pre-Design is a preparatory phase of the project delivery process in which the Owner's Project requirements (OPR) are established and general information about the overall project is gathered, including:

- a. Building Enclosure requirements (e.g. materials, durability, energy efficiency and sustainability goals, life cycle of the building and facility interior conditions);
- b. Community context (e.g. Codes, regulations, standards, guidelines);
- c. Site information and climate conditions;
- d. Owner desired spaces that would occur in proximity to the exterior wall, sub-sequently having a direct relationship to the performance of the building enclosure;
- e. Occupant comfort requirements;
- f. Owner's Training requirements to facilitate maintenance and successful operation of the building enclosure;
- g. Documentation requirements;
- h. Other owner requirements, such as insurance company requirements, facility guidelines or preferred systems/manufacturers;

The OPR developed during Pre-Design should be recognized as a starting point for subsequent design phases. The OPR will continue to evolve during the design phases in order to balance the functional, performance and budgetary criteria of the project.

ii. Design Phase

The design phase is comprised of tasks that verify the Owner's Project Requirements are comprehensively outlined, detailed and specified in the Contract Documents (CD's). Design reviews are performed and documented by the BECxA, and team meetings are held to review and discuss building enclosure systems and their performance for compliance with the OPR. The BECx plan is further refined and the BECx project specific specification is included in the Project Manual.



iii. Procurement Phase

During the procurement phase, the BECxA supports to the Owner and Design Team in reviewing the BECx specification and project impact, as well as providing assistance in responding to RFP/RFQ questions, and evaluating the project bids. At the end of this phase, the BECxA will update commissioning documents after Owner approval at bid award. As the project progresses, the commissioning team assembled during the design phase is augmented as the design and construction progresses and the operational requirements are established.

iv. Construction Phase

The recommended building enclosure commissioning team members during the Construction Phase are to include but are not limited to: Owner, A/E, specialist design sub consultants, CxA, BECxA[KRPN7], Construction Manager, General Contractor, Subcontractors, Manufacturers, Independent Testing Laboratories and others as required by the project. The Commissioning Process activities in this phase, which are performed by the members of the Construction-Phase Commissioning Team, are described in ASHRAE Guideline 0 – The Commissioning Process.

v. Occupancy Phase

In this phase, the commissioning team is preparing for the submittal of the Substantial Completion Document. Active involvement by the BECxA at his significant transition from building the facility to using it is essential to successful completion of the Building Enclosure Commissioning Plan. At this phase, the BECxA is to verify the accuracy of the documentation records required by the Commissioning Plan relative to the acceptance of the completed Building Enclosure.



III. Objectives of the Building Envelope Commissioning Plan

As the project progresses, the commissioning team assembled at the design phase is augmented as the design and construction progresses and the operational requirements are established.

The resulting activities and/or deliverables [ZEM8] in response to the BECx project goals are:

A. BECx Objectives during the Design Phase

i. Building Envelope Design Review

The BECxA will review the provided Owner's Project Requirements (OPR) and the Architect's Basis of Design (BOD) documents. The review and feedback will be provided on the established building envelope performance concepts, criteria, and identified measurable targets. The OPR is a written document that details the goals, concepts, and criteria that are determined by the Owner to be important to the success of the project. The OPR that relates to the building envelope is considered to be a "living document" for the Building Envelope Commissioning (BECx) process and outlines the objectives upon which the Pre-Design, Design, and Construction phases are evaluated.

The BECxA will review the architectural drawings and specifications to evaluate the intended building envelope performance relative to the OPR stated criteria. The review will be performed by architectural, engineering, and/or building science personnel. Conflicts, omissions, constructability, and performance concerns in the design drawings and specifications will be highlighted and recommendations provided for consideration and incorporation into the documents by the designer of record, as appropriate. The scope of our review will include the following items, as appropriate:

- 1. Water control
- 2. Air control
- 3. Thermal control
- 4. Vapor control and drying potential

The review will primarily focus on the following aspects of the documents, as appropriate:

- 1. Exterior wall assemblies The design of the above and below grade exterior wall and fenestration systems will be assessed with respect to the hygrothermal characteristics, waterproofing and water management, constructability, and compatibility of the various materials and systems incorporated in the design. A general hygrothermal review will be performed to identify potential excessive moisture or condensation within the exterior wall assemblies. Where the potential for condensation occurs, the BECxA will offer basic recommendations and suggest further study. Please note, a hygrothermal review does not include a separate hygrothermal analysis and report often required by the authority having jurisdiction or some owners.
- 2. Roofing and horizontal waterproofing systems The waterproofing systems and assemblies at the roof, terraces, balconies and other low-slope areas will be assessed with regard to function,



- continuity at tie-ins to adjacent wall assemblies, and compatibility with other adjoining building envelope systems, landscape elements, and through-wall penetrations.
- 3. Exposed floor systems Areas where floor systems extend to unconditioned spaces will be assessed with respect to hygrothermal characteristic and the continuity of the air barrier system between pressurized areas and the exterior of the building envelope. Compatibility of the various materials and systems will also be reviewed for incorporation into the design. Where the potential for condensation occurs, the BECxA will offer basic recommendations and suggest further study.
- 4. Interface conditions Building Envelope assemblies like below grade waterproofing, horizontal waterproofing, slabs, walls, extrusions, roof, and others will be assessed paying close attention to transitions at penetrations, flashing, expansion joints, sealants and other building envelope components for material compatibility and constructability.

The plans and specifications will be compared to the project Owner's Project Requirements (OPR), project Basis of Design (BOD), industry-accepted standards, manufacturer's printed literature, and our experience performing quality assurance observations during construction and condition surveys of completed building envelope projects. A narrative of our review and a listing of drawing and specifications technical comments will be prepared including the following:

- 1. The identified concern or OPR/BOD non-conformance;
- 2. The risk posed by the condition; and
- 3. A potential solution to resolve the issue.

The final report will consist of an executive summary with a narrative of system general comments, a matrix of review comments and drawing (redline) mark-ups. The comment matrix will be in tabular format. The table will include a brief description of each issue, the basis for concerns if deemed appropriate, referenced to the specific sheet, detail and/or specification paragraph, and recommendation if deemed appropriate. The table is intended to facilitate review, response, and tracking actions of each review comment. Comments will be submitted through the Procore site, as noted in section II.B.

ii. Building Envelope Commissioning Specification

The BECxA will provide a draft Building Envelope Commissioning (BECx) specification and the Functional Performance Test Specification (FPT) outlining the roles and responsibilities of the commissioning team during construction; functional performance verification testing, occupancy and operations commissioning responsibilities of the commissioning team; and documentation requirements. The FPT Specification will include a list of systems to be tested including frequency of testing, performance requirements, and an outline of inspection protocols and testing procedures.

iii. Building Envelope Commissioning Plan

The Building Envelope Commissioning (BECx) Plan will outline the organization, schedule, allocation of resources, responsibilities, and documentation requirements of the complete BECx process.



iv. Design Phase Commissioning Review Meetings

Upon completion of each Design Phase Review and a review of the feedback by the Project Team, the BECxA will conduct a partial day design review meeting to discuss BECx Plan, Specifications, and review comments with the project team, identify potential solutions to the feedback, and discuss any revisions to the OPR/BOD/BECx Plan based on these discussions.

B. BECx Objectives during the Procurement Phase

As requested, the BECxA will support the Owner and Design Team in reviewing the BECx specification and project impact, as well as providing assistance in responding to RFP/RFQ questions, and evaluating the project bids. At the end of this phase, the BECxA will update commissioning documents after Owner approval at bid award.

C. BECx Objectives during the Construction Phase

i. Construction Phase Envelope Kick-off Meeting

The BECxA will lead a partial day meeting with the project team including the general contractor and their trade/subcontractors relative to the building envelope to familiarize the construction team with the commissioning process and address any special project performance related to the OPR.

ii. Building Envelope Submittal Review

The Contractor's and Sub-Contractors' project shop drawings, submittals, RFI's and other Contract Document requirements pertaining to the building envelope assemblies will be reviewed to evaluate compliance with the OPR, specifications, and architectural drawings. The Client and The BECxA will discuss and agree on the items to be reviewed by The BECxA. This is proposed as an hourly service for Client flexibility and we have assumed 44 hours in this scope and fee estimate for your budgeting purposes. These reviews shall be limited to items related to the building envelope.

iii. Performance Mock-up Review

The BECxA will review mockup construction to verify that it meets the functional intent of the OPR and construction documents. The BECxA will verify that the installation follows the manufacturer requirements of the individual building envelope systems, as well as review the interfaces of separate systems for issues of compatibility and constructability.

iv. Below-Grade Waterproofing Systems

Observations of the work performed on a periodic basis to ascertain compliance with the Contract Documents and industry standards. Specific items to typically be observed may include:

- a. Storage conditions of moisture or UV-sensitive materials;
- b. Condition and preparation of the substrate prior to and during the waterproofing work;
- c. Application of surface conditioner or primer materials;
- d. Installation of the waterproofing membrane;
- e. Installation of penetration flashings, terminations, and associated accessories;

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- f. Installation of drainage composite and/or protection layer;
- g. State of the waterproofing prior to backfill placement.
- v. Above-Grade Exterior Wall Air and Water Barrier Systems

Air-barrier materials, accessories, and installation observed for compliance with requirements. Inspections may include the following:

- h. Continuity of air-barrier system;
- i. Continuous structural support of air-barrier system;
- j. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings;
- k. Site conditions for application temperature and dryness of substrates;
- I. Maximum exposure time of materials to UV deterioration has not been exceeded;
- m. Surfaces primed, if applicable;
- Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths;
- o. Termination mastic has been applied on cut edges;
- p. Strips and transition strips have been firmly adhered to substrate;
- q. Compatible materials have been used;
- r. Transitions at changes in direction and structural support at gaps have been provided;
- s. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal;
- t. Penetrations have been sealed.

vi. Curtainwalls, Windows, Doors and Fenestrations

Observations of the work performed on a periodic basis to ascertain compliance with the OPR, Contract Documents, and industry standards. Specific items to typically be observed may include:

- a. Condition of the framing and substrate prior to and during installation;
- b. Examination of fenestrations to document compliance with contract documents and shop drawings;
- c. Installation of aluminum and glass entrances, storefronts and window assemblies with regard to structural elements;
- d. Installation of sub-sill and flashing components;
- e. Installation of end dams, gaskets, insulating glass units and setting blocks;
- f. Installation of joint sealants, to include surface preparation, backer rod and primer application, sealant application and tooling.

vii. Roofing Systems

Observations of the work performed on a daily or periodic basis to ascertain compliance with the OPR, Contract Documents, and industry standards. Specific items to typically be observed may include:

a. Substrates;



- b. Environmental conditions;
- c. Materials and storage;
- d. Mixing and application of products;
- e. Flashings, insulation, fastening and protection layers;
- f. Installation of roofing system associated accessories.

D. BECx Objectives during the Occupancy Phase

i. 10-Month Warranty Site Observation

The BECxA will meet on site approximately 10 months after substantial completion to review with facility staff, the current building operation and the condition of outstanding issues related to the original commissioning; make suggestions for improvements and identify areas that can be fixed under the original construction contract warranty; and update and resubmit the Commissioning Report to include observations, recommendations and lessons learned from the 10 month visit.

ii. Building Envelope Commissioning Final Process Report

The BECxA will provide a final BECx report to the Project Team incorporating documentation of the completed process and a final summary of the conformance of the construction, including the 10-month observation with the Construction Documents and the OPR.



Appendix I - Owner Project Requirements/Basis of Design

Refer to FCPS Standards for the Design of New and Renovated Facilities.



Appendix II - BECx Responsibility Matrix

Annex F: Roles and Responsibilities Matrix

NIBS Guideline 3-2006

Phase & Guideline 3 Section Number	Provided by Owner & BECxA, reviewed and supplemented by Architect. BOD by Architect.	Owner	Architect	BECxA	Exterior Enclosure Manufacturers	Construction Manager	General Contractor	Exterior Enclosure Contractors	Testing Contractors	Facilities Management	Facilities Engineer (O&M)
Construct 7.2.4	Owner's Project Requirements	Α	P	R			_	_			_
7.2.5	Commissioning Plan & Inspection Checklists Update	A	1	P	+	R	11	ш		H	۳
7.2.6	Pre-Construction Commissioning Process Briefing	A	+	P	U	R	ŭ	ŭ	Ü	+	\vdash
7.2.7	Submittal Review Comments	R	Ü	-	Ü	ï	ŭ	ŭ	Ü	÷	Н
7.2.8	Commissioning Milestone Schedule	Α	Ĭ	P	Ŭ	Ü	Ŭ	Ŭ	Ŭ	-	г
7.2.9	Test Procedures	Α	Ť	P	Ī	ij	IJ	IJ	IJ	÷	Н
1.2.9	Mockups	A	÷	-	+	Ř	Н	P	IJ	÷	Н
7.2.10	Test Data Reports	A		÷	÷	R	×	ū	Р	÷	Н
7.2.10	Commissioning Meeting Record	A	R	R	Ξ	P	IJ	ŭ	Ξ	R	R
7.2.12	Site Visit Record	Α	R	R	Ŭ	P	ŭ	ŭ	Ü	R	
7.2.13	Test Verification Record	R	R	R	Ŭ	À	P	P	P	R	R
7.2.14	Training Plans	R	Τ	_		Р	Ü	Ü	U	Α	R
7.2.15	Construction Phase Commissioning	_	_))	Ĺ
	Process Report (Prior to Occupancy)	Α	1	Р	U	U	U	U	U	R	R
7.2.16	Systems Manual Update	Α	_	_	_	Р	Т	П	_	R	R
7.2.16	Issues Log & Report	R	_	-	Ü	Р	Ü	Ü	Ü	Ť	$\overline{}$
7.2.17	Basis of Design Update	R	Р	-	Ŭ	Ŕ	Ŭ	Ŭ	Ŭ	-	Η
7.4	Construction Phase Acceptance & Commissioning)	1		Ī.				·	·
	Process Report (Close of phase report)	Α	R	Р	U	<u>'</u>	U	U	U	'	' '
7.5	Training	Α	R	_		R	Р	Р	Р	J	U
Occupanc	v and Operations										
8.2.1	Owner's Project Requirements			-		Р	R	П		^	R
	Compliance Update			-		Г				^	
8.2.3	Seasonal Testing Record			-	П	R	R		Р	Α	R
8.2.4	Deferred Training Record			_		Ρ	R	\Box		Α	R
8.30	Acceptance & Commissioning			Р		ı	U			Α	R
	Process Report (Final Report)	$oxed{oxed}$			$ldsymbol{ldsymbol{eta}}$	Ŀ	Ľ	╙	Ш	_	
8.4.1	System Manual Update			Ρ		\perp	$\overline{}$	ш	Ш	Α	R
8.4.2	Continuous Commissioning Plan	\sqcup		Ρ	\vdash	_	_	╙	Щ	Α	R
8.5	Training Update	Ш	Р			$ldsymbol{ldsymbol{ldsymbol{ldsymbol{L}}}$	R	Ш	Ш	Ш	Α
	Enclosure Tech. Requirements for the Cx Provided by A - Approved by R - Reviewed by R/A - Reviewed/8		_					om I	11.	l lea	d by

Please clarify. -



SEPTEMBER 24, 2019

Appendix III - BECx Team Contact Information

BECx Team Role	Contact Name	Title	Organization	Contact information
Owner	Brian Staiger	Senior Project Manager	Frederick County Public Schools	Brian.staiger@ecslimited.com
Construction Manager (CM)	Dave Toth	Project Manager	Oak Contracting, LLC	dtoth@oakcontracting.com 443-506-7532
Construction Manager (CM)				
Commissioning Authority (CA)	David Davenport		Lutz Engineering	
Building Envelope Commissioning	Zaira Martinez	Project Manager	ECS Limited	zmartinez@ecslimited.com 571-329-8616
Architect	Jason Hearn	Project Manager	GWWO Architects	jhearn@gwwoinc.com 410-319-0018
Structural Engineering entity	Brittany Pavelko	Project Manager	Carney Engineering Group	bpavelko@carneyengineeringgroup.c 717-852-1262
Civil Engineering entity	Jim Barto	Senior Project Manager	Adtek Engineering	jbarto@adtekengineers.com 717-852-1262



Appendix IV - BECx Risk Assessment Results

Intentionally left blank



Appendix V - BECx Project Milestone Schedule



Provide dates based on current design/construction schedules; Architect to merge with with running project schedule.



Appendix VI - Abbreviations and Definitions

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

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.

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.

Building Envelope Commissioning Provider (BECxProvider): Contracted to Owner. BECxA directs and coordinates day-to-day building enclosure commissioning activities in coordination with the CxA.

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

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

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

Construction Manager: Contracted directly to Owner.

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

Functional Performance Test (FPT): Test of performance of building enclosure 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.

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

Specifications: Construction specifications of Contract Documents.

Mock-up: The activities where systems or materials are initially constructed and tested. Mock-ups are to be free standing and approved prior to the commencing full scale construction.

