City of Lake Oswego – City Hall

Building Envelope Condition Assessment

380 A Avenue, Lake Oswego, OR 97034

Presented To:

City of Lake Oswego, Public Works Department
c/o Ms. Rachael Petersen, CFM
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## TABLE OF CONTENTS

INTRODUCTION & BACKGROUND DOCUMENTS ................................................................. 3
BUILDING DESCRIPTION .................................................................................................. 5
SUMMARY OF OBSERVATIONS ......................................................................................... 6
  1. INFRARED THERMOGRAPHIC SURVEY SUMMARY ............................................. 6
  2. VISUAL & INVASIVE TESTING SUMMARY ............................................................ 7
RECOMMENDATIONS: ..................................................................................................... 10
PRELIMINARY SCOPE OF REPAIR ............................................................................... 11
CONCLUSION AND NEXT STEPS ............................................................................... 13
APPENDIX A: THERMAL IMAGING PHOTOS .............................................................. 15
APPENDIX B: ASSESSMENT PHOTOS ......................................................................... 24
INTRODUCTION & BACKGROUND DOCUMENTS

Morrison Hershfield (MH) was retained by the City of Lake Oswego, Public Works Department to conduct a building envelope condition assessment of the Lake Oswego City Hall building, located at 380 A Avenue, Lake Oswego, Oregon. This report documents the results of our assessment. The building envelope assemblies were primarily evaluated from a weatherization standpoint and where feasible and applicable, to review assemblies currently being used to control air leakage, vapor diffusion and thermal performance. Deficient conditions reported herein are based on the information provided to us by the City of Lake Oswego’s representatives, review of the provided background documents, and our onsite observations that were performed from ground level, from ladders and from accessible roof areas. Components reviewed as part of this assessment included the exposed portions of the foundation walls, Exterior Insulated Finish System (EIFS), exterior doors and windows, a waterproofed balcony, low-sloped roofs assemblies, the subterranean parking garage, and limited interior review. Methods of analysis included a visual review of the exterior building envelope that also included non-invasive moisture readings. With the aid of a contractor (A Cut Above Construction), eleven (11) exploratory openings were made through the EIFS at select locations to view the existing condition of the underlying weather-resistive barrier, flashing details, wall sheathing and framing members. Moisture content measurements of the exterior wall sheathing were taken during the invasive testing phase. In addition, MH performed an infrared survey of the building from the exterior to determine locations of thermal bridging, air leakage, and possible trapped moisture in the enclosed system.

The objective of this assessment was to provide an indication of the risks and the extent of construction defects that have been impacting the building’s envelope systems for an extended period of time. This would include identifying typical areas where resultant damage has occurred and may be occurring elsewhere, and to provide a recommended scope of repair to address the building’s failing cladding systems. Documented deficiencies within this report does not represent a total listing of all locations, nor do they imply that all similar locations or items to be deficient. Our scope for this assessment did not include structural connections, mechanical or electrical systems, fire rated assemblies, interior finishes or other components not related to the building envelope.

The following background documents were provided to us by Ms. Rachael Peterson, the city's representative during an onsite meeting that took place on April 21, 2015, (Note: A detailed set of drawings used during construction were not available for this review):

- Remediation Analysis Report, Completed by SERA Architects, Dated January 2007 which includes a roof evaluation report from Professional Roof Consultants dated August 2006

The following MH team members were involved in performing this assessment:

- Bryan Costa, PE / Building Envelope Consultant
- Justin Barnhart, CEI / Building Envelope Consultant
- Jack Pearson, CBST / Building Envelope Consultant
- Caleb VanderMolen, Project Manager / Building Envelope Consultant

MH retained a contractor (A Cut Above Construction), to assist with the removal and re-installation of the wall assemblies for this review.

Field observations and invasive testing were conducted on the following days:

- Non-Invasive Moisture Readings – Wednesday April 22, 2015
  - Weather Conditions: Partly Cloudy with a temperature high of 61°F.
  - Field Testing completed by Justin Barnhart

- IR Thermographic Survey - Thursday April 23, 2015
  - Weather Conditions: Mostly Cloudy with a temperature high of 52°F.
  - Field Testing completed by Jack Pearson

- Exploratory Openings, (Invasive Testing) – April 28, 2015
  - Weather Conditions: Cloudy, periods of heavy rain with a temperature high of 63°F.
  - Field Testing completed by Bryan Costa and Caleb VanderMolen
BUILDING DESCRIPTION

The Lake Oswego City Hall building is a steel-framed structure with three floor levels that are supported on a concrete podium slab that extends and supports a small parking lot at the front entry of the building. Below the podium slab is a subterranean parking garage. Framing components beyond the steel girders and columns consists of light gauged metal studs, with paper-faced gypsum sheathing installed on the cold side of the wall assemblies and batt insulation within the stud bays. It is our understanding that construction was completed in 1987.

The cladding assemblies primarily consist of EIFS at the vertical walls and exterior soffit areas. Polished masonry tiles have been installed to embellish the main entrances to the building. At locations where the cladding was removed, we discovered these materials to be directly applied to the paper-faced gypsum sheathing. The use of an appropriate weather-resistive barrier or sheet-metal flashing to assist with diverting water away from the building’s underlying framing materials was omitted during the original installation of the cladding assemblies. Glazing throughout the complex consists of large, non-thermally broken, aluminum/steel framed units. The primary roof is low-sloped, built-up roofing system and a granulated cap sheet. Retrofitted sheet-metal coping has been installed at all parapet wall locations. The building’s mechanical equipment is on the roof. There is a balcony on the southeast corner of the second floor that has a fluid applied waterproofing membrane system installed to protect the interior space located directly below the balcony’s open sitting area.
SUMMARY OF OBSERVATIONS

INFRARED THERMOGRAPHIC SURVEY SUMMARY

MH performed an infrared survey of the building from the exterior to determine locations of thermal bridging, air leakage, and possible trapped moisture in the enclosure system. Use of infrared thermography focuses on the detection of thermal patterns and anomalies in the building envelope. The data collected must then be interpreted by a trained and experienced thermographer. When viewing the infrared images in this report, the lighter colors resemble warmer temperatures and the darker colors resemble cooler temperatures.

Thermal bridging is typically noted at framing elements, penetrations, and fenestrations. These conditions conduct the exterior temperature to the interior and vice versa. Detection of air leakage depends on a temperature differential between the interior and exterior and is evidenced by washing patterns on surfaces as a result of air of a different temperature flowing across them. In an Exterior Insulation and Finish System (EIFS) system, trapped moisture can be detected by surveying the surface soon after a transition from or to solar exposure during which the thermal capacitance of water will cause wet building materials to retain their temperature longer than adjacent dry materials. The survey was conducted on an overcast day following a light rain, but long enough after solar exposure to dry surface moisture and create a temperature differential.

- During the survey, MH noted consistent thermal bridging at fenestrations, floor lines, and internal framing elements. This thermal bridging can be seen in the imagery as light-colored lines amidst darker areas, as well as light-colored frames around windows and doors. Thermal bridging in the field of the walls was most prevalent at areas of stone cladding, which MH assumes to have little or potentially no exterior insulation behind it (as opposed to the EIFS system).

- Significant air leakage was noted at recessed light fixtures in soffits, around doors, and around the curved glass block wall. Little evidence of air leakage was noted at the majority of windows, though it is possible that leakage exists but is flowing close to perpendicular to the wall surface and thus not detectible with infrared.

- MH noted numerous areas of apparent trapped moisture in the EIFS system, largely at/below window corners and control joints. These locations can be seen in the imagery as distinct dark patterns that take a similar shape to a liquid stain or water soaking into a material from an edge or point.

Anomalies indicating the above discussed issues have been marked in the imagery with green arrows. Please note that not every anomaly has been marked in each image, but rather a representative sampling.

A photographic record of observations was made using digital photos. Selected photographs referenced throughout this portion of the report are contained in Appendix A.
VISUAL & INVASIVE TESTING SUMMARY

Prior to conducting our fieldwork, MH reviewed various background documents provided by the City of Lake Oswego in order to become more familiar with the property and to review the observations documented by envelope consultants and other design professionals previously hired by city. After reviewing these reports and assessing the information gathered during our non-invasive tests, we concluded that the best course of action would be to focus on areas that were not incorporated in the previous studies. The additional information gathered from these locations would better assist us when assessing the current condition of the building’s exterior envelope assemblies by providing us a holistic perspective in terms of how the building is managing rainwater, and would later prove valuable when developing the scope of repair.

Methods of analysis included a visual review of the exterior building envelope components from the ground and off ladders, and eleven exploratory openings through the wall assemblies.

As noted earlier, MH was not provided with construction documents, (i.e. - architectural drawings, permit drawings, project specifications). These documents are very helpful when developing a more precise scope of repair.

The following highlights the documented deficiencies observed during our assessment:

**Exterior Wall Assemblies**

- EIFS cladding is installed as a barrier system, which is not a good construction practice in the pacific NW and is no longer permitted under the Oregon Structural Specialty Code (OSSC). A barrier system does not account for water behind the cladding system and does not provide means for egress of incidental moisture. Any failures at the outer surface of the cladding assembly is effectively a failure of the assembly as a whole, as water behind the system has no means of egress.

- EIFS cladding is installed in contact or within 8 inches of landscaping, which is not permitted by the Association of the Wall and Ceiling Industry (AWCI). Inadequate clearance, exposes the EIFS lamina to extended or prolonged periods of wetness, which will lead to premature deterioration of the finish.

- The expanded polystyrene (EPS) foam is adhered directly to paper faced gypsum without the use of an adequate weather-resistant barrier (WRB). This method of installation is not a good construction practice in the pacific NW and is no longer permitted under the OSSC.

- Through-wall penetrations were not flashed and did not have sheet-metal flashings installed at top of penetration. Where metal flashings was observed, metal flashings were face sealed to the finish coat of the EIFS lamina. This condition is not permitted by AWCI.

- Joint sealant applied around through wall penetrations, was not properly formed, profiled or applied, leading to premature failure of the sealant. Sealant was observed to be installed without the proper closed cell backer rod and in some cases was sealed to the finish coat, which is not permitted by AWCI.

The wet-wall scanning devise detected the presence of moisture consistently trapped behind the EIFS cladding assembly at numerous locations. Invasive testing at some of these locations confirmed the presence of moisture behind the cladding assembly.
• Water intrusion was most notable under aluminum framed windows. The moisture has infiltrated the cladding assembly through failed joints in the aluminum frames. At some locations, sealant has been applied over the frame to mitigate leakage; however, because the joint continues under the cladding assembly, there is not a practical way of completely sealing the failed joint.

• Water damage has affected the paper face gypsum at most locations due to prolonged exposure to trapped moisture.

• An insect infestation was observed in the paper-faced gypsum sheathing and EIFS. Insects were drawn into the assembly due to the deteriorating organic materials (wood sheathing, paper-facing on gypsum sheathing).

• Surface corrosion was observed on several steel framing members. Some corrosion has compromised the integrity of the stud framing.

• Fiberglass batt insulation within the exterior wall cavities has been damaged by exposure to incidental moisture.

Windows and Doors

Aluminum-framed double-pane windows are installed throughout the building. These windows are attached by integral flange to stud-framed rough openings. Some of the windows do have an operable casement, but most windows are fixed pane. The windows appear to be one of the primary sources of water intrusion behind the cladding assembly, due to failed joints in the window frames. These components have reached the end of their serviceable life cycle.

• Aluminum framed windows have cracked at joints in the framing. Cracks were typically observed at the mitered corners and at joints at the center mullion. These cracks are likely the result of prolonged heating and cooling cycles. Cracks in the aluminum frames compromise the windows ability to drain incidental moisture to the exterior of the building, which has resulted with water entering the wall assembly behind the EIFS cladding.

• Extruded silicone gaskets, intended to seal around the Insulated Glazed Unit (IGU) have failed or shortened. This is typically caused by UV-light exposure over a long period of time. The failure or shortening has created voids between the glazing and the aluminum frame that is allowing bulk water to enter the window frame. Failures at the butt-joints and miter-joints are allowing the bulk water to infiltrate the EIFS cladding assembly before the moisture can be mitigated through the weep holes at the face of the aluminum frame.

• In addition to water related issues, the windows are not installed in a manner that limits air leakage or thermal bridging. Thermal Imaging of the building envelope indicated significant heat loss around the window perimeters and through the glazing.

• Storefront assemblies are installed at the primary entrances on the north and south elevation of the building. These areas are protected by large overhangs and were not noted as having water-related performance issues. It should be noted that Thermal Imaging of the storefront assemblies indicated that they are not thermally broken and may be negatively impacting the buildings heating and cooling loads.
• Exterior swing doors were not properly flashed around the perimeter of the frames. In addition, the threshold of the swing doors do not appear to be properly integrated with the terrace waterproofing, which poses a risk of water intrusion at the door threshold and traffic coating transition.

Fluid Applied Deck Membrane (at Southeast Corner Balcony)

• A monolithic traffic coating is applied on what appears to be a concrete surface at the third-level terrace on the south elevation. The terrace has a primary surface drain, which appears to be located at the low point of the deck and an adjacent overflow scupper. The surface of the traffic coating appeared to be in good condition at the time of our inspection. Invasive testing was not performed at this location to confirm the substrate or flashing integration with the adjacent cladding surfaces; however, it was noted, that the traffic coating appears to terminate and seal to the outer frame of the swing door that provides access to the terrace as opposed to integrated into the door rough opening.

Roofs

The lower roof surfaces consist of an EPDM single-ply membrane and a ballasted overburden. The seams of the membrane are typically bonded with adhesive. In general, we did not note any issues with the roof surface, as it was not the focus of our primary investigation; however, we did notice an abundance of organic life forms growing on the roof, which tends to indicate the roof is older in age. The primary roof surface was not accessed at this time

• Where the membrane turns up the wall and is exposed to UV-light, visible degradation can be observed on the membrane. This type of degradation is typical of an EPDM membrane that is exposed to UV-light for long periods of time, which causes it to become brittle and vulnerable to tear or puncture.
• Rock ballast is applied to a roof surface, such as this one, to provide protection from UV-light, which will degrade the membrane. The ballast is abrasive and can potentially puncture or wear down the single-ply EPDM membrane. Typically, a layer of XPS insulation board is applied over the EPDM membrane to protect the membrane from these forces; however, a protection layer was omitted from this roof system.
• Penetrations through the roof surface do not extend 8 inches above the roof deck as is industry standard. This condition will allow water to drain into exhaust pipes penetrating the roof surface.
• Over-flow drains are designed to drain through the parapet wall and down the EIFS surface. Invasive testing determined this was allowing water intrusion to occur around these points.
• Saddle transitions were not properly installed at the roof-to-wall interfaces, and are face sealed to the EIFS lamina. The sealant is applied directly to the finish coat, which may cause the finish coat to debond. Saddle transitions are flashed with a gum-lip metal flashing, which is sealant dependent. We observed failed and distressed sealant at several locations. Sealant failure at these locations will allow water to migrate under the parapet cap flashing, where it can get under the roof membrane or behind the cladding assembly.

A photographic record of observations was made using digital photos. Selected photographs referenced throughout this portion of the report are contained in Appendix B.
RECOMMENDATIONS

The inadequate drainage system of the building, compounded by the long history of excessive amounts of rainwater penetrating through the cladding’s surface where it becomes trapped behind the cladding, has damaged the underlying components of the wall assembly. Based on the current condition of the windows, roofing and EIFS cladding and review of the past building surveys by other consulting firms and architects, it is no longer practical to actively maintain the building envelope, as it is beyond its serviceable life. The majority of the water damage does appear to be limited primarily to the non-load bearing wall assemblies and therefore can be practically repaired without extensive repair to the primary building structure. The lack of a drainage system and the significant concealed damages under the EIFS cladding eliminates the feasibility of targeted repairs. Remediation of the cladding assembly will require fully removing all of the existing cladding systems to repair damaged underlying assemblies. At that time, a new cladding system can be installed, which will have the added benefit of improved thermal performance, incidental water drainage capacity, reduced maintenance requirements, and improved indoor environmental experience.

MH recommends the City of Lake Oswego undertake the following building envelope repairs:

- Replace all existing windows, storefront assemblies and exposed man doors.
- Replace all EIFS and underlying gypsum sheathing and insulation.
- Perform structural steel and metal framing replacement/repairs.
- Replace all roofing systems and associated flashings.
- Replace all glass block with new curtain wall.
- Perform interior repairs on exterior walls.
- Protect interior working space and public from interior repairs.

The following section outlines the scope of repairs which is based on our preliminary assessment work undertaken to date and review of past building surveys. This scope of repair summary has been submitted to contractor for budget pricing. Please note the pricing will be based on the expectation that a complete set of plans and specifications with construction details and sequential drawings will be provided for construction and permitting requirements.
PRELIMINARY SCOPE OF REPAIR

(ORDER OF MAGNITUDE PRICING)

General Conditions

1. Contractor to procure all required building permits for the listed repairs. All requirements to perform the work in a safe and professional manner should be covered by the General Contractor. Supervision, project management, temporary site facilities, job trailer, temporary toilet, public safety and protection, daily and final clean-up are required for this project. Weekly construction meeting with owner, contractor and consultant will take place on site. Meeting notes will be provided by contractor.

2. Contractor to construction insulated wood framed temporary walls on the interior of the units to protect the units from the elements while the windows and other exterior work is being performed. The building is expected to be occupied during construction so contractor to have an allowance to move any furniture or other items that may be in the way of the work to be performed.

3. Include line item for building envelope consultant coordination and oversight.

Exterior Wall Assembly

4. Remove and legally dispose of all cladding, paper-faced gypsum sheathing and batt insulation. Remove, store and reinstall exterior light fixtures.

5. Repair and/or replace all damaged metal stud framing, metal structural connectors, and steel structural members. Replace all members where corrosion has resulted in a surface loss of 10% or more. Framing members are to be reviewed by a structural engineer to determine if replacement is needed. Assume that 40% of the metal framing and 10% of the structural members will need to be replaced.

6. Abate all organic growth and properly dispose of all materials.

7. Once all metal stud framing and structural members are repaired and/or replace, install new batt insulation with foil face vapor barrier on the interior (warm) side. Factor 50% of the wall areas need new insulation.

8. Install new Dens Glass gypsum sheathing over steel studs on all exterior walls.

9. Install new self-adhered or liquid applied weather-resistive barrier with all proprietary system components including membrane flashings and sealants.

10. Install a continuous back-angle around the full perimeter of window and door rough openings and wrap rough openings with weather-resistive barrier and membrane to create a waterproof sill pan.
11. Provide proper flashing around all other miscellaneous penetrations, along transitions and interfaces to dissimilar materials.

12. Install minimum of 1 inch of mineral wool insulation over the weather-resistive barrier to reduce thermal bridging of steel studs as required by current code.

13. Install fiberglass clips (assume Cascadia clips) to fur out cladding to create a drainage medium as required by code.

14. Installed new cladding assembly on fiberglass clips. At this time, provide alternate pricing to install a stucco cladding system, a metal panel or Nichia panel system and a brick veneer.

15. Remove and properly dispose of existing glass block assembly. Replace glass block with curtain wall glazing system. Provide sill pan and membrane flashing into pan.

Windows & Doors

16. Remove and legally dispose of all windows, storefronts and exposed swing doors.

17. Install new aluminum storefront entry doors. Provide soldiered sill pans under new storefront doors. Install flexible flashing into the jambs and head of the rough opening and down into the sill pan.

18. Install new fiberglass windows with integral nailing flanges. Provide a metal back angle around the full perimeter of the rough opening in line with the back of the window frames. Provide a self-adhered membrane pan flashing that turns up the back angle at the window sill to waterproof the rough opening. Shim windows at sill to allow sill pan to drain.

19. Install new hollow metal swing doors at exposed locations. Flash the jambs and head of the door rough openings with the self-adhered weather-resistant barrier membrane wrapped into the rough openings. Apply two coats of exterior grade enamel paint to new doors. Provide head flashing above the swing doors integrated with the WRB and wall cladding system. Install new sheet-metal coping over all parapet wall that positively integrate with the cladding assemblies secured with clips on exterior and neoprene gasket fasteners on the interior side. Slope parapet cap metal to drain back to building.

Interior Repairs

20. Perform interior repairs to preconstruction conditions. Assume 20% of the exterior wall gypsum sheathing will need to be properly disposed and replaced.

21. Perform interior repairs with proper mold remediation standards to prevent contamination to the air within the occupied areas of the building.
22. Remove window coverings, store and reinstall window coverings at completion of the interior repairs.

23. Install new wood surrounds at the interior of the windows and doors and new rubber base at all perimeter walls.

24. Paint interior side of all exterior walls, corner to corner.

25. Provide dust control, daily clean up and final cleaning of all affected areas.

**CONCLUSION AND NEXT STEPS**

MH was retained to perform a building assessment on the current conditions of the City Hall building plus review previous building envelop reports. Following our assessment, we have outlined the above recommendations based on our observations. Going forward we recommend the City perform the following steps.

A. Morrison Hershfield to meet with client to discuss rough order of magnitude budget pricing and report.

B. Evaluate repair cost with budget constraints to determine all required repairs.

C. Develop a formal RFP/bid package listing the scope of repairs, generate construction drawings, specifications and details so the City of Lake Oswego can solicit bids from prequalified general contractors.

D. Assist the City of Lake Oswego with contractor bid evaluations and contractor interviews to confirm qualifications for remediation work in occupied public building.

E. MH to provide construction administration and quality assurance oversight during the repair process. Generating site visit reports documenting phases of construction, listing observations and provide digital photo documentation.

F. Provide certification at project completion verifying the building envelop repairs were performed per the permit set of construction document, to current code, per manufacturers installation requirements and in a weather tight manner.

G. Given the uncertainty of all of the underlying conditions due to the limited exploratory openings, it is crucial for an experienced building envelope consultant and design professional be involved in the construction phase.
Yours truly,
Morrison Hershfield Corporation

Bryan Costa, P. E.
Building Science Consultant

Jeffrey Forell
Building Science Consultant
APPENDIX A: THERMAL IMAGING PHOTOS
Figure 1. Infrared image showing thermal bridging and possible trapped moisture on the west elevation

Figure 2. Corresponding visible-light image to Figure 1

Figure 3. Infrared image showing thermal bridging and possible trapped moisture on the south and west elevations – replaced patch areas appear as lighter rectangles

Figure 4. Corresponding visible-light image to Figure 3

Building Envelope Condition Assessment
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MH Project No.: P150062.00

MORRISON HERSHEYIELD
Building Envelope Condition Assessment
Lake Oswego City Hall
City of Lake Oswego
MH Project No.: P150062.00

Figure 5. Infrared image showing thermal bridging at stone attachments, second floor line, and storefront entrance on the south elevation

Figure 6. Corresponding visible-light image to Figure 5

Figure 7. Infrared image showing thermal bridging and possible trapped moisture on the east elevation

Figure 8. Corresponding visible-light image to Figure 7
Figure 9. Infrared image showing thermal bridging and possible trapped moisture on the east elevation

Figure 10. Corresponding visible-light image to Figure 9

Figure 11. Infrared image showing thermal bridging and possible trapped moisture on the east elevation

Figure 12. Corresponding visible-light image to Figure 11
Figure 13. Infrared image showing thermal bridging and possible trapped moisture on the east elevation

Figure 14. Corresponding visible-light image to Figure 13

Figure 15. Infrared image showing air leakage above the curved glass-block wall section on the north elevation

Figure 16. Corresponding visible-light image to Figure 15
Figure 17. Infrared image showing air leakage above the curved glass-block wall section on the north elevation.

Figure 18. Corresponding visible-light image to Figure 17.

Figure 19. Infrared image showing probable air leakage at a corner interface of the EIFS, planter waterproofing, and glass block wall.

Figure 20. Corresponding visible-light image to Figure 19.
Figure 21. Infrared image showing thermal bridging and possible trapped moisture in the EIFS system on the north elevation.

Figure 22. Corresponding visible-light image to Figure 21.

Figure 23. Infrared image showing air leakage and thermal bridging at an exterior door on the west elevation.

Figure 24. Corresponding visible-light image to Figure 23.
Figure 25. Infrared image showing air leakage around can lights in the soffit adjacent to the south entrance

Figure 26. Corresponding visible-light image to Figure 25

Figure 27. Infrared image showing air leakage and thermal bridging at the south elevation entrance

Figure 28. Corresponding visible-light image to Figure 27
Figure 29. Infrared image showing air leakage at can lights and thermal bridging at the north entrance and 2nd floor line above

Figure 30. Corresponding visible-light image to Figure 29
APPENDIX B: ASSESSMENT PHOTOS
Figure 31. EIFS cladding in contact with landscapes surfaces along the raised planter beds on the north elevation.

Figure 32. Non-shielded sprinkler head, exposing EIFS lamina to frequent and extended periods of moisture.

Figure 33. Overall, east elevation. EIFS expanded polystyrene foam applied directly to paper faced gypsum board without use of weather protective barrier.

Figure 34. Close up of water damage on paper faced gypsum. Typical condition at exploratory openings.
Figure 35. Saddle flashings are face sealed to the exterior face of the EIFS lamina.

Figure 36. Projecting sheet metal flashing is omitted at window heads.

Figure 37. Sealant is applied directly to the finish coat of the EIFS lamina as a repair to vertical cracks.

Figure 38. Joint sealant applied without the use of closed cell backer rod.
Figure 39. Wet wall scanner indicating the presence of moisture directly under the center mullion of a window, typical.

Figure 40. EIFS cladding removed. Elevated moisture content in the paper faced gypsum and moisture staining.

Figure 41. Wet wall scanner indicating the presence of moisture directly under the mitered jamb connection of the window frame, typical.

Figure 42. EIFS cladding removed. Elevated moisture content in the paper faced gypsum and moisture staining.
Figure 43. Typical water damage of paper faced gypsum at improperly flashed transitions.

Figure 44. Typical water damaged paper faced gypsum. Gypsum has delaminated behind paper.

Figure 45. Typical water damage around window frames.

Figure 28. Extensive corrosion on stud framing.
Figure 47. Surface corrosion on stud framing surface, typical.

Figure 48. Heavy corrosion on structural tube steel, typical at columns.

Figure 49. Typical corrosion at sill plate, where moisture is gathering. Typical damaged fiberglass insulation.

Figure 50. Typical damaged fiberglass insulation.
Figure 51. Typical miter condition at jamb/head. Bulk water is flooding frame and leaking from joints as weep holes reach capacity.

Figure 52. Typical damaged frame at center mullion. Water is draining between EIFS cladding and paper faced gypsum.

Figure 53. Damaged or shortened extruded gaskets allowing bulk water to enter the window frame, typical.

Figure 54. Damaged or shortened extruded gaskets allowing bulk water to enter the window frame, typical.
Figure 55. Water behind the EIFS cladding cannot drain due to omitted through wall flashing and application of barrier system. Bulk water is flooding the window frame and leaking out through joints in the frame, typical.

Figure 56. Typical, failed sealant at window head, caused by excess water behind the cladding.

Figure 57. Water leaking around roof overflow drain, typical.

Figure 58. Evidence of water leaking on outer face of parapet wall.
Figure 59. Plumbing vent barely rises above roof surface.

Figure 60. Where exposed, roof membrane showing visible signs of deterioration.