Roofing and Envelope Feasibility Study

Wellesley Police Station
Wellesley, MA
2 October 2015

SGH Project 150841

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

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Project 150841 – Roofing and Envelope Feasibility Study (#WFMD-RFP-FY16-001), Wellesley Police Station, 485 Washington St., Wellesley, MA

Dear Mr. McDonough:

Enclosed is our report summarizing the results of our roofing and envelope feasibility study, as outlined in our revised 27 May 2015 Proposal for Roofing and Envelope Feasibility Study submitted in response to Wellesley Facilities Maintenance Department (FMD) Request for Proposal (RFP) #WFMD-RFP-FY16-001.

Sincerely yours,

10/2/2015

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EXECUTIVE SUMMARY

The report provides the results of our roofing and envelope feasibility study in response to Wellesley Facilities Maintenance Department (FMD) Request for Proposal (RFP) #WFMD-RFP-FY16-001. The goal defined by the RFP "is to evaluate and analyze key elements of the existing roofing and building envelope systems for the purpose of identifying repairs, replacement or other improvements to these systems" at the Wellesley Police Station (WPS) because it "has been plagued with numerous and extensive roofing problems including water infiltration in the form of ice dam leaks, rain leaks and snow entrainment almost since it was built in 1995."

Reported building enclosure issues include, in part:

- Excessive snow and ice accumulate on the roof. Ice dams form along the eaves, resulting in interior water leakage and building damage. Icicles hang from the eaves that fall and can damage property and injure pedestrians.
- Water occasionally leaks below dormers with HVAC intake louvers. FMD staff believe that a portion of this leakage is caused by snow that is drawn into the ductwork (entrainment), melts, and leaks to the interior.
- Water occasionally leaks through the roof during rain events.
- Water occasionally leaks into the basement Fitness and Storage Rooms.
- The windows are drafty, making work spaces near the windows uncomfortable for WPD staff.

Simpson Gumpertz & Heger Inc. (SGH) performed its on-site roofing and envelope feasibility study investigation of the Wellesley Police Station (WPS) on 29 – 31 July 2015 and 3 August 2015, and observed and concluded the following:

- The roof lacks effective ventilation, and its geometry concentrates water and snow runoff along dormer side walls, resulting in water leaks.
- The roof lacks an effective ice barrier, and has defective waterproofing detailing at rising walls, resulting in water leaks.
- A new roof with properly designed and installed flashings and ventilation is required to stop water leakage.
- The louvers lack effective perimeter flashing, and the louver plenum is not waterproofed and drained, resulting in water leaks.

- The louver perimeter must be flashed and the plenum must be modified to be watertight and drained to stop water leakage; other modifications may also be appropriate.

- The windows meet current industry standards for air infiltration, but leak more air than a good quality new window. We expect WPD staff near the windows feel some air movement though the windows when it is cold outside. However we do not expect it to be the primary contributor to occupant discomfort.

- The aluminum-framed windows provide poor thermal resistance, and lack perimeter flashing and air seals, resulting in cooler interior window frame and adjacent interior finish surface temperatures. The cooler surfaces locally cool the air, which is felt by building occupants working near the windows. We expect that air from the ceiling diffusers move locally cool air from the windows to the occupants.

- Water leaked through the windows and around the window perimeter during our water testing that simulated a severe rain and wind event. Based on our observations and reports by WPD staff, we do not expect that water leaks through and around the windows often.

- The windows require flashing to stop perimeter air leakage and reduce the risk of perimeter water leakage. The scope of work should include new windows because the flashing work is the majority of the cost associated with the window replacement project, it is the only way to address the poor thermal performance of the windows, and the insulating glass units are near the end of their service life.

- The below-grade dampproofing is performing satisfactorily and does not require replacement. Localized wall and below-grade dampproofing repair is required where water leaks into the Fitness and Storage Rooms.

We recommend the following scope of work in Report Section 8, which is classified as an Alteration in the building code. Structural modification will not be required and the thermal resistance of the roofing system will not need to be upgraded. We recommend budgeting $100,000 for design/bid services, and $1,955,000 for designer CA, OPM and construction costs for the below described scope of work:

- Construct a new vented roof over the existing sheathing. We assume the roof covering will be asphalt shingles or other material that is lighter than the currently installed natural slate to avoid potential structural upgrades.

- Flash the louvers, waterproof and drain the plenums, and other air intake and louver modifications.

- Replace all windows and provide proper flashing.

- Locally repair the building wall and below-grade dampproofing at the Fitness and Storage Rooms.

- Replace all exterior sealant joints. Stain all masonry joints to make new joints match existing.

1. INTRODUCTION

This report provides the results of our roofing and envelope feasibility study, as outlined in our revised 27 May 2015 Proposal for Roofing and Envelope Feasibility Study submitted in response to Wellesley Facilities Maintenance Department (FMD) Request for Proposal (RFP) #WFMD-RFP-FY16-001.

2. BACKGROUND

We understand from the RFP and 15 April 2015 introductory meeting that the Wellesley Police Station (WPS) was designed by Donham & Sweeney Inc. – Architects and constructed in approximately 1995-1996. Donham & Sweeney Inc. Architectural "As Builts" drawings provided to us by FMD are dated 14 February 1995.

FMD staff report the following related to the building enclosure issues:

- The roof was originally covered with artificial slate shingles that were replaced within a few years due to material failure.

- Snow guards were added within the last 10 yrs to address sliding snow/ice safety concerns.

- The basement area has intermittent water leaks. Chapman Waterproofing Company grout injected cracks in the concrete foundation walls in two locations in mid-2000. This apparently reduced the leakage in those areas (Fitness and Storage rooms, Photos 1 and 2).

- The attic and second-floor crawl spaces have a wet pipe sprinkler system (Photos 3 and 4). Access doors were installed to the crawl spaces in December 1999. In approximately 2005, a sprinkler pipe in a crawl space froze and broke causing interior water damage. Following that break, electric heat was added to these crawl spaces. The addition of the electric heat appeared to increase the ice dam formation on the roofs. Large icicles form and hang from the eaves during the winter.

- The roof experiences water leaks at several locations in the winter when ice dams form. The roof also experiences occasional leakage during rain events. In addition to these leaks, occasional water leaks occur below dormers with HVAC intake louvers. Facilities staff believe that a portion of this leakage is caused by snow that is drawn into the ductwork (entrainment), melts, and leaks to the interior. Photos 5 – 7, provided by the FMD show some of the damage caused by water leaks; this damage was repaired prior to our work.

- In June 2014, the town made localized roofing repairs at two locations with significant ice dam leakage (each about 70 sq ft above crawl space). We understand from the 15 April 2015 meeting that "ice barrier" had not been installed consistently (or at all) in those areas, but was added as part of the repairs. Also, the sprinkler piping was heat-traced and insulated, and the air temperature in the attic and crawl spaces was reduced to 40°F, but this resulted in cold drafts in the adjacent Men's locker room.

- During the winter of 2014-2015, large ice dams and icicles formed, and the roof experienced several leaks, including below the two repaired roof areas (Photos 8 – 11).

- The windows are drafty, making work spaces near the windows uncomfortable for building occupants.

Scott A. Tomlinson and Siena B. Mamayek of Simpson Gumpertz & Heger Inc. (SGH) visited the WPS on 29 – 31 July 2015 and 3 August 2015 to perform the roofing and envelope feasibility study investigation. Niklas W. Vigener of SGH visited the site on 29 and 31 July 2015 during the investigation. Our field investigation consisted of three exploratory roof openings (Roof Openings 1 through 3), two exploratory openings in the exterior brick veneer wall at one window (Lieutenants Office tested window, Wall Openings 1 and 2), one exploratory base-of-wall and below-grade opening (Wall Opening 3), and air and water testing at two window locations (Patrol Supervisors Office and Lieutenants Office). Appendix A shows the locations of the openings. Greylock Roofing, Inc. (Greylock) provided contractor support to SGH.

3. SUMMARY OF OBSERVATIONS

The WPS has a basement and two above-grade stories, and is 21,200 sq ft (Photos 12 –16). It has an approximate "T"-shaped footprint with a short stem oriented north-south (this section of the building is referred to as the "sally port" by FMD/Wellesley Police Department), and the longer cross length forming the main building (east-west), and both ends of the cross length "bent" away from the stem to partly wrap the main entrance on the south elevation. It has a steep-sloped natural slate roof, including three curved roof planes. The exterior walls are covered with brick masonry veneer with precast concrete along the base of the walls, at the second-floor line on most elevations, and at window heads and sills. The windows are aluminum-framed single-hung windows, some of which are ganged.

3.1 Interior Evidence of Water Leakage

We reviewed the RFP, which provides known water leak locations, discussed the known water leak locations with WPD staff, and visually inspected the interior finishes at the majority of the windows for evidence of water leakage. The SGH-marked-up plans in Appendix A provide the locations of known and SGH-observed evidence of apparent water leakage.

We visually inspected thirty-two of forty-two window openings (some openings have two windows) and identified ten openings that have evidence of water leakage or water stains/streaks from condensed water. We observed the following, in part:

- Stained sealing tile that may be from exterior water leakage; we did not inspect above the ceiling tile (Photo 17). WPD staff told us that several ceiling tiles were damaged from ice dam-related roof leaks during the 2014-2015 winter, and the damaged/stained ceiling tiles were replaced in spring 2015.

- Water stains and/or deteriorated finish on the laminated wood stools (Photo 18). Most of the water stains appear to be from cups, plants, leaving the windows open, etc. At two locations, we observed stains on the sill that could be from water leakage through the sill/jamb frame corner (Photo 19) based on the water leakage observed during our testing (see Report Section 4.2)

- Water stains/streaks on window frame head and/or jambs (Photos 20 and 21). These stains/streaks could be from exterior water leakage or condensed water.

- Brown water streaks and/or injection grout on the white painted concrete foundation walls in the fitness room and storage room (Photos 1 and 2), at the inside corners between the sally port and main building. Based on the streak stains and description from WPD staff, these leaks appear to originate from the top of the foundation wall. WPD staff told us that the top of both walls were previously injected with grout to mitigate the leakage, with limited success. We observed yellow/orange foam-like material remnants suggesting that the walls were injected with urethane material.

3.2 Roofing System and Air Intake Louvers

The as-built drawings show that the natural slate roofs have 7.6/12 slope, 9/12 slope, and 12/12 slope at the sally port, main building, and dormers, respectively. The dormers all have windows or louvers. Most of the dormers are along the eaves (Photos 12 and 16). Pad- and/or pipe-style snow guards are installed along the main roof eaves (Photo 22). Electrical heat tracing is installed along the sally port roof eaves. The main roof drains into painted metal hung gutters along all eaves, except at the dormer gable walls. The dormer eaves do not have gutters. Downspouts mounted to the walls conduct water in the gutters to a below-grade drainage system (Photo 15).

We observed the following general roofing assembly (top-down):

- Natural roof slate with lead-coated copper valley pans and flashings (Photo 23). The slate has a typical dimension of approximately 18 in. x 12 in.
- Soffit and ridge vents (Photos 24 – 28). The soffit vent is 2 in. wide, but mostly blocked by metal frieze and fascia trim cladding. The ridge vent has 3/8 in. dia. holes at approximately 2-1/4 in. o.c. The dormers have perforated soffits, but no ridge vents.
- Multiple layers of self-adhering ice barrier membrane (at eaves where we made openings) and asphalt-saturated felt roofing underlayment (Photo 29).
- 5/8 in. thick plywood roof sheathing.
- Engineered wood I-joist roof rafters typically at 16 in. o.c. (Photo 30); we documented the spacing and dimensions in the sally port only. The rafters in the sally port are 14 in. deep, with an 11 in. oriented strand board (OSB) web and 2-1/2 in. x 1-1/2 in. flanges, and supplemented with laminated veneer lumber at dormers and skylights.
- Owens Corning EcoTouch Pink fiberglass batt insulation (R-30) (Photos 31 through 33) between the joists with a Kraft paper facer on the attic side. The insulation is installed with an approximate 0 in. to 3 in. air space between the batt insulation and underside of the plywood roof deck to provide roof ventilation between soffit and ridge vents. In various locations the batt insulation is in direct contact with the underside of the plywood sheathing. Wood blocking installed between the joists has 1-1/2 in. dia. holes (visual estimate) that are located below the vent space between the insulation and roof sheathing.

HVAC mechanical equipment is located in the attic spaces.

We directed Greylock to make three roof openings at three locations as follows (Appendix A): valley/eave/sidewall intersection at the sally port connection to the main building (Roofing Opening 1), dormer sidewall at the front of the building (Roof Opening 2), and at an air intake louver over the sally port (Roof Opening 3). At the roof openings, we observed the following, in part:

Roof Opening 1 (Valley/Eave/Sidewall)

- The self-adhering ice barrier membrane and asphalt-saturated felt underlayment terminate at the edge of the plywood sheathing at the brick masonry. A fluid-applied liquid mastic/sealant covers the gap between the plywood sheathing and brick masonry (Photo 34). The plywood sheathing has apparent water staining.

- W.R. Grace Ice & Water Shield is installed over layers of self-adhering ice barrier membrane and asphalt-saturated felt underlayment with the release paper still on the backside (the release paper is supposed to be removed during installation, Photo 29). The Ice & Water Shield turns up the exterior face of brick masonry approximately 1 in. to 4 in.

- Lead-coated copper step and base flashing forms the transition between the slate roofing and the brick masonry (Photos 35 and 36). Individual step flashing pieces are 8 in. by 12 in., folded along the long axis, and lap the downslope step flashing 3 in. The step flashing is counterflashed by base flashing that engages a reglet-terminated or through-wall flashing.

- The roofing underlayments (felt and membrane) terminate at the fascia and under the soffit where the eave is terminated against the roof at the base of the valley (Photos 37 and 38). We observed holes in the underlayment, through which water can leak, at several locations along the base of the sidewall. A large volume of sealant filled the void between the end of the gutter and roofing at this location (Photo 39); we assume this was an attempt to mitigate water leakage.

- We observed evidence of water leakage (water stained and damaged plywood sheathing and gypsum wallboard) in the crawl spaces below this opening and the corresponding location on the other side of the sally port (Photos 40 and 41).

Roof Opening 2 (Dormer at the front of the building)

- The roofing underlayment turns up the dormer sidewall and is adhered to DuPont Tyvek water-resistant barrier (WRB) installed on the sidewall, with tunnels through the underlayment laps (Photos 42 – 44). The underlayment does not turn up the end of the brick masonry on the front face of the dormer.

- Lead-coated copper step flashing is counterflashed by standing seam lead coated copper wall panels (Photo 45). The step flashing is 8 in. by 12 in., folded along the long axis, and laps the downslope step flashing 3 in.

- The roofing underlayment terminates at the fascia and under the soffit where the dormer eave terminates against the main roof at the base of the valley, similar to Photo 38). We observed holes in the underlayment through which water can leak.

Roof Opening 3 (Louver at Sally Port)

- The louver perimeter joint is filled with sealant. We observed no flashing at the head, jamb or sill of the louver (Photo 46). The sealant is deteriorated and has holes. The wood dormer framing at the louver perimeter is covered with sheet metal cladding that terminates behind the sealant joint. The roof sheet metal base flashing terminates behind the louver sill sealant joint with no end or back dams (Photo 47).

- We observed holes at the ends of the painted metal base flashing between the louver sill and roofing through which water can leak to the roofing underlayment (Photo 48).

- The asphalt-saturated felt roofing underlayment does not turn up the dormer wall below the louver (Photo 49).

- The vertical rise of the louver fins is approximately 5-1/2 in. with 1/2 in. overlaps. The louver screen has approximately 1/2 in. square holes. The plenum behind the louver is not watertight and has approximate 12 in. square access hatches in the bottom (Photos 50 – 52).

3.3 Walls

The exterior walls are covered with brick masonry and have precast concrete along the base of the walls, a decorative precast concrete band along the second-floor line (on most elevations), and precast window head and sill pieces (Photo 13). The precast bed joints typically have weeps at the base of the walls (commonly at the bottom of head joints) and below precast window sills on the second floor (Photos 53). We observed no weeps above or below the precast band at the second floor (inspected from the ground). At our exterior openings, we typically observed weeps above through-wall flashing locations. Window and louver perimeter joints are filled with backer rod and sealant (apparently urethane). Mortar in precast concrete joints is covered with sealant. The sealant is generally chalky, cracked, crazed, and debonded (Photos 53 through 55).

We directed Greylock to make the following openings (Appendix A):

- Two interior openings. One at a window in the Patrol Supervisors Office (Test Location 1) and the other at a window in the Lieutenants Office (Test Location 2). We performed air and water penetration resistance tests at both of these windows (refer to Report Section 4).

- Three exterior openings. One opening at the head and one opening at the sill of the tested window in the Lieutenants Office (Wall Openings 1 and 2 at Test Location 2), and one opening at the base of the wall at the inside corner between the sally port and main building (east elevation, Wall Opening 3).

We observed the following wall assembly (exterior-to-interior):

- Brick veneer with 1/2 in. mortar joints. The brick masonry is anchored to the backup wall with vertically adjustable wire ties with sheet metal plates (Photo 56) that appear similar to a DW-10 veneer anchor by Hohmann & Barnard, Inc.
- Approximate 1-1/2 in. air space.
- Tyvek WRB over 1/2 in. thick brown paper faced gypsum sheathing (Photo 57). We observed a self-adhering membrane patch over the WRB at the brick veneer anchors.
- 6 in. deep steel studs with unfaced fiberglass batt insulation between the studs (Photo 58). The studs are spaced at 12 in. o.c. in the Patrol Supervisors Office and 16 in. o.c. in the Lieutenants Office.
- Plastic sheeting vapor retarder.
- 1/2 in. thick gypsum board, finished, and painted.
- Wood blocking in the window rough opening (Photo 59). The window stool is laminated wood.

3.4 Windows

The building has thirty-seven single windows in addition to five double-ganged windows, which are located in the curved portion of the training room. All of the windows are aluminum-framed and single-hung (Photo 60). The aluminum sashes are thermally broken, and the aluminum frame has a thermal break in line with the fixed upper sash (Photos 61 and 62). The insulating glass (IG) units are stamped “96” on the spacer bar, indicating the year of manufacture as 1996. We observed no failed IG units, nor did staff report failed IG units (i.e., dirt and/or moisture between the pieces of glass that form the IG unit).

We observed the following window flashing through the interior openings, and exterior head and sill openings at the Lieutenants Office window (Wall Openings 1 and 2):

- A continuous sealant joint (appears to be urethane) with open cell backer rod is installed between the window frame and the brick masonry along the jambs, and between the window frame and the precast concrete sill, and steel lintel at the head. The joint between the angle and precast concrete head is not sealed.
- Asphalt-coated flexible copper flashing is installed over a steel lintel that supports the precast window head and masonry above (Photo 63). The flashing turns up the wall approximately 9 in. and terminates approximately at the toe of the lintel. The lintel and flashing extend approximately 7 in. beyond the window jamb. The flashing terminates with an approximately 2 in. high folded end dam in a brick head joint (i.e., the end dam was created by folding a “pig ear,” not by cutting and folding the material).

- Asphalt-coated flexible copper flashing is installed at the window sill (Photo 64). The sill flashing is wider than the rough window opening. It is cut and folded over the rough opening sill with no end- or back-dams; the flashing extends to approximately the interior side of the window sill. The flashing counterflashes the WRB below the window and is counterflashed by the WRB at the window jambs. We did not determine whether the flashing extends through the brick masonry below the precast concrete sill.
- We observed no flashing between the WRB (or sill flashing) and window frame (Photos 64 and 65).

At the interior openings around the windows in the Patrol Supervisors Office and Lieutenants Office we observed apparent water streaks on the cavity side of the exterior gypsum sheathing below windows (Photos 66). We observed no damage to the exterior gypsum sheathing, apparent mold growth, or rusted steel framing.

We observed a stain on the wood blocking at the rough opening sill in the Patrol Supervisors room, below the right window jamb, that could be caused by water leakage. The window sill/jamb frame corner leaked at that location during our testing (Photo 67, refer to Report Section 4.2).

3.5 Base of Wall and Below-Grade Dampproofing

We observed the precast concrete assembly at the base of the walls and the below-grade dampproofing at one exterior opening at the inside corner between the sally port and main building (Wall Opening 3). We did not remove the precast concrete panels to observe the flashing at the inside corner due to the size and weight of the panels, and the risk of damage to the panels. We observed the following (Photos 68 – 70):

- The base of the wall consists of the following (top-to-bottom and exterior-to-interior). The wall configuration is generally as shown on “As Builts” Drawing 3/A-12:
    - 8 in. deep precast concrete cap, approximate 1-1/2 in. air space, WRB/flashing, and back-up wall.
    - 3-5/8 in. deep x 21-1/2 in. high precast concrete panel, approximate 5/8 in. air space, 3-5/8 in. concrete masonry unit (CMU), 1-1/4 in. air space, WRB/flashing, and backup wall. The panel and CMU bear on the concrete floor slab.
    - 3-5/8 in. deep x 13-1/2 in. high precast concrete panel, approximate 5/8 in. air space, flashing, and concrete foundation wall. The panel bears on a ledge in the concrete foundation wall.
- Asphalt-coated copper through-wall flashing is installed underneath the precast concrete cap and at each panel. The flashing below the cap and 21-1/2 in. panel is counterflashed by the wall WRB. The through-wall flashing on the ledge is not counterflashed. The flashing stops slightly short of the face of the precast panels.

- The head and bed joints in the precast concrete panels are filled with mortar and covered with a thin layer of white color sealant (apparently urethane). We observed weep holes at the bottom of most head joints.

- A thin fluid-applied dampproofing is applied to the concrete foundation wall and covered with 2 in. thick extruded polystyrene insulation (typically R-10.0). The foundation is backfilled with a sandy soil.

4. SUMMARY OF WINDOW AIR AND WATER FIELD TESTING

We performed air and water testing at two aluminum-framed single-hung window locations; one on the south elevation in the Patrol Supervisors Office (Room 113) and one on the west elevation in the Lieutenants Office (Room 101). At each location we constructed a test chamber using wood studs and clear polyvinyl plastic sheeting on the interior side of the window test specimen (Photo 71).

4.1 Air Leakage

We performed air infiltration tests in general accordance with ASTM E783, Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors (Photos 72 through 74). We performed three different air tests to measure various air leakage paths through the window and perimeter conditions. During each test we isolated different components of the window frame by applying and removing polyethylene sheeting and/or tape. Table 1 below summarizes our air infiltration test results for each window location.

Table 1 – Air Infiltration Test Results

Location	Result	
Test Location No. 1 Patrol Supervisors Room 113	Leakage through window	0.26 cfm per sq ft, with measurement error the actual air leakage ranges 0.15 to 0.37 cfm per sq ft
Test Location No.2 Lieutenants Office Room 101	Leakage through window	0.01 cfm per sq ft, with measurement error the actual air leakage ranges 0.00 to 0.22 cfm per sq ft
The allowable air leakage for residential, light commercial, and commercial window is defined in AAMA/WDMA/CSA 101/I.S.2/A440-11 NAFS 2011 – North American Fenestration Standard/Specification for Windows, Doors, and Skylights as 0.30 cfm per sq ft (Table 6.2).		

WPD staff told us that the windows feel drafty and work spaces near the windows are cold and uncomfortable during the winter. Paul McDonald (FMD custodian) told us that the window frames and adjacent interior finishes are cold to the touch during the winter, and that, using an infrared thermometer he measured the surface temperatures to be much lower than the interior air temperature. Mr. McDonald told us that he has never observed condensation on the window frames or adjacent interior finishes.

The building has a forced air HVAC system. Three-way air diffusers are commonly located in the ceiling above the windows. The three-way air diffusers are typically oriented to direct air away from the windows.

4.2 Water Penetration

We performed water penetration tests in general accordance with ASTM E1105, 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. We performed two water tests at Test Location No. 1 and one at Test Location No. 2. The following procedure notes apply to all of the tests unless stated otherwise:

- We used the interior test chamber described for the air infiltration testing to conduct the water penetration test.
- We removed the interior gypsum wall board along the window jambs and below the windows and removed the batt insulation from the wall cavity to observe water leakage into the wall cavity during the water tests (Photos 76 and 77). We covered the holes with clear polyvinyl plastic sheeting prior to testing.
- We applied water to the exterior window and wall using a water-spray rack calibrated to deliver a uniform film of water over the window/wall surface at a rate of 5.0 gal/sq ft*hr.
- We applied a static pressure differential of 6.4 psf during the water testing where indicated. A pressure of 6.4 psf has an equivalent wind velocity of 50 mph, which represents the average of the maximum five-second wind speed recorded each month from January 2010 to July 2015 at the Norwood Memorial Airport (National Oceanic and Atmospheric Administration, National Climatic Data Center, Weather Station #54704).

Table 2 summarizes our water penetration test results for each window location.

Table 2 – Water Penetration Test Results

Location and Test	Notes
<u>Test Location No. 1</u> (30 July 2015) Patrol Supervisors Room 113 Setup A: Spray rack over the window (Photo 78) Test Type: Static Test Duration: 17 min. Applied Air Pressure Differential: 0 psf with short-term periods of increased pressure while verifying the test equipment and chamber Setup B: Spray rack above half the window (Photo 79) Test Duration: 1 hr-31 min. (A and B total) Applied Air Pressure Differential: 0 psf	49 min. – We observed water running down the backside of the brick masonry when looking through the gap between the window jamb and rough opening. 1 hr-31 min. – We observed water flowing down the cavity side of the exterior gypsum sheathing along a metal stud and into the track (Photo 80), wet spots at the horizontal joint in the exterior gypsum sheathing at both window jambs (Photo 81), and wet carpet below the window (Photo 82). <u>Note</u> – We understand from the WPD staff that water leakage has wet the floor below this window during previous weather events.

Location and Test	Notes
<u>Test Location No. 1 (3 August 2015)</u> Patrol Supervisors Room 113 Setup C: Spray rack over the window (Photo 83) Test Type: Static Test Duration: 30 min. without pressure differential, immediately followed by 15 min. with pressure differential Applied Air Pressure Differential (ΔP): 6.4 psf	6 min. – Water started wetting the carpet below the window (Photo 84) similar to the 30 July 2015 water test. The carpet was dry prior to the test. The wet are increase on the carpet during the test. 11 min. – Water started leaking (spitting/bubbling) from the right sill/jamb window frame joint (interior view, Photo 85). 1 min. after removing the differential pressure, but leaving the water on – We observed wet spots at the horizontal joint in the exterior gypsum sheathing at both window jambs similar to the 30 July 2015 water test
<u>Test Location No.2 (3 August 2015)</u> Lieutenants Office Room 101 Setup D: Spray rack over the window (Photo 86) Test Type: Static Test Duration: 7 min. without pressure differential, immediately followed by 15 min. with pressure differential Applied Air Pressure Differential (ΔP): 6.4 psf	1 min. after applying pressure differential – Water started leaking (spitting) at the joint between the window sill and wood blocking on the rough opening sill (Photo 87). 2-3 min. after applying pressure differential – Water started leaking (spitting) from the right sill/jamb window frame joint (interior view, Photo 88).

5. CODE REVIEW

We performed a summary review of the existing building code review relating to the proposed scope of work defined in Report Section 8. Our review is limited to the building enclosure and impacted structural systems.

Our review is based on the Massachusetts State Building Code (MSBC), Ninth Edition using the 2015 I-Codes, unless otherwise stated. The Eighth Edition is the current MSBC code. We understand from information provided on Mass.gov (http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/buildings/draft-9th-edition-of-the-building-code-approved-by-bbrs.html) that the Ninth Edition is anticipated to become effective sometime before mid-2016 and there will be no concurrency period with the Eighth Edition. We met with the following Town of Wellesley staff on 11 September 2015 to discuss the recommended scope of work: Joseph F. McDonough, P.E. (Facilities Director), Erik Tardif (Local Inspector, Assistant Zoning Enforcement Officer), and Michael T. Grant (Inspector of Buildings, Zoning Enforcement Officer). Tardif and Grant agree that we should consider the Ninth Edition.

We downloaded the Ninth Edition MSBC from the above referenced website. The MSBC I-Code amendment language is bracketed "[ ]" where referenced in this report.

The following I-Codes apply to the recommended scope of work:

- International Existing Building Code 2015 (IEBC) with MSBC amendments.
- International Energy Conservation Code 2015 (IECC) with MSBC amendments.

The Massachusetts Stretch Energy Code does not appear to apply based on the IECC C503.3.1.

5.1 Applicable Code References

The following code excerpts are applicable to our code analysis.

- IEBC Chapter 2 – Definitions, Section 202 – General Definitions:

  "Alteration. Any construction or renovation to an existing structure other than a repair or addition. Alterations are classified as Level 1, Level 2, and Level 3."

  "Repair. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage."

- IEBC Chapter 3 – Provisions for all Compliance Methods, Section 301 – Administration, Para. "301.1 General. The repair, alterations, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 301.1.1 through 301.1.3 as selected by the applicant. Sections 301.1.1 through 301.1.3 shall not be applied in combination with each other…"

- IEBC Chapter 3 – Provisions for all Compliance Methods, Section 302 – General Provisions, Para. "302.3 Existing materials. Materials already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the building official to be unsafe."

- IEBC Chapter 3 – Provisions for all Compliance Methods, Section 302 – General Provisions, Para. "302.4 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs and alterations, provided no unsafe condition is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location."

- IEBC Chapter 3 – Provisions for all Compliance Methods, Section 302 – General Provisions, Para. ["302.7 Structural requirements pertaining to roofing work… 2. Structural requirements of roof diaphragms resisting wind loads in high wind regions required by this code per Sections 403.8 and 707.3.2 when the intended alteration requires a permit for reroofing shall only apply when roof covering is removed from the entire roof diaphragm and the building is located where the ultimate design wind speed is greater than 150 mph and the building is occupancy category IV per Table 1604.5 of the International Building Code.]

  <u>SGH Note:</u> Ninth Edition MSBC building code Table 1604.5 shows the ultimate design wind speed for Wellesley as 138 mph (Occupancy Category IV).

- IEBC Chapter 4 – Prescriptive Compliance Method, Section 403 – Alterations, Para. "403.4 Except as permitted by Section 403.5, where the alteration increases design lateral loads… the structure of the altered building or structure shall be shown to meet the requirements of Section 1609 or 1613 of the International Building Code… Exception: Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is no more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered…."

- IEBC Chapter 5 – Classification of Work:

  Section 502 – Repairs, Para. "502.1 Scope. Repairs, as defined in Chapter 2, include the patching or restoration or replacement of damaged materials, elements, equipment or fixtures for the purpose of maintaining such component in good or sound condition with respect to existing loads or performance requirements."

  Section 503 – Alteration – Level 1, Para. "503.1 Scope. Level 1 alterations include the removal and replacement or the covering of existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose."

Section 504 – Alteration – Level 2, Para. "504.1 Scope. Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment."

Section 505 – Alteration – Level 3, Para. "505.1 Scope. Level 3 alterations apply where the work area exceeds 50 percent of the building area."

- IEBC Chapter 7 – Alterations – Level 1, Section 706 – Reroofing, Para. "706.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code. Exception…"

- IEBC Chapter 7 – Alterations – Level 1, Section 707 – Structural, Para. "707.1 General. Where alteration work includes replacement of equipment that is supported by the building or where a reroofing permit is required, the provision of this section shall apply."

- IEBC Chapter 7 – Alterations – Level 1, Section 707 – Structural, Para. "707.2 Addition or replacement of roofing or replacement of equipment. Where additional or replacement of roofing or replacement of equipment results in additional dead loads, structural components supporting such reroofing or equipment shall comply with the gravity load requirements of the International Building Code. Exceptions:

  1. Structural elements where the additional dead load from the roofing or equipment does not increase the force in the element by more than 5 percent…."

- IEBC Chapter 7 – Alterations – Level 1, Section 707 – Structural, Para. "707.3 Additional requirement for reroof permits. The requirements of this section shall apply to alteration work requiring reroof permits.

- IEBC Chapter 7 – Alterations – Level 1, Section 707 – Structural, Para. "707.3.2 Roof diaphragms resisting wind loads in high-wind regions. Where roofing materials are removed from more than 50% of the roof diaphragm or section of a building located where the ultimate design wind speed, V_{ult}, determined in accordance with Figure 1609.3(1) of the International Building Code, is greater than 115 mph (51 m/s)…roof diaphragms, connections of the roof diaphragm to the roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the International Building Code, including wind uplift. If the diaphragms and connections in their current condition are not capable or resisting at least 75% of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the International Building Code."

  <u>SGH Note:</u> Refer to MSBC amendment Para. 302.7.

  Eighth Edition MSBC Amendment to the 2009 IEBC, Chapter 6 – Alteration – Level 1, Section 606 – Structural, Para. ["606.3.2 Roof Diaphragms Resisting Wind Loads in High Wind Regions. Where roofing materials are removed from the entire roof diaphragm of a building located where the basic wind speed is 115 mph or greater and the occupancy category is type IV as defined in Table 1604.5 of 780 CMR, roof diaphragms and connections that are part of the main wind-force resisting system shall be evaluated for the wind loads specified in 780 CMR, including wind uplift. If the diaphragms and connections in their current condition do not comply with those wind provisions, they shall be replaced or strengthened in accordance with the loads specified in 780 CMR."]

SGH Note: The current MC code, Table 1604.11 "Ground Snow Loads; Basic Wind Speeds; Earthquake Design Factors" list the basic wind speed for Wellesley as 105 mph.

- IECC Chapter 5 CE – Existing Buildings, Section C503 – Alterations, Para. "C503.3 Building Envelope. New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.5."

- IECC Chapter 5 CE – Existing Buildings, Section C503 – Alterations, Para. "C503.3.1 Roof replacement. Roof replacements shall comply with Table C402.1.3 or C402.1.4 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck."

5.2 SGH Analysis

The recommended scope of work described in Report Section 8 is an Alteration (Level 1 if using the Work Area Compliance Method; IEBC Section 202 and Chapter 5). If the roofing and window work is permitted separately (i.e., performed as different projects in different years) and the scope of the roofing work is limited to localized repair, the roofing work would be considered a "Repair," which would eliminate the structural requirements listed below; we do not review this approach in this report.

The following considerations and requirements apply to the recommended scope of work based on the Ninth Edition MSBC; the scope is similar for the Eighth Edition MSBC:

- The code requirements for this scope of work are the similar for the "Prescriptive Compliance Method" (IEBC Chapter 4) and "Work Area Compliance Method" (IEBC Chapters 5 through 13). One important exception is that the Prescriptive Compliance Method requires review of the lateral system resistance, and possibly modification, unless the "existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is no more than 10 percent greater than is demand-capacity ratio with the alteration ignored" (IEBC 403.4). This review is not required for Work Area Compliance Method Alteration – Level 1 (it is required for Level 2).

- Compliance methods "shall not be applied in combination with each other" (IEBC Section 301.1).

- New work and materials must meet the requirements of the code for new construction (IEBC Sections 302 and 706.1).

- The existing roofing insulation thermal resistance does not need to be upgraded to meet the code for new construction (IECC Paras. C503.3 and C503.3.1), assuming the existing roofing is removed down to the existing sheathing, but the sheathing is not removed, except for localized work.

- The gravity loads and gravity load-carrying elements/system must be reviewed, and possibly modified. Analysis is required to determine if this project is one “where the additional dead load from the roofing or equipment increases the force in the element by more than 5 percent (IEBC Para. 707.2). Based on our preliminary analysis, it is likely necessary to analyze the gravity load-carrying elements if the existing slate is used in the new roofing assembly. Structural modifications may be required to accommodate the added gravity load. Structural modifications are unlikely to be necessary if a lighter roof covering is utilized (e.g., synthetic slate, asphalt shingles, etc.).

- The roof diaphragm and related connections do not require review or modification because the design wind speed using the Eighth Edition MSBC or Ninth Edition MSBC is below the threshold (IEBC Para. 302.7 and 707.3.2; MSBC Amendment to the 2009 IEBC, Para. 606.3.2).

6. DISCUSSION

6.1 Roofing System and Air Intake Louvers

6.1.1 Roof Water Leaks

The WPD staff report large snow and ice accumulations (ice dams) along the roof eaves, large icicles hanging and falling from roof eaves, water leaks below the majority of the dormers and roofing terminations at sidewalls when snow and ice are present, and water leakage below several air intake louvers. The snow and ice accumulation and roof leak problems are worst between the front elevation dormers and where the sally port roof eaves terminate at the main building.

Ice dams form in cold weather when snow on roof surfaces melts and re-freezes on colder roof surfaces, typically at eaves. Heat loss from the building interior, direct solar radiation and warmer weather all contribute to snow melt. Once an ice dam starts to form it impedes drainage of subsequent snow melt and rain water. As the water collects behind/upslope of the ice it freezes and increases the size of the ice dam (along the eave and upslope). Roof geometries that require large roof areas to drain over small lengths of eave and/or create locations where snow drifts, exacerbating ice dam growth. When there is a pathway through the roofing assembly, the hydrostatic pressure of the backed-up water results in water leakage.

In cold regions like Massachusetts, ice dams can form on any roof under the right conditions. As a result, the building code and good roofing practice require the installation of an ice barrier membrane roofing underlayment where snow and ice accumulate to prevent leaks under reasonably expected service conditions. The ice barrier must be installed along eaves, but is also recommend at valleys and various flashing conditions. Modern-day ice barriers are self-adhering membranes. Asphalt-saturated felt underlayment is typically installed elsewhere.

For successful roofing system performance, the ice barrier membrane must be designed and installed to perform as “waterproofing,” using the same principles as adhered waterproofing. The membrane must be installed without holes (ice membranes seal around nail penetrations and provide sufficient water resistance) and defects at seams through which backed-up water can leak, and must be flashed into the wall system. All roofing underlayment should turn up walls a minimum of 4 in., and ice barrier membrane installed where snow and ice are expected to accumulate should extend up walls higher, commonly 18 in. or more. Where terminating at clad walls, the roofing underlayment/membrane should extend through the veneer (e.g., brick masonry veneer) and tie-into the wall WRB to prevent water that soaks or leaks through the veneer from bypassing the roofing base flashing. Typical roof covering and metal flashings will not prevent water leakage at areas where excessive snow and ice accumulate.

The existing roofing underlayment (asphalt-saturated felt and ice barrier membrane) has defects through which water can, and does, leak:

- Sally port to main building eave/valley/sidewall intersection – At Roof Opening 1 the existing ice barrier terminates at the front face of the brick masonry with little or no effective upturn, the underlayment does not extend through the brick masonry veneer and flash into the wall WRB, and the ice barrier does not extend into the upslope valley. Also, the ice barrier apparently installed to mitigate leakage was not adhered (the release paper was left in place), rendering it ineffective. We observed water stains and damage below this location from water leaks and WPD staff told us that this is one of the worst leak locations. Based on our observation of water leak damage, we expect that the location on the opposite side of the sally port has similar construction.

  In the existing system water can leak through the joint between the sheathing/roofing underlayment and brick masonry. The installation of mastic or sealant at this joint will not prevent water leaks. The roofing underlayment must extend through the brick masonry and flash into the wall WRB. If the roofing underlayment turns up the exterior face of the brick masonry, water can bypass it when it leaks or soaks through the brick, unless the underlayment extends up to the soffit.

  There are typically holes in the roofing underlayment at the roof level through which water can leak at eave/valley/sidewall intersections. These holes are inherent to the roof geometry, and this detail often leaks when it occurs in areas where snow and ice accumulate. The intersection must be modified to move the holes as high above the roofing level as possible. Also, the ice barrier must extend up the valley.

- Dormer sidewall – At Roof Opening 2, the roofing underlayment turns up part of the sidewall, but terminates at the end of the brick masonry veneer without an upturn, similar to Roof Opening 1, leaving a hole through which water can leak. Also, the roofing underlayment termination appears to have the same holes/limitations as the eave/valley/sidewall intersection as Roof Opening 1. The intersection must be modified and the roofing underlayment must be properly flashed into the walls.

- Roof and Perimeter Louver Flashing at the Sally Port Air Intake – There are holes in the metal flashing below the louver through which water can leak and the roofing underlayment does not turn up the wall below the louver. Water that backs-up at the base of the louver can leak through the wall below the louver. We assume the sidewall has similar leakage paths as the other locations. Also, the louver lacks perimeter flashing, but instead relies on a single sealant joint to keep water out. The sealant joint has holes through which water can leak.

6.1.2 Roof Snow and Ice Accumulation

Roofing can be designed and constructed to resist significant accumulations of snow and ice. However, such a design approach of resisting significant snow and ice accumulations, but not concurrently reducing the amount and frequency of snow and ice accumulation, has a greater risk of leakage through construction imperfections or where the accumulation exceeds the designed water resistance. Additionally, this approach does not reduce the risk of ice falling from the roof, which may cause injury and/or property damage.

The existing roofing system design is intended to be ventilated to limit snow melt, in part, but the ventilation system is ineffective. The soffit vents are blocked by sheet metal, the vent space between the insulation and sheathing is blocked where insulation is pushed tight to the roof sheathing and by wood blocking installed between the rafters, and the system lacks effective provisions for cross venting to allow air entering the soffit vents to vent the roof areas upslope of valleys. Excessive heat migrates from conditioned areas to the underside of the roof deck and melts snow during the winter, which refreezes at the eaves.

Supplemental heat added to crawl spaces along the sally port eaves contributes to snow melting. Reducing or eliminating this heat will reduce ice accumulation. The heat should be operated as low as possible without allowing the wet sprinkler pipes to freeze. Installation of a dry fire-suppression system, if practical and budget allows, would allow the heat to be turned off if it does not affect occupant comfort in adjacent spaces, such as the Men's Locker Room. We understand that the Men's Locker Room used to feel cold along the crawl space walls prior to installing heat in the crawl space. The addition of supplemental heat in the Men's Locker Room (e.g., base board heat along the crawl space walls) may resolve this issue.

To reduce ice accumulation the roof must be modified to reduce heat loss that melts the snow. An ideal approach is to increase the thermal resistance of the roofing assembly, and provide an effective ventilation system to lower the temperature of the roof deck. For existing buildings like the WPS, providing both modifications has practical, cost, and aesthetic implications. We expect that only increasing the thermal resistance will not be sufficiently effective to reduce ice dam formation, and that this approach would have to be paired with providing proper ventilation of this roof.

Since repairing the existing ventilation system is not practical, an effective approach to reducing heat loss and providing proper ventilation is to remove the existing roofing assembly and install an air barrier and ventilation space over the existing roof sheathing. The air barrier will reduce the flow of warm air through the roofing assembly (thereby limiting convective heat loss). A properly designed and constructed roof ventilation system over the existing sheathing will allow cold air to enter the eaves, travel along the underside of the roof sheathing, and exit at vents at the ridge. This air movement cools the roof sheathing and reduces snow melt during the winter due to conductive/radiant heat loss. The ventilation also reduces the roof assembly temperature in the summer.

6.1.3 Air Intake Louver Leaks

We understand that water leaks into the building below four air intake louvers. At these locations rain and snow are drawn though the louvers by the intake air, and/or rain and snow are blown though the louver. Snow and water that enters the louvers collects in the plenum where the snow eventually melts. The plenum is not watertight or drained, as a result the water leaks through the plenum to the interior space below. In addition to the leak path described by WPD staff, we expect that the lack of functional louver perimeter flashing and roof flashing also contributes to water leakage.

To stop the water leakage the plenum must be modified to be watertight and drained. It may be possible to also reduce the volume of snow that passes through the plenum by reducing the louver area, reducing the louver screen mesh size, modifying the geometry of the louver blades, and/or reducing the intake air velocity. These options require analysis by a mechanical engineer to ensure appropriate coordination with the building mechanical systems that are served by the louver.

6.2 Windows

6.2.1 Window Air Leakage

We understand from WPD staff that the windows feel “drafty” and work spaces near the windows are cold and uncomfortable during the winter. The staff descriptions are consistent with our performance expectations based on our observations and testing.

The windows generally meet the air infiltration standard for residential, light commercial, and commercial windows of this type (AAMA/WDMA/CSA 101/I.S.2/A440-11 NAFS 2011 – North American Fenestration Standard/Specification for Windows, Doors, and Skylights). The window tested at Test Location 1 (Patrol Supervisors Office) leaks more air than the window tested at Test Location 2 (Lieutenant Office), and barely meets the standard. While we expect occupants near the windows “feel” some air movement though the windows when it is cold outside, we do not expect it to be the primary contributor to occupant discomfort.

The windows have poor thermal performance and lack a perimeter air seal, other than the interior gypsum board seal to the window frame. Poor window thermal performance and perimeter air seals create cooler interior window frame and adjacent interior finish surface temperatures. The cooler surfaces locally cool the air, which is felt by building occupants stationed near the windows (radiant cooling). We expect that air from the diffusers in the ceiling moves the locally cool air from the windows to the occupants.

The window frames are aluminum, which conducts hot and cold very well. The frames are thermally broken to reduce the conduction of hot and cold in and out of the building interior. However, the existing windows lack sufficient thermal breaks to effectively minimize conductive heat loss. The single thermal break in the frame jambs is aligned with the thermal break in the upper fixed sash, which is outboard of the lower operable sash. The portion of the frame that is between the exterior face of the lower sash and thermal break is exposed to cold exterior temperatures in the winter, and conducts the cold to the interior. This conductive pathway results in cooler interior window frame and adjacent interior finish surface temperatures. This is consistent with Mr. McDonald's surface temperature observations. The windows must be replaced to address this conductive pathway.

A lot of air leaks around the window perimeters due to the lack of an effective air seal between the frame and the wall membrane, and between the frame and the interior finishes. The air leaking around the window also cools the interior window frame and adjacent interior finish surfaces, which is consistent with Mr. McDonald's surface temperature observations. Currently, the seal between the interior finishes (gypsum wallboard and wood stool) and window frame is the only air seal. This seal may reduce air flow from exterior to interior until it fails, but it does not prevent cooling of interior surfaces. An air seal must be installed at each window perimeter (and likely door, although we did not make sample openings at the door perimeters). An air seal could be provided using spray foam insulation and other interior seals, but with limited effectiveness because the seal is not integrated into the wall WRB.

For proper air seal performance, and to reduce the risk of future water leaks (discussed in Report Section 5.3.2), a membrane flashing seal between the WRB and window frame should be provided in conjunction with a spray foam perimeter seal. This requires removal and reinstallation of the brick and precast masonry at each window perimeter.

The building walls are framed with steel studs with batt insulation between the studs. Each steel stud conducts cold and hot temperatures through the insulation. This type of construction can create generally cooler interior wall surface temperatures in the winter that the building heating system must counteract. Typically, this alone will not make the interior space feel cold if adequately heated, but it may contribute to perceived cold and draftiness at the windows. Contemporary building codes mandate continuous insulation over steel studs, but there is no practical approach to improving the wall thermal performance without significant reconstruction.

6.2.2 Window Water Leakage

We understand from WPD staff that they do not observe water leakage through the windows, but they have observed water leakage wetting the carpet below the window we tested in the Patrol Supervisors Office, and below a window in the Kingsbury Room. Other than water leakage at these two locations, we would not expect occupants to notice the limited water leakage we observed during our window testing. We do not expect that the windows leak very often based on the lack of water damage to the wood blocking in the rough opening and in the wall cavity below the windows. Our water testing simulated a relatively severe storm (both wind pressure and water volume per hour) for this building location and we do not expect that similar water leakage occurs often, if ever, and what water does leak is of sufficiently small quantity that it likely does not damage interior finishes and goes unnoticed before it dries.

Flashing repairs to address air leakage issues will prevent further water leaks around the window perimeters, but will not address the water leakage at the sill/jamb frame corner. The sill/jamb frame corner leakage is minor and to be expected at some windows (existing or new) under the applied test conditions.

6.2.3 Window Service Life

The IG units in the windows are approximately 20 yrs old (fabricated around 1996), which is approaching the service life of a typical IG unit. We expect that some IG units have started to fail (but it is not yet noticeable) and that IG units will continue to fail. Over the next decade, we expect that occupants will notice condensation forming within the IG units during interior/exterior conditions that never used to cause condensing. As time progresses, the frequency of condensing will increase. At some point, the frequent condensing will leave enough dirt within the IG unit to be unsightly and/or the condensation will not go way. The thermal performance of the IG units will also decrease. At this point, the IG units will have to be removed and replaced, which can occur with the windows in place.

6.3 Base of Wall and Below-Grade Dampproofing

We understand that the only locations where water leaks into the basement are at the two inside corners between the sally port and main building (leaks into the Fitness and Storage Rooms), where water appears to leak from the top of the foundation walls. Both of the basement leaks are directly below roof leaks.

Based on our exterior roof opening and opening at the base of the wall at the inside corner at the Fitness Room, water could be leaking from the one or more of the following sources:

- From the roof above. Water that leaks through the roofing base flashing at the building wall could travel within the wall assembly, bypass wall flashings, and leak to the basement. There is a reasonable probability that this water leakage path exists.
- From the wall inside corner. Water that leaks through the roof above or through the brick masonry and/or precast concrete wall veneer may leak through the WRB and/or through-wall flashings and leak to the basement. There is a reasonable probability that this water leakage path exists. We were not able to expose the flexible through-wall flashing laps at the inside corner (in the precast at the base of the wall), but in our experience such laps are difficult to form and often imperfect, leaving pathways for water to leak through the laps.
- Through the below-grade fluid applied dampproofing. This leakage path is unlikely since the water leaks originate from the top of the foundation walls on the interior and we observed no cracks in the concrete foundation wall on the interior.

The below-grade fluid-applied material appears to be a dampproofing, which is a thinly applied, low-quality waterproofing. The product performs by relying of the fact the concrete foundation walls themselves are reasonably waterproof, except at cracks and other holes, and will not leak if most water is reasonably well drained away from the building. Replacement of the dampproofing is not warranted since WPD staff do not report water leaks into the basement after 20 yrs of service (excluding the two locations described above) and most or all of the foundation walls are visible from within the basement (i.e., not covered with interior finishes that can conceal water leaks and be damaged). If a leak develops in the future it can be locally repaired by grout injection from the interior or localized repair on the exterior.

7. CONCLUSIONS

Based on our work as set forth herein, we conclude the following:

7.1 Roofing System and Air Intake Louvers

- The roof lacks effective ventilation, and its geometry concentrates water and snow runoff along dormer side walls. These conditions contribute to snow and ice accumulation, and the resultant water leaks.

- The roof lacks an effective ice barrier, and has defective waterproofing detailing at rising walls. As a result, water leaks through the roofing at susceptible detailing.

- The louvers lack effective perimeter flashing. The louver plenum is not waterproof and cannot drain to the exterior. Consequently, the louvers leak during rainstorms and when snow that is drawn to the interior melts in the plenum.

- A new roof with properly designed and installed flashings and ventilation is required to stop water leakage. The volume of snow that accumulates on the roof cannot be practically reduced without significant modification to the roof and building geometry.

- The louver perimeter must be flashed and the plenum must be modified to be watertight and drained to stop water leakage. If permitted by engineering analysis, the louver area, louver screen mesh size, fins, and/or intake air velocity should also be reduced.

7.2 Windows

- The windows meet current industry standards for air infiltration, but leak more air than a good quality new window. We expect occupants near the windows feel some air movement though the windows when it is cold outside. However, we do not expect it to be the primary contributor to occupant discomfort.

- The aluminum-framed windows provide poor thermal resistance, and lack perimeter flashing and air seals, resulting in cooler interior window frame and adjacent interior finish surface temperatures. The cooler surfaces locally cool the air, which is felt by building occupants working near the windows. We expect that air from the ceiling diffusers move locally cool air from the windows to the occupants.

- Water leaked through the windows and around the window perimeter during our water testing that simulated a more severe rain and wind event. Based on our observations and reports by WPD staff, we do not expect that water leaks through and around the windows often.

- The scope of work should include new windows. The majority of the cost associated with a window replacement project in a brick masonry veneer building is removal and reinstallation of the masonry and interior finishes around the windows, which is necessary to address air and water leaks. The only way to address the poor thermal performance of the window is to replace the windows. Replacing the windows eliminates the upcoming maintenance costs of replacing the IG units as they start to fail.

7.3 Base of Wall and Below-Grade Dampproofing

- The below-grade dampproofing is performing satisfactorily and does not require replacement. The flashing at the base of the walls and the top few feet of below-grade dampproofing require repair at the two inside corners between the sally port and main building where water currently leaks. Staff will be able to observe localized future leaks that develop, if any, because the foundation walls are not covered with interior finishes in the basement. Future water leaks, if any, can be repaired by urethane grout injection from the basement or localized excavation and repair on the exterior.

7.4 Code Analysis

- The recommended scope of work in Report Section 8 is an Alteration under the IEBC (assume one permit). Use of the Work Area Compliance Method (Alteration – Level 1) requires the least amount of work because it does not require lateral load-carrying elements/system review, and possible modification. Structural modifications may be required depending on the roofing scope of work. The thermal resistance of the roofing system will not need to be upgraded, assuming most of the roof sheathing is left in place.

8. REPAIR OPTIONS AND RECOMMENDATIONS

8.1 Roofing System

Report Sections 8.1.1, 8.1.2, and 8.1.3 provide roofing repair options based on the following scope of work and consideration to reduce snow and ice accumulation, the risk of falling ice, and stop the water leakage:

- **Water Leakage Through The Roofing** – The flashing must be corrected at building/dormer walls and eave/wall/valley intersections to stop water leaks. There are several areas that require repair, which will impact a substantial portion of the roof. A localized repair will correct the flashing defects, which should stop the water leaks, but it will not reduce ice accumulation. The more ice accumulates, the greater the risk that backed-up water will challenge the flashing and leak through imperfections or exceed the design limits, or fall and cause injury and/or damage. A new roof is necessary to reduce ice accumulation and reduce the risk of water leaks

- **Roof Ventilation** – The existing roof ventilation system is ineffective. Correction of the existing roof ventilation system is not practical, would do little to reduce ice accumulation, and would be disruptive to building occupants. Installation of a new ventilation system over the existing roof sheathing allows proper ventilation of all the roof areas that will reduce ice accumulation, and will be less disruptive to building occupants. Proper ventilation will reduce ice accumulation, but should not be expected to eliminate ice accumulation.

- **Roof Geometry** – Snow and ice often accumulate between dormers, in valleys, and at other rising walls. The snow and ice accumulation increases the risk of water leakage. Modification of the roof geometry is possible, such as removing dormers, but is costly and will change the building aesthetics, interior space and light, and be disruptive to occupants.

- **Sally Port Crawl Space Heat** – Supplemental heat added to crawl spaces along the sally port eaves contributes to snow melt and ice accumulation, and should be reduced to the minimal temperature necessary to prevent the wet sprinkler pipes from freezing. If the WPD wishes to further reduce ice accumulation after the roofing work is complete, it should consider installation of a dry fire-suppression system, which is frost tolerant and would allow the heat to be turned off.

- **Roof Replacement and Code Impact** – The recommended scope of work in this section is an Alteration under the IEBC (assume one permit). Use of the Work Area Compliance Method (Alteration – Level 1) requires the least amount of work because it does not require lateral load-carrying elements/system review, and possible modification.

  The thermal resistance of the roofing system will not need to be upgraded, assuming most of the roof sheathing is left in place.

  The recommended system is unlikely to require gravity load-carrying elements/system modification if a lighter roof covering is installed (e.g., modern synthetic slate, metal shingles, asphalt shingles, metal panels, etc.), but is likely to require modification if the existing slate is reinstalled. Structural modification of the gravity load-carrying elements will likely require removal of the existing roof sheathing, which may trigger a requirement to upgrade the thermal resistance of the roofing system.

8.1.1 Roof Option 1 – Construct a New Vented Roof over the Existing Roof Sheathing

We recommend this Option. This scope of work will stop the existing water leakage, provide durable and reliable protection against future water leakage, and reduce ice accumulation and associated falling hazards. It requires limited or no interior work and, therefore, has a limited impact on facility operation. It will increase the overall roof thickness by approximately 2-1/2 in.

For the cost estimate we assume use of a lighter roof covering in lieu of the salvaged slate (e.g., modern synthetic slate, metal shingles, or asphalt shingles) to avoid review of the gravity load-carrying elements, and possible modification.

- Remove snow guards, brick masonry veneer, wall claddings, pipe flashings, gutters, fascia/soffit/frieze claddings, etc.
- Remove and salvage the existing slate. We assume the slate is in good condition and durable, and worth salvaging for other projects.
- Remove the existing asphalt-saturated felt underlayment and prepare the existing self-adhering membrane.
- Install an air barrier over the existing roof sheathing.
- Install new wood furring to provide a 1-1/2 in. vent space over the new air barrier. Adjust the furring to provide cross venting at valleys, dormers, etc. SGH Note: The actual thickness will be determined based on analysis.
- Install new roof sheathing over the furring.
- Install new roofing underlayment layer over the sheathing, with ice barrier membrane where appropriate to resist snow and ice accumulation.
- Install a new roof covering.
- Install wall claddings, trim, etc.

8.1.2 Roof Option 2 – Construct a New Unvented Roof over the Existing

We recommend against this option. This scope of work provides improved thermal performance without providing proper ventilation. The work will stop the existing water leakage, but is not as durable or reliable as Option 1. Also, if there is a leak through the roof in the future, the water may not leak to the interior. The water will be trapped in the roofing assembly and take weeks and months to dry. If the roof continues to leak it may never dry. The extended exposure to water will damage the roofing assembly, which is likely to go unnoticed until it is severe. This scope of work is likely to reduce ice accumulation, but we do not expect it to be as effective as providing proper ventilation in combination with a reliable roof assembly.

Similar to Option 1, this scope of work will increase the overall roof thickness by approximately 2-1/2 in. and requires limited or no interior work (limited impact on facility operation), and has similar structural requirements. We also use the same cost estimating assumptions.

- Remove snow guards, brick masonry veneer, wall claddings, pipe flashings, gutters, fascia/soffit/frieze claddings, etc.
- Remove and salvage the existing slate. We assume the slate is in good condition and durable, and worth salvaging for other projects.
- Remove the existing asphalt-saturated felt underlayment and prepare the existing self-adhering membrane.
- Install an air barrier over the existing roof sheathing.
- Install a 2 in. of rigid insulation. SGH Note: The actual thickness will be determined based on analysis.
- Install new roof sheathing over the insulation and fasten through the insulation into the existing roof sheathing. Provide structural support at the eaves to reduce bending of the fasteners securing the new sheathing and prevent the roof assembly from sliding.
- Install new roofing underlayment layer over the sheathing, with ice barrier membrane where appropriate to resist snow and ice accumulation.
- Install a new roof covering.
- Install wall claddings, trim, etc.

8.1.3 Roof Option 3 – Re-roof in the Current Configuration

We recommend against this option. This scope of work will stop the existing water leakage, but is not as durable or reliable as Option 1, and will not reduce snow melt and ice accumulation. The roof thickness will remain the same and the existing salvaged slate can be reused if testing demonstrates that it is in good condition and durable. As referenced in Report Section 5.2, if the scope of work were reduced to localized repair and this is permitted as a Repair, no structural review or modification will be required.

- Remove (and possibly salvage some components) snow guards, brick masonry veneer, wall claddings, pipe flashings, gutters, fascia/soffit/frieze claddings, etc.
- Remove and salvage the existing slate. We assume the slate is in good condition and durable.

- Remove the existing asphalt-saturated felt underlayment and prepare the existing self-adhering membrane.

- Remove the existing roof sheathing along the eaves and ridges to modify existing roof diaphragm and related connections. Supplement the existing sheathing fastening to the roof rafters.

- Install new roofing underlayment layer over the sheathing, with ice barrier membrane where appropriate to resist snow and ice accumulation.

- Install the salvage slate.

- Modify the metal fascia/frieze cladding that is impeding air flow through the soffit vents. Inspect and modify the ventilation at the eave and ridge (e.g., modify blocking between the rafters), if required, where accessible. Confirm adequate air flow through the ridge vents and modify if required.

- Install wall claddings, trim, etc.

8.2 Louvers

8.2.1 Modify Air Intake Louver Plenum

We recommend this work. Assume this work is concurrent with the roofing scope of work and the necessary roofing and cladding removal occurs during that work.

- Remove the louver and metal fascia cladding around the louver perimeter.

- Install self-adhering membrane and an integrated system of metal louver perimeter flashing, including sill pan flashing, in the louver rough opening.

- Modify the existing plenum behind the louver to create a watertight pan that is drained to the exterior or to interior plumbing.

- Reinstall the louver and metal fascia cladding around the louver perimeter.

8.2.2 Reduce Intake Air Velocity and Louver Area

We recommend this work, if analysis permits.

- Reduce the louver screen area and/or screen mesh size.

- Reduce the intake air velocity to decrease the volume of snow and water carried though the louver.

8.3 Windows

8.3.1 Windows Option 1 – Replace Windows and Add Flashing

We recommend this Option. This scope of work will stop air and water leakage around the windows, reduce air and water leakage through the windows, provide a window with better thermal performance, and address the upcoming maintenance costs of replacing the IG units.

- At all window openings, remove and salvage the precast concrete head and sill pieces, steel lintel, and brick masonry around the window. Remove the interior finishes in the window returns.
- Remove and discard the existing windows and asphalt-coated copper flashing.
- Provide new windows. Provide self-adhering membrane watertight pan flashing, jamb, and sill flashing.
- Reinstall the salvaged steel lintel and provide new metal flashing with watertight end dams.
- Reinstall the salvaged precast and brick (or new brick). Provide anchors as required.
- Install sealant and backer rod at the window perimeter.
- Install spray foam between the window frame and rough opening on the interior.
- Restore the interior finishes.

8.3.2 Windows Option 2 – Add Flashing to the Existing Windows

We recommend against this option. This scope of work may not be sufficient to reduce the occupant discomfort near the window during the winter and does not address the aged IG units that will require future maintenance.

- Same scope as Windows Option 1, except salvage and reinstall the windows.

8.3.3 Localized Repair at Patrol Supervisors Office and Kingsbury Room

We recommend this scope of work regardless of the window scope of work.

- Flash the window similar to Windows Option 2.
- Remove the precast concrete panels below the window and reflash the base of the wall similar to the existing flashing system.

8.4 Base of Wall and Below-Grade Dampproofing

8.4.1 Sally Port Option 1 – Repair Wall and Through-Wall Flashing at Sally Port inside Corners

We recommend this Option. This scope of work, in conjunction with the roof scope of work, addresses the probable water leak sources.

- Remove and salvage the gutter downspouts and portions of the underground drainage system within the work area.
- At the sally port inside corners, remove and salvage approximately 3 ft of brick on either side of the corner for the full wall height (precast concrete to roof eave).
- Remove and salvage the precast concrete pieces at the inside corner.
- Directly below the brick and precast concrete removal, excavate approximately 5 ft deep. Clean the existing dampproofing and concrete substrates.
- Install self-adhering below-grade waterproofing on the exposed concrete foundation. Extend the waterproofing to the top of the foundation (behind the precast). Provide protection metal at the precast.
- Reinstall the precast concrete pieces (anchors as required) with soldered sheet metal through-wall flashing at the inside corner. Integrate the new sheet metal with the existing asphalt-coated flexible copper flashing.
- Install 3 ft wide self-adhering membrane over the exterior gypsum sheathing along the inside corner for the full wall height. Integrate the membrane with the through-wall flashings and existing Tyvek WRB.
- Install salvaged or new brick masonry to match existing with anchors as required.
- Fill the excavation area with removed soil.
- Reinstall the gutter downspouts.

8.4.2 Sally Port Option 2 – Repair Through-Wall Flashing at Sally Port Inside Corners

We recommend against this Option because it does not address all of the probable water leak sources.

- Same as Option 1, except limited to the through-wall flashing work at the precast concrete pieces at the base of the wall.

8.5 Other Repairs

- Replace all exterior sealant joints. **We recommend this repair.**

- Repointing all brick masonry, or staining all new and existing mortar joints to provide a uniform appearance when the work is complete. This work is only necessary if the WPD and FMD cannot tolerate less than perfectly matching mortar where the brick masonry must be removed and replaced to implement the various scopes of work. We include this repair in our cost estimate.

- Install a dry fire-suppression system in the sally port crawl spaces to allow the heat in the crawl spaces to be turned off. We recommend waiting to implement this scope of work after observing the ice accumulation on the new roof for a winter. If the heat in the crawl spaces is turned off, consider adding supplemental heat in the Men's Locker Room near the crawl space (e.g., baseboard heat along the crawl space walls). We include this repair in our cost estimate.

9. REPAIR COST ESTIMATE

We prepared an engineer's cost estimate for each scope of work included in Report Section 8. Table 3 below summarizes the cost estimate for each scope of work. We assume the following for cost estimating purposes:

- Roofing Options 1, 2, and 3, and Windows Options 1 and 2 will be performed as individual projects.
- The roof work will occur and be combined with other work such that the total construction cost exceeds $1,500,000 and triggers the Owner's Project Manager (OPM) requirement.
- The combination of work will result in duplicate design/bid service fees. We recommend assuming approximately 50% of the combined design/bid services fees for a combined project.
- The combination of the roof and wall work will result in duplicate design/bid services, construction administration (CA) services, OPM, and general conditions (GC). We recommend assuming approximately 150% of the larger CA/OPM/GC fees for a combined project.
- The louver work, localized repair at the Patrol Supervisors Office and Kingsbury Room (two to three windows), sally port base of wall repairs, dry fire-suppression system in the crawl spaces, and supplemental heat in the Men's Locker Room can be performed as individual projects or as part of a larger project. If performed as individual projects we assume no OPM will be required and limited general conditions. The Total Cost of these scopes can be combined with the other scopes without modification.
- The replacement of exterior sealant joints, and repointing or staining of masonry joints will occur as part of a larger project. The Total Cost of these scopes can be combined with the other scopes without modification.

For the scope of work recommended in Report Section 8, <u>we recommend budgeting $100,000 for design/bid services, and $1,955,000 for designer CA, OPM and construction costs</u>, calculated as follows:

Recommended Scope of Work	**Design/Bid Services**	**Designer CA, OPM, and Construction Cost**
Roof Option 1		$1,100,000
Designer CA Services and OPM		-$200,000
General conditions deduct		-$190,000
Louvers		$70,000
Windows Option 1		$675,000
Designer CA Services and OPM		-$100,000
General Conditions deduct		-$220,000
Sally Port Base of Wall Option 1		$40,000
Replace all exterior joint sealants		$25,000
Stain masonry joints		$125,000
Roof/windows combined design/bid and CA/OPM	$100,000	$300,000
Roof/Windows combined general conditions		$330,000
TOTAL	**$100,000**	**$1,955,000**

The Total Cost values summed to create the recommend budget are underlined in Table 3.

Table 3 – Engineer's Cost Estimate

	Design/Bid Services	Designer CA Services and OPM	General Conditions	Work	Tax, Permit, 20% General Requirements and Work Contingency	Total CA, OPM, and Construction Cost
ROOFING SYSTEM						
Option 1 – Construct a new vented roof over the existing sheathing	$100,000	$200,000	$190,000	$540,000	$170,000	$1,100,000
Option 2 – Construct a new unvented roof over the existing sheathing	$100,000	$200,000	$180,000	$470,000	$150,000	$1,000,000
Option 3 – Re-roof in the current configuration	$70,000	$150,000	$150,000	$380,000	$120,000	$800,000
LOUVERS						
*Plenum waterproofing, and air intake velocity and louver modifications	$15,000	$15,000	$5,000	$40,000	$10,000	$70,000
WINDOWS						
Option 1 – Replace windows and add flashing	$65,000	$100,000	$220,000	$245,000	$110,000	$675,000
Option 2 – Add flashing to the existing windows	$65,000	$100,000	$220,000	$225,000	$110,000	$655,000
*Localized Repair at Patrol Supervisors Office and Kingsbury Room	$18,000	$7,000	$5,000	$18,000	$5,000	$35,000
BASE OF WALL AND BELOW-GRADE DAMPPROOFING (SALLY PORT)						
*Option 1 – Repair wall and through-wall flashing at Sally Port inside corners	$18,000	$7,000	$3,000	$24,000	$6,000	$40,000
*Option 2 – Repair through-wall flashing at Sally Port inside corners	$18,000	$7,000	$2,000	$21,000	$5,000	$35,000
OTHER REPAIRS						
**Replace all exterior sealant joints	$2,000	-	-	$20,000	$5,000	$25,000
**Cut and point all masonry joints	$5,000	-	-	$120,000	$35,000	$155,000
**Stain masonry joints	$5,000	-	-	$95,000	$25,000	$120,000
*Install dry fire-suppression system and supplemental heat in the Men's Locker Room (designed by installer)	-	-	-	$80,000	$20,000	$100,000

*We assume no OPM is required and limited general conditions. The work can be performed as individual projects or as part of a larger project. The Total Cost of these scopes can be combined with the other scopes without modification.

** We assume this work will be performed as part of a larger project. The Total Cost of these scopes can be combined with the other scopes without modification.

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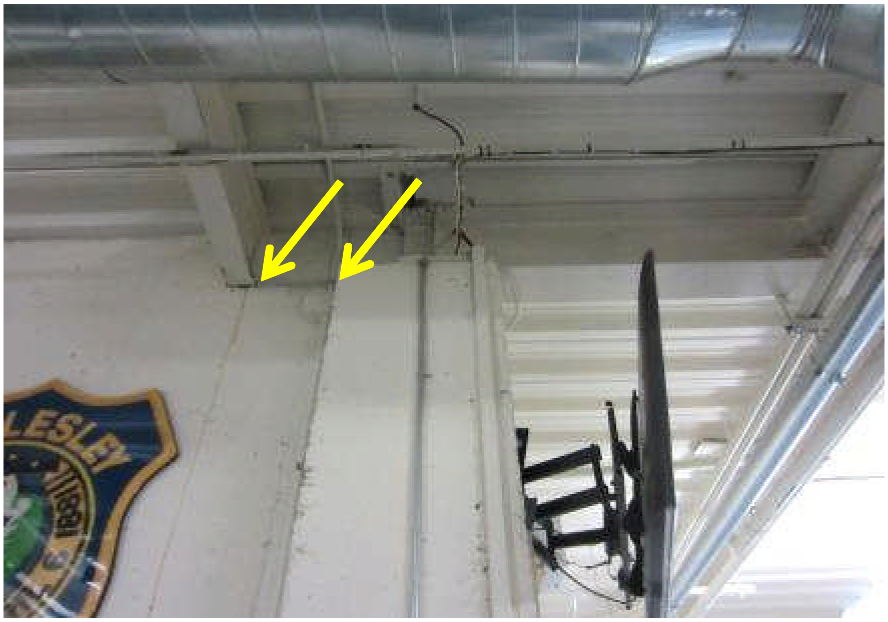

Photo 1

Fitness room

Brown water streaks and/or injection grout on the white painted concrete foundation walls in the fitness room. The arrow identifies the general location where we were told water leaks from the top of the wall.

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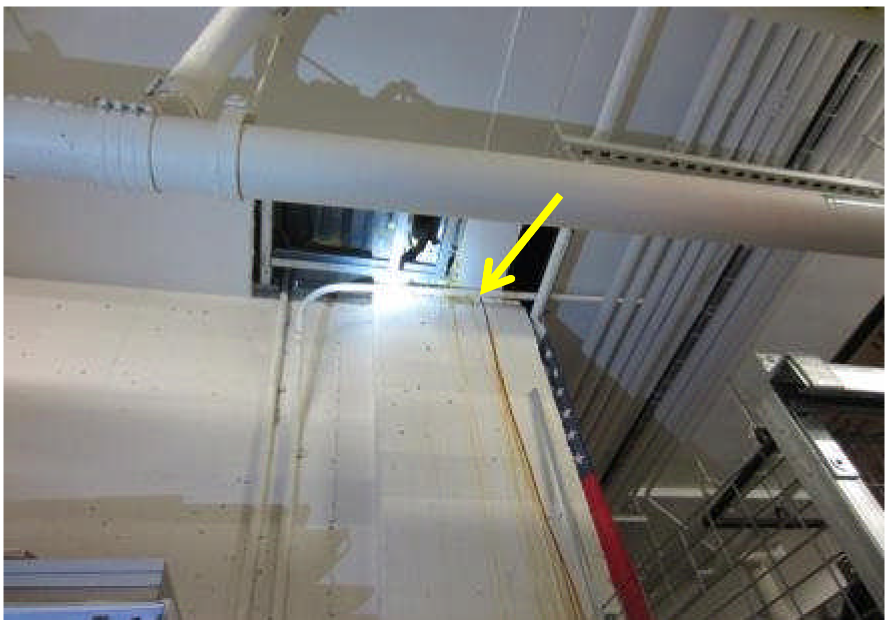

Photo 2

Storage room

Brown water streaks and/or injection grout on the white painted concrete foundation walls in the storage room.

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Photo 3

Access door to second floor crawl space over the garage (sally port west eave).

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Photo 4

Sprinkler pipe and base board heating in crawl space over the garage (sally port west eave).

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Photo 5

Room 204

Interior water damage below HVAC intake louver (sally port east wing).

Photo provided by FMD
IMG_20150408_103441969.JPG

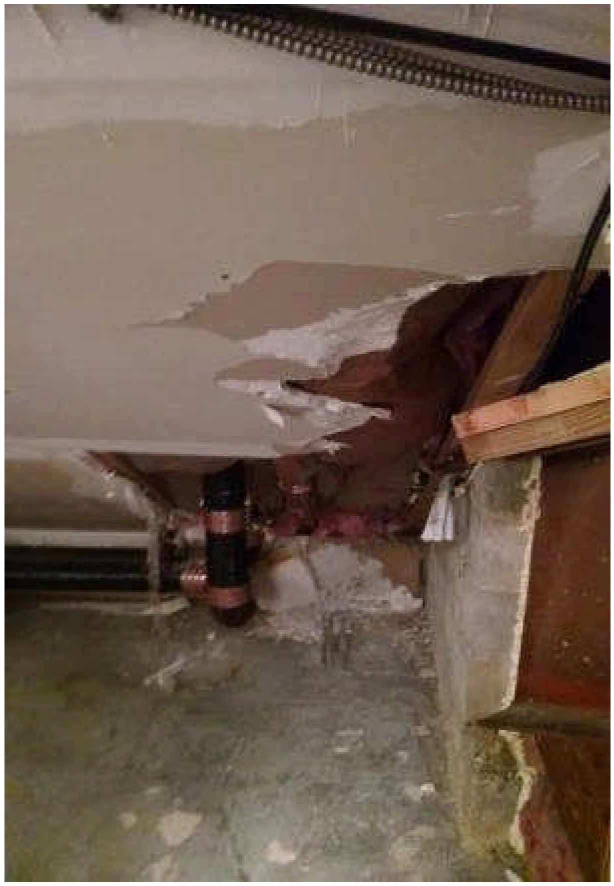

Photo 6

Interior water damage in the crawl space over the garage (sally port west wing).

Photo provided by FMD
IMG_20150408_104827054.JPG

Photo 7

Interior water damage in a crawl space.

Photo provided by FMD
IMG_20150408_104956310.JPG

Photo 8

Ice and snow accumulation (ice dam) at the valley/eave/sidewall above the sally port during the winter of 2014-2015.

Photo provided by FMD
IMG_20140220_135056_048.JPG

Photo 9

Ice and snow accumulation (ice dam) at the HVAC intake louver above the sally port during winter of 2014-2015.

Photo provided by FMD
IMG_20140220_135134_239.JPG

Photo 10

Snow and ice on the front roof during the winter of 2014-2015.

Photo provided by FMD
IMG_20150213_121403357.JPG

Photo 11

Workers removing snow and ice from the valley/eave/sidewall above the sally port during the winter of 2014-2015.

Photo provided by FMD
IMG_20150218_134354303.JPG

Photo 12

South elevation of the WPS.

150841.00_SBM20150803_SAM_0449.JPG

Photo 13

Southwest elevation of the WPS.

150841.00_SBM20150803_SAM_0578.JPG

Photo 14

Partial north elevation of the WPS. The main building is on the right and the sally port is on the left.

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Photo 15

Partial north elevation of WPS ("sally port").

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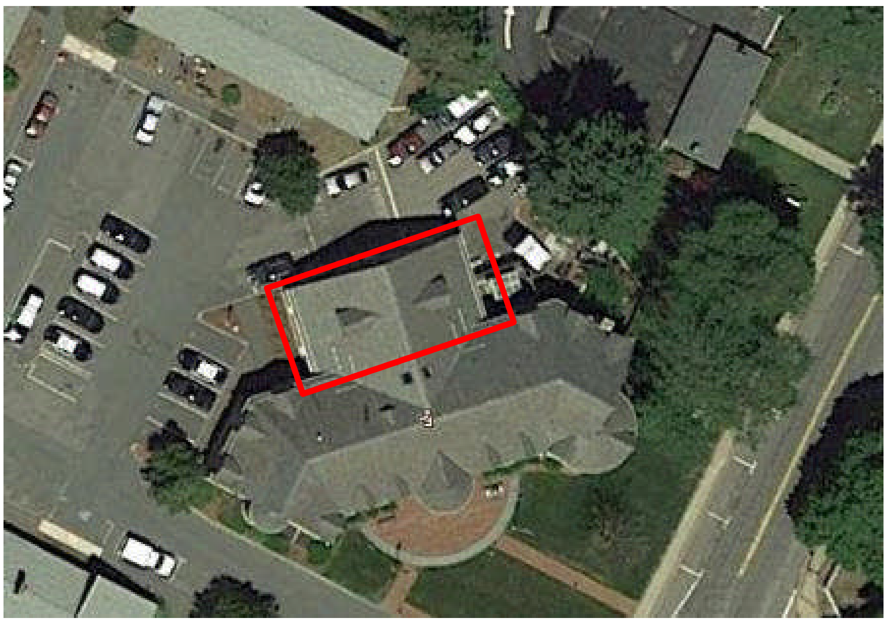

Photo 16

Satellite image of the WPS roof. The boxed area is the sally port.

Image provided by Google Earth (Imagery Date: 6/6/2015)

Photo 17

Room 107

Stains on ceiling tile that may be caused by exterior water leakage.

150841.00_SBG20150803_646.JPG

Photo 18

Room 138

Water stains and/or deteriorated finish on the laminated wood stool.

150841.00_SBM20150803_SAM_0621.JPG

Photo 19

Room 110

Water stains on the stool below the jamb that could be from water leakage through the sill/jamb frame corner.

150841.00_SBG20150803_650.JPG

Photo 20

Room 108

Water stains/streaks on window frame head. Note: photo is oriented with window head on the left and the window jamb at the top.

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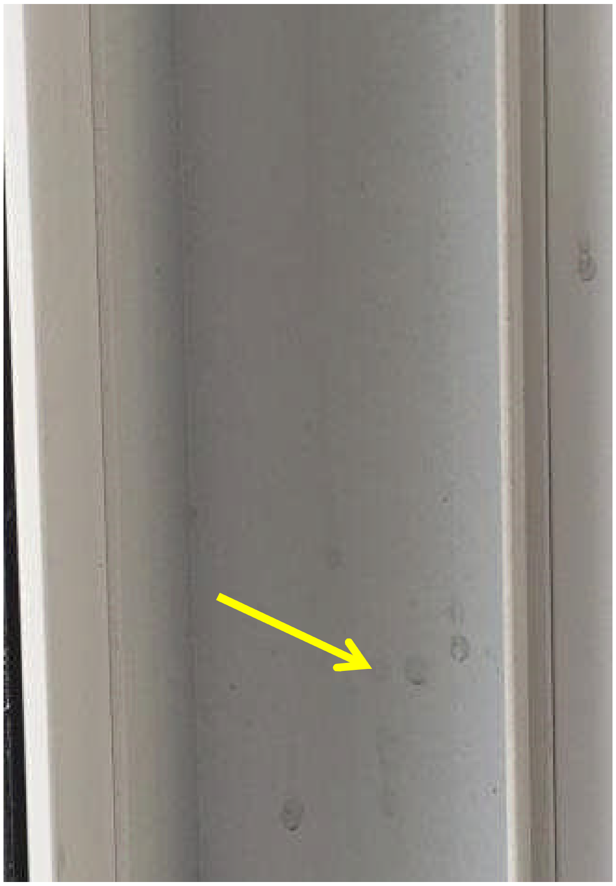

Photo 21

Room 139

Water stains/streaks on window frame at jamb.

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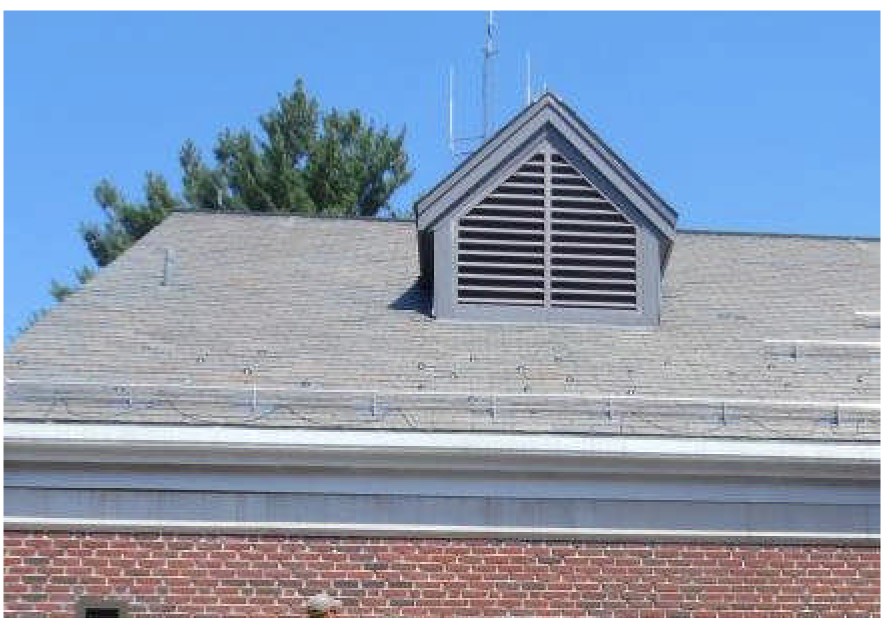

Photo 22

Pad- and pipe-style snow guards installed along the main roof eaves.

150841.00_SBM20150803_SAM_0590cropped.JPG

Photo 23

Natural roof slate with lead-coated copper valley pans and flashings.

150841.00_SAT20150803_IMG_3427.JPG

Photo 24

Soffit vents.

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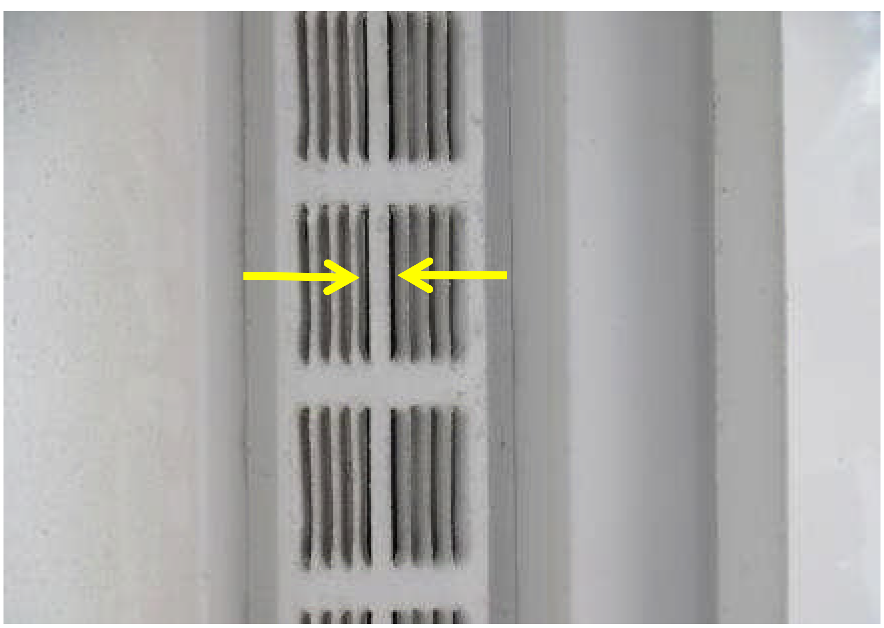

Photo 25

The soffit vent is 2 in. wide, but mostly blocked by metal frieze and fascia trim cladding. The yellow arrows identify the cladding metal edges behind the soffit vent. The space between the arrows is the available vent opening.

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Photo 26

The ridge vent has 3/8 in. diameter holes at 2 1/4 in. o.c.

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Photo 27

The dormers have perforated soffit vents, but do not have ridge vents.

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Photo 28

The dormers have perforated soffit vents.

150841.00_SBM20150729_SAM_0138.JPG

Photo 29

Roof Opening 1

Multiple layers of self-adhering ice barrier membrane (at eaves where we made openings) and asphalt-saturated felt roofing underlayment. W.R. Grace Ice & Water Shield installed at this location (sally port), which we understand was part of repair work to mitigate roof leakage (release paper not removed).

150841.00_SBM20150729_SAM_0097.JPG

Photo 30

Engineered wood I-joist roof rafters typically at 16 in. o.c.

150841.00_SBM20150730_SAM_0281.JPG

Photo 31

Owens Corning EcoTouch Pink fiberglass batt insulation (R-30) between the joists with a kraft paper facer on the attic side.

Photo shows the Sally Port/main building intersection.

150841.00_SBM20150730_SAM_0284.JPG

Photo 32

In various locations the batt insulation is in contact with the underside of the plywood sheathing (arrow).

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Photo 33

Wood blocking installed between the joists has approximately 1-1/2 in. diameter holes (visual estimate) that are located below the vent space between the insulation and roof sheathing.

150841.00_SBM20150730_SAM_0294.JPG

Photo 34

Roof Opening 1

A fluid-applied liquid mastic/sealant covers the gap between plywood sheathing and brick masonry. We observed an apparent water stain on the sheathing (arrow).

150841.00_SBM20150729_SAM_0104.JPG

Photo 35

Roof Opening 1

Lead-coated copper step flashing, counterflashing, and reglet-set or through-wall flashing.

150841.00_SAT20150729_IMG_3094.JPG

Photo 36

Roof Opening 1

Lead-coated copper reglet-set or through-wall flashing.

150841.00_SBM20150729_SAM_0018.JPG

Photo 37

Roof Opening 1

The roofing underlayment (felt and membrane) terminates at the fascia and under the soffit where the eave terminates against the roof at the base of the valley. The upper arrow identifies the hole shown in Photo 38, and the lower arrow points to the membrane termination.

150841.00_SAT20150729_IMG_3108.JPG

Photo 38

Roof Opening 1

Hole in the roofing underlayment.

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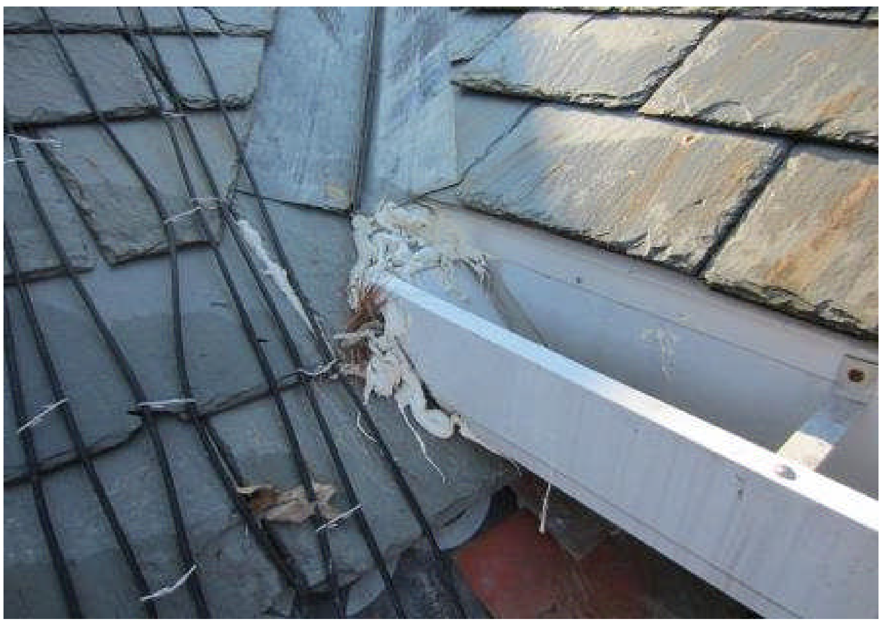

Photo 39

Roof Opening 1

A large volume of sealant filled the void between the end of the gutter and the roofing.

150841.00_SAT20150729_IMG_3099.JPG

Photo 40

Crawl space along the sally port west eave.

Damaged gypsum board in the crawl space below the valley/eave/sidewall intersection at the main building.

150841.00_SBM20150730_SAM_0301.JPG

Photo 41

Crawl space along the sally port east eave.

Water stains on plywood sheathing in the crawl space below the valley/eave/sidewall at the main building.

150841.00_SAT20150730_IMG_3167.JPG

Photo 42

Roof Opening 2

The roofing underlayment turns up the dormer sidewall and is adhered to DuPont Tyvek water-resistant barrier installed on the sidewall, forming a reverse lap.

150841.00_SBM20150729_SAM_0125.JPG

Photo 43

Roof Opening 2

The roofing underlayment turns up the dormer sidewall and is adhered to DuPont Tyvek installed on the sidewall. Note tunnels through laps at base of sidewall (arrow).

150841.00_SBM20150729_SAM_0153.JPG

Photo 44

Roof Opening 2

The underlayment does not turn up the end of the brick masonry on the front face of the dormer.

150841.00_SBM20150729_SAM_0148.JPG

Photo 45

Lead-coated copper step flashing is counterflashed by standing seam lead coated copper wall panels.

150841.00_SBM20150729_SAM_0078.JPG

Photo 46

Roof Opening 3

Lead-coated copper step flashing is counterflashed by standing seam lead coated copper wall panels.

The joint around the louver perimeter is filled with sealant. We observed no flashing at the louver head, jamb, or sill.

150841.00_SAT20150803_IMG_3424.JPG

Photo 47

Roof Opening 3

Interior view of the louver sill. The wood framing is stained from apparent water leakage.

150841.00_SAT20150730_IMG_3165.JPG

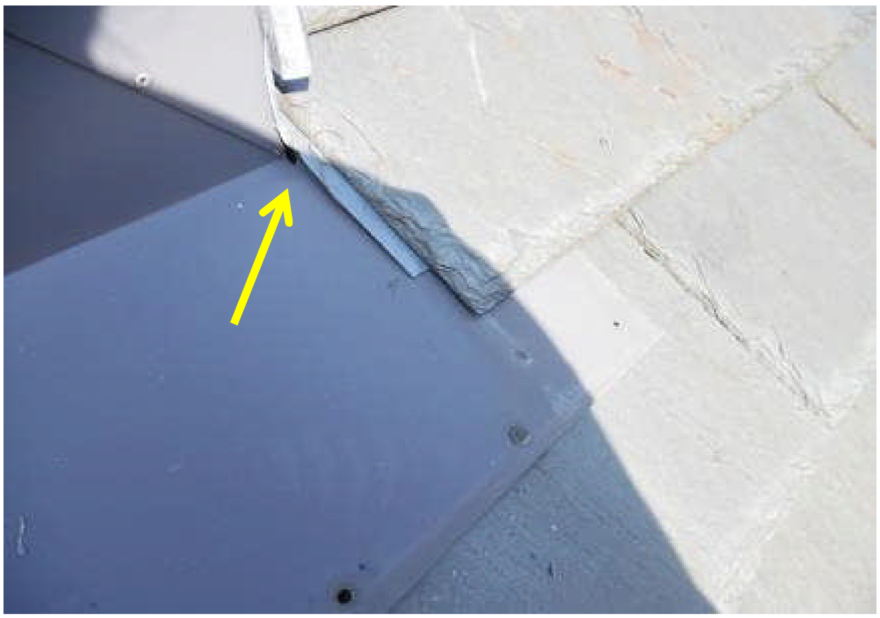

Photo 48

Roof Opening 3

Hole at the end of the painted metal base flashing between the louver sill and roofing. See Photo 46 for a further back view.

150841.00_SBM20150730_SAM_0245.JPG

Photo 49

Roof Opening 3

The asphalt-saturated felt roofing underlayment does not turn up the dormer wall below the louver sill (looking underneath the metal base flashing, see Photo 46).

150841.00_SBM20150730_SAM_0257.JPG

Photo 50

Roof Opening 3

The vertical rise of the louver fins is approximately 5-1/2 in. with 1/2 in. overlaps. The louver screen has approximately 1/2 in. square holes.

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Photo 51

Roof Opening 3

The plenum behind the louver is not watertight and has approximately 12 in. square access hatches in the bottom.

150841.00_SAT20150730_IMG_3152.JPG

Photo 52

Roof Opening 3

View of the louver fins and screen from within the plenum.

150841.00_SAT20150730_IMG_3162.JPG

Photo 53

Weeps in the precast bed joints at the base of the walls (commonly at the bottom of head joints) and below precast window sills on the first floor.

150841.00_SAT20150630_IMG_2876.JPG

Photo 54

Continuous sealant joint at precast concrete joints. The sealant is failed.

150841.00_SAT20150415_IMG_0591.JPG

Photo 55

Window perimeter sealant joint. The sealant is generally chalky, cracked, crazed, and debonded.

150841.00_SBM20150803_SAM_0458.JPG

Photo 56

Wall Opening 3

The brick masonry is anchored to the backup wall with vertically adjustable wire ties with a sheet metal plate.

150841.00_SBM20150803_SAM_0650.JPG

Photo 57

Wall Opening 1.

DuPont Tyvek over 1/2 in. thick brown paper-faced gypsum sheathing.

150841.00_SBM20150803_SAM_0661.JPG

Photo 58

Test Location 2

6 in. deep steel studs with unfaced fiberglass batt insulation between the studs, plastic sheeting vapor retarder, and painted interior gypsum wallboard.

150841.00_SBM20150803_SAM_0441.JPG

Photo 59

Test Location 1

Wood blocking in the window rough opening. Wall assembly similar to Test Location 2. Note that batt insulation and vapor barrier was removed prior to the photo.

150841.00_SAT20150803_IMG_3352.JPG

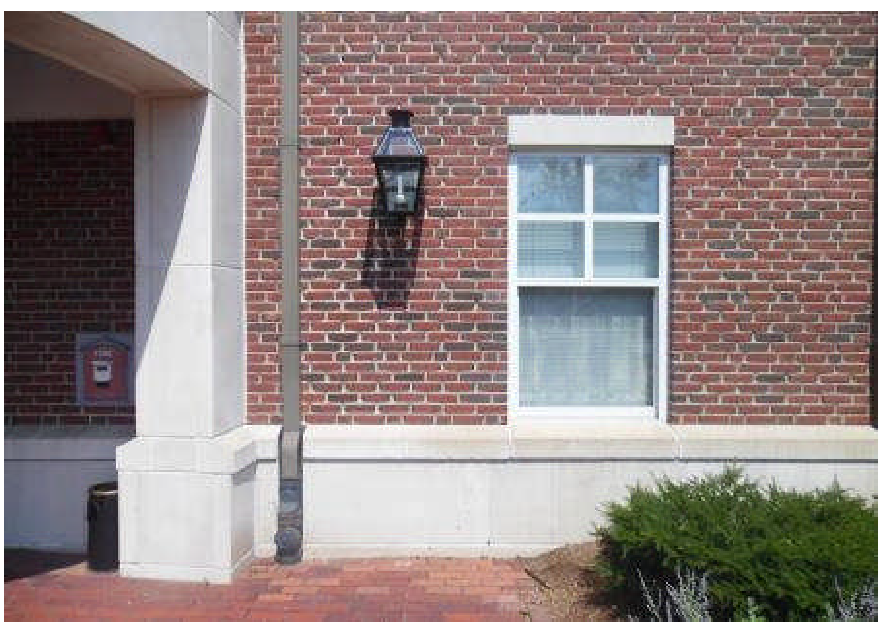

Photo 60

Windows are aluminum-framed and single-hung.

150841.00_SBM20150803_SAM_0454.JPG

Photo 61

The aluminum sashes are thermally broken, and the aluminum frame has a thermal break in line with the fixed upper sash (arrow).

150841.00_SAT20150730_IMG_3141.JPG

Photo 62

The aluminum sashes are thermally broken, and the aluminum frame has a thermal break in line with the fixed upper sash (arrow).

150841.00_SAT20150803_IMG_3347.JPG

Photo 63

Wall Opening 1

Asphalt-coated flexible copper flashing is installed over a steel lintel that supports the precast window head and masonry above.

150841.00_SBM20150803_SAM_0629.JPG

Photo 64

Wall Opening 2

Asphalt-coated flexible copper flashing is installed at the window sill (arrow).

We observed no flashing tie-in between the window frame and DuPont Tyvek, or the sill flashing, and the window frame.

150841.00_SBM20150803_SAM_0668.JPG

Photo 65

Wall Opening 1

There is no flashing between the AWRB and window frame.

150841.00_SBM20150803_SAM_0641.JPG

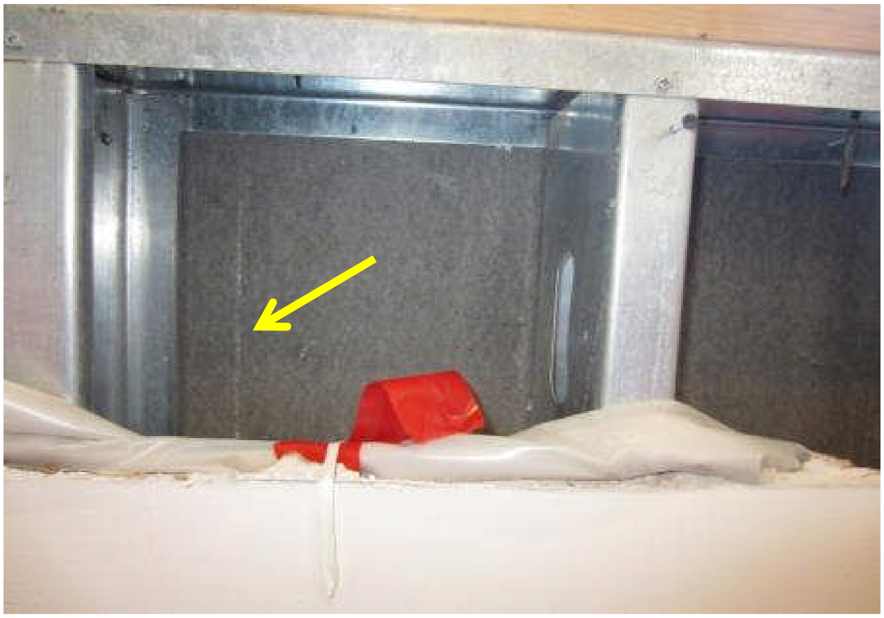

Photo 66

Test Location 1

Arrow points to apparent water streaks on the cavity side of the exterior gypsum sheathing the windows.

150841.00_SAT20150803_IMG_3353.JPG

Photo 67

Test Location 1

Apparent water stains on the wood blocking in the window rough opening.

150841.00_SAT20150803_IMG_3344.JPG

Photo 68

Location of Wall Opening 3

Overall view of precast concrete panels before removal.

150841.00_SAT20150630_IMG_2876.JPG

Photo 69

Wall Opening 3

The flashing below the precast cap and the wall panel is counterflashed by the wall WRB (upper arrow).

Asphalt-coated copper flashing through-wall flashing is installed underneath the precast concrete panel (lower arrow).

150841.00_SAT20150731_IMG_3186.JPG

Photo 70

Wall Opening 3

A thin fluid-applied dampproofing is applied to the concrete foundation and covered with 2 in. thick extruded polystyrene insulation.

150841.00_SAT20150731_IMG_3184.JPG

Photo 71

Testing Location 2

Typical Test Chamber set-up.

150841.00_SBM20150803_SAM_0440.JPG

Photo 72

Test Location 1

Example of air test set-up. Plastic sheeting applied to the exterior of the window to prevent air from leaking through the window.

150841.00_SBM20150731_SAM_0340.JPG

Photo 73

Test Location 1

Example of air test set-up. Tape applied over the joint between the gypsum wallboard and window frame to prevent air from leaking through the joint.

150841.00_SBM20150731_SAM_0334.JPG

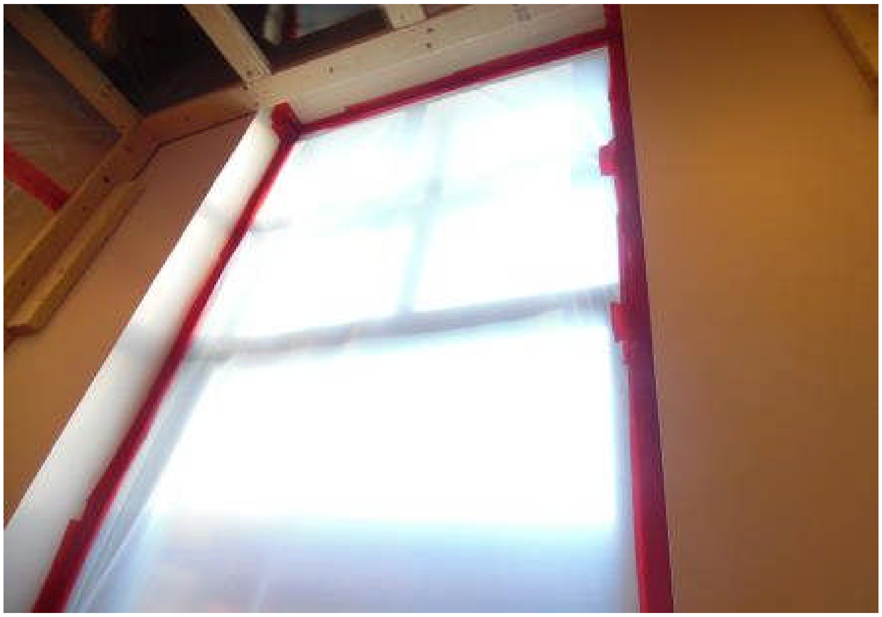

Photo 74

Test Location 2

Example of air test set-up.

150841.00_SBM20150731_SAM_0361.JPG

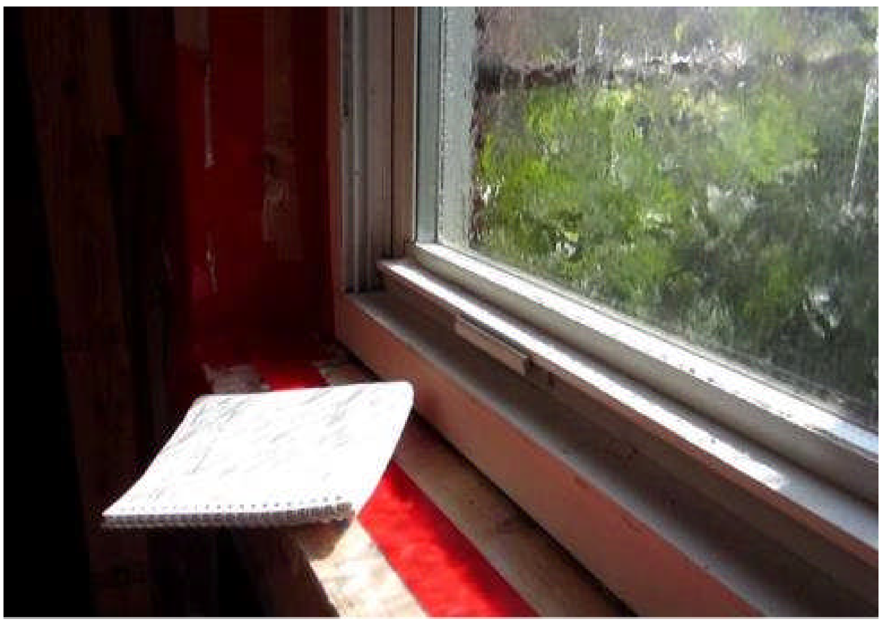

Photo 75

Test Location 2

During our test at Location No. 2 the flowing air blew a 0.2 lb field book off the rough opening sill.

Screenshot of 150841.00_SAT20150803_MVI_3253

Photo 76

Test Location 1

We removed the interior gypsum board but covered the resulting wall opening with plastic sheeting in preparation for the test. The test chamber is not shown.

150841.00_SBM20150803_SAM_0530.JPG

Photo 77

Test Location 2

We removed the interior gypsum board but covered the resulting wall opening with plastic sheeting in preparation for the test. The test chamber is not shown.

150841.00_SBM20150803_SAM_0446.JPG

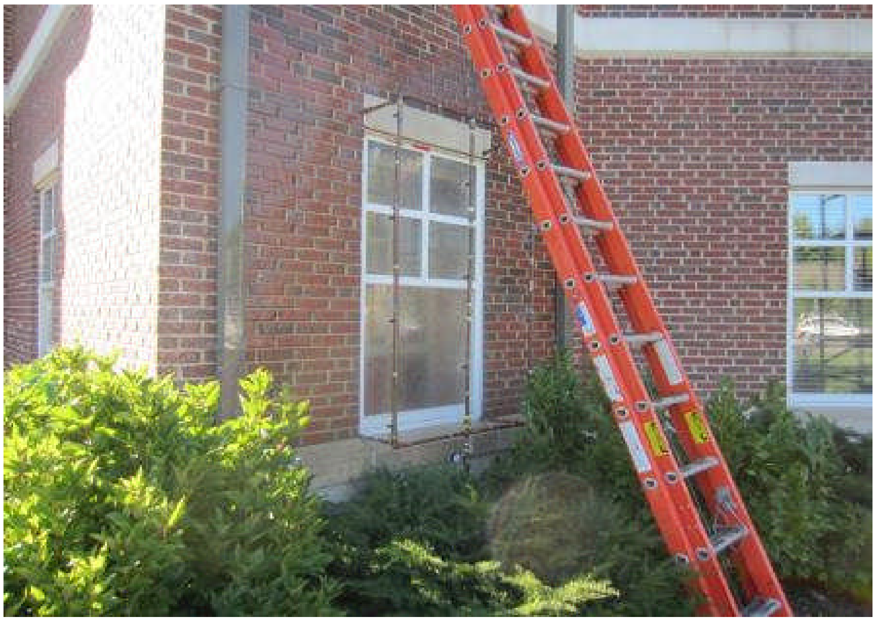

Photo 78

Test Location 1

Water test Setup A (30 July 2015).

150841.00_SAT20150731_IMG_3207.JPG

Photo 79

Test Location 1

Water test Setup B (30 July 2015).

150841.00_SAT20150731_IMG_3209.JPG

Photo 80

Test Location 1

Water test Setup B
(30 July 2015).

Water flowing down the cavity side of the exterior gypsum sheathing along a metal stud and into the stud track below the window.

150841.00_SAT20150731_IMG_3224.JPG

Photo 81

Test Location 1

Water test Setup B
(30 July 2015).

Wet spot at a horizontal joint in the exterior gypsum sheathing at the window jamb. We saw a similar spot at the other jamb.

150841.00_SAT20150731_IMG_3220.JPG

Photo 82

Test Location 1

Water test Setup B
(30 July 2015).

Wet carpet below the window.

150841.00_SAT20150731_IMG_3216.JPG

Photo 83

Test Location 1

Water test Setup C
(3 August 2015).

150841.00_SAT20150803_IMG_3240.JPG

Photo 84

Test Location 1

Water test Setup C
(3 August 2015).

Water wetting the carpet
below the window.

150841.00_SAT20150803_IMG_3244.JPG

Photo 85

Test Location 1

Water test Setup C
(3 August 2015).

Water leaking (spitting/bubbling) from the right sill/jamb window frame joint.

150841.00_SAT20150803_IMG_3250.JPG

Photo 86

Test Location 2

Water test Setup D
(3 August 2015).

150841.00_SBM20150803_SAM_0518.JPG

Photo 87

Test Location 2

Water test Setup D
(3 August 2015).

Water leaking (spitting) at the joint between the window sill and wood blocking on the rough opening sill.

150841.00_SAT20150803_IMG_3321.JPG

Photo 88

Test Location 2

Water leaking (spitting) from the right sill/jamb window frame joint.

150841.00_SAT20150803_IMG_3326.JPG

APPENDIX A

APPENDIX A

- Past Leak Location as Reported in Wellesley Facilities Maintenance Department Request For Proposals #WFMD-RFP-FY16-001 Wellesley Police Station Roofing and Envelope Feasibility Study and Wellesley Police Department Staff
- SGH Observed Apparent Evidence of Leakage at Windows During On-Site Investigation (29 - 31 July 2015 and 3 August 2015)
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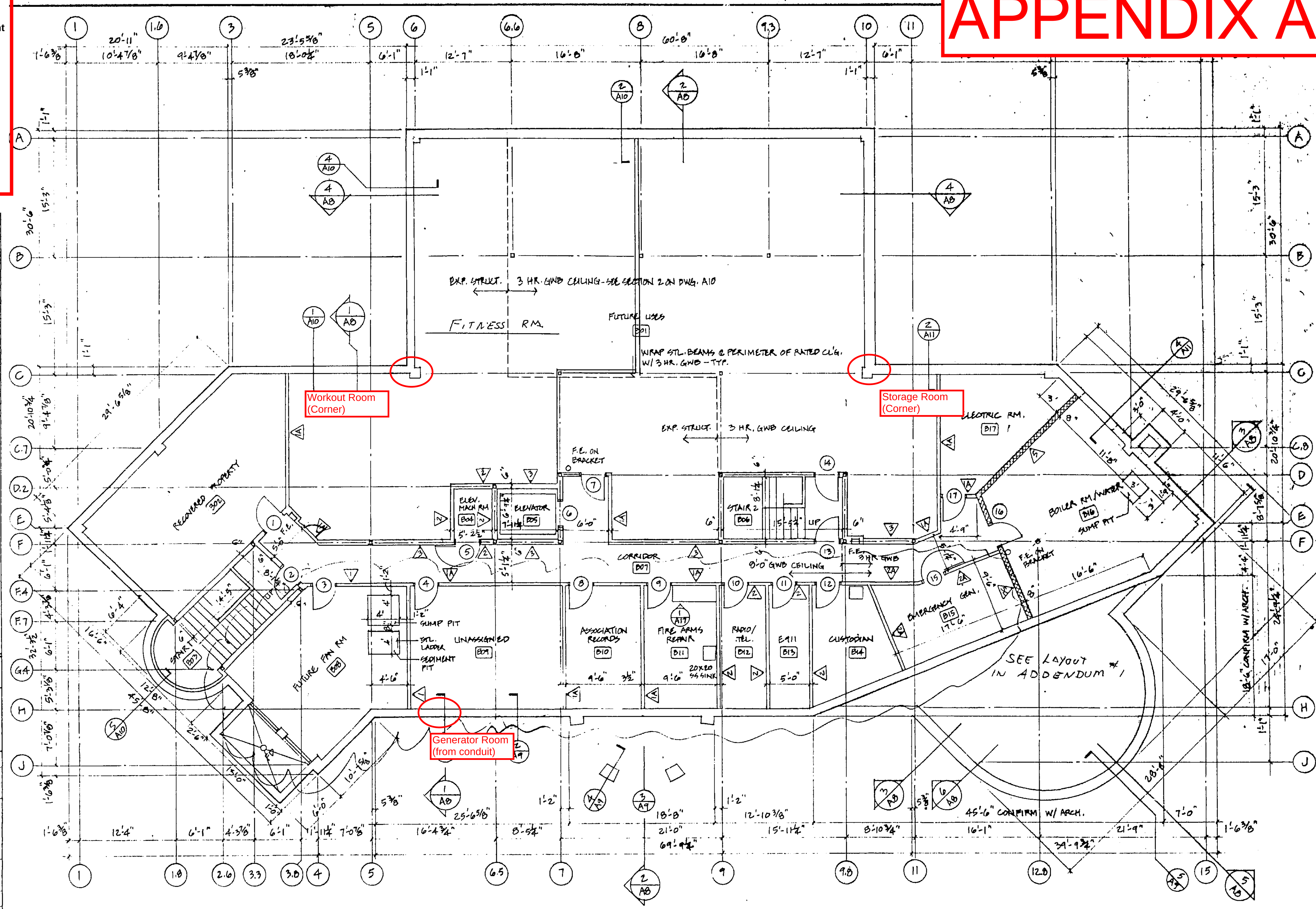
2 October 2015
Siena B. Mamayek
Scott A. Tomlinson

Page 1 of 4

		VCT	4" VINYL	"	ACOUST. T. 2	8'-0"	
	...R	CONC. W/ HARD.	4" VINYL @ GWB	"	GWB	"	
		"	"	"	" *	"	* 2 HR. RATED CEILING
		"	"	"	" *	"	* " " "
		"	"	"	"	"	
	...N.	"	"	CMU/GWB/CONC	" *		* W/ ACOUST. BATT INSUL.
	...ER	"	"	CMU/CONC	" *		* FOLLOW BEAM/DECK CONTOUR
B17	ELECTRIC RM.	"	"	CMU/GWB/CONC	"		



DOOR SCHEDULE

DR. NO.	LOCATION	DOOR: ELEVATION	DOOR: WIDTH	DOOR: HEIGHT	DOOR: MATERIAL	FRAME: ELEVATION	FRAME: FRAME MATERIAL	FRAME: WALL MATERIAL	FRAME: WALL THICKNESS	FRAME: JAMB DTL.	FRAME: HEAD DTL.	FRAME: SILL DTL.	UL LABEL	HW SET	REMARKS
1	RECOVERED PROP.	F	3'-0"	7'-0"	HM	A	HM	GWB						5	
2	STAIR 1	ST	"	"	"	"	"	"					C	8	
3	FUTURE FAN RM.	F	"	"	"	"	"	"						14	
4	UNASSIGNED	"	"	"	PTD. WD.	"	"	"						1	
5	ELEV. MACH. RM.	"	"	"	HM	"	"	"					B	14	
6	ELEVATOR	—	"	"	"	"	"	"						—	BY ELEV. MFR.
7	FUTURE USES	F	"	"	PTD. WD.	"	"	"						1	
8	ASSOC. RM.	"	"	"	"	"	"	"						1	
9	FIRE ARMS	"	"	"	"	"	"	"						5	
10	RADIO/TEL.	"	"	"	HM	"	"	"					B	14	
11	E911	"	"	"	"	"	"	"					B	14	
12	CUSTODIAN	"	"	"	"	"	"	"						2	
13	STAIR 2	ST	"	"	"	"	"	"					C	8	
14	"	"	"	"	"	"	"	"					C	8	
15	EMERGENCY GEN.	F	"	"	"	"	"	"					B	14	
16	BOILER RM.	"	"	"	"	"	"	"					C	14	
17	ELECTRIC RM.	"	"	"	"	"	"	"						14	

GENERAL NOTES

1. ALL DIMENSIONS ARE ROUGH TO ROUGH (CMU TO CMU, STUD TO STUD) UNLESS OTHERWISE NOTED. CMU SIZES ARE NOMINAL ON 1/8" PLANS.
2. WALL TYPES (2 INDICATES TYPE WHEN NOT COVERED BY FOLLOWING NOTES. SEE A-19)
   EXTERIOR A. BRICK & STUD - SEE WALL SECTION 1 ON A-9
   B. BRICK & BLOCK - SEE WALL SECTION 2 ON A-10
   INTERIOR C. TYPICAL GWB U.O.N. - TYPE 1 ON A-19 (1ST FLR.), TYPE 1B (2ND FLR.)
   D. GWB PLUMBING CHASE U.O.N. - TYPE 4 ON A-19.
   E. STAIR AND ELEVATOR WALLS U.O.N. - TYPE 3 ON A-19.
3. INTERIOR WALL HEIGHT:
   BASEMENT - ALL WALLS GO UP TO STRUCTURAL DECK ABOVE U.O.N
   FIRST FLOOR - ALL WALLS GO UP TO STRUCTURAL DECK ABOVE U.O.N. (SEE DETENTION AREA)
   SECOND FLOOR - ALL WALLS STOP ABOVE CEILING EXCEPT:
   FAN ROOM, DETECTIVES, CHIEF, CONFERENCE RM., UPPER COMMUNICATIONS
4. LOCKERS AT 2ND FLR. LOCKER RMS. ARE 24"x24"x FULL HT. W/ SLOPING TOPS — SEE SPECS
   LOCKERS AT 1ST FLR. BOOKING AREA/SALLYPORT ARE 12"x12"x12"
5. F.E. = FIRE EXTINGUISHER IN RECESSED CABINET U.O.N.
6. 1/4" STAIR PLANS & SECTIONS - SEE DWG. A-15
7. 1/4" ELEVATOR PLANS & SECTIONS - SEE DWG. A-16
8. 1/2" CELL PLANS - SEE DWG A-16
9. 1/4" TOILET/SHOWER RM. PLANS - SEE DWG. A-18
10. SEE PLUMBING DWGS. FOR FLOOR DRAINS NOT SHOWN ON ARCH. PLANS.
11. SEE ADDENUM FOR CHANGES

FINISH SCHEDULE NOTES

1. EPOXY PAINT - SURFACES TO BE PAINTED INCLUDE WALLS, CEILINGS, DOORS AND FRAMES, AND ALL STEEL ITEMS.
2. ALL WALLS AND CEILINGS SHALL BE PAINTED UNLESS OTHERWISE NOTED.
3. TRIM: NAT. WOOD BASE - SEE DETAIL 16 ON A-19
   NAT. WOOD CHAIR RAIL - " 16 "
   WAINSCOT 1 - " 14 "
   WAINSCOT 2 - " 15 "
4. CONCRETE TOPPING AT DETENTION AREA: TOP OF STRUCTURAL FLOOR SLAB IS EL. 145'-0" (REFERENCE ELEVATION). ALL FLAT AREAS ARE +1". FLOOR DRAINS ARE +1/2". ELEVATIONS @ BUNKS/HOLDING CELL BENCH EDGES IS +2". INSTALL CMU ON STRUCTURAL FLOOR SLAB, THEN INSTALL CONC. TOPPING.
5. ACOUST. T. 1 - 12"x12" ACOUSTIC TILE W/ CONCEALED SUSPENSION - SEE SPECS
   ACOUST. T. 2, 3 & 4 - 24"x24" ACOUSTIC TILE W/ EXPOSED SUSPENSION - "
6. CERAMIC TILE - SEE SPECS FOR SUBSTRATE
7. CLOSETS - PROVIDE SHELF & POLE IF NOT CALLED OUT.
   - 7 SH - PROVIDE 7 PTD. WD. SHELVES. RUN SUPPORT CLEATS FULL CLOSET DEPTH.
8. REFLECTED CEILING PLANS - SEE DWG. A-5.

DOOR SCHEDULE NOTES

1. NAT. WD. = SOLID CORE WOOD DOOR W/ PLYWD. VENEER FOR NAT. FIN.
   PTD. WD. = " " " " " " PTD. "
   NAT. WD./MIN. CORE = MINERAL CORE DOOR W/ PLYWOOD VENEER FOR NATURAL FINISH.
2. A LABEL = 3 HR. FIRE RATING U.O.N.
   B LABEL = 1 1/2 " " "
   C LABEL = 3/4 " " EXCEPT STAIR DOORS WHICH SHALL BE 1 HR. FIRE RATED.
3. HOLLOW METAL ELEVATIONS & DETAILS - SEE DWG A-14.
4. ALUMINUM ENTRANCE ELEVATIONS & DETAILS - SEE DWG A-14.

Donham & Sweeney Inc
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617 423 1400 Fax 423 2939

WELLESLEY POLICE STATION

Basement Floor Plan
Door and Finish Schedule

SCALE: 1/8" = 1'-0"
DRAWN BY: J.H.
DATE: 2/14/95
REVISED:

As Builts

A-1

TRIM LINE

Charrette

APPENDIX A

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Scott A. Tomlinson

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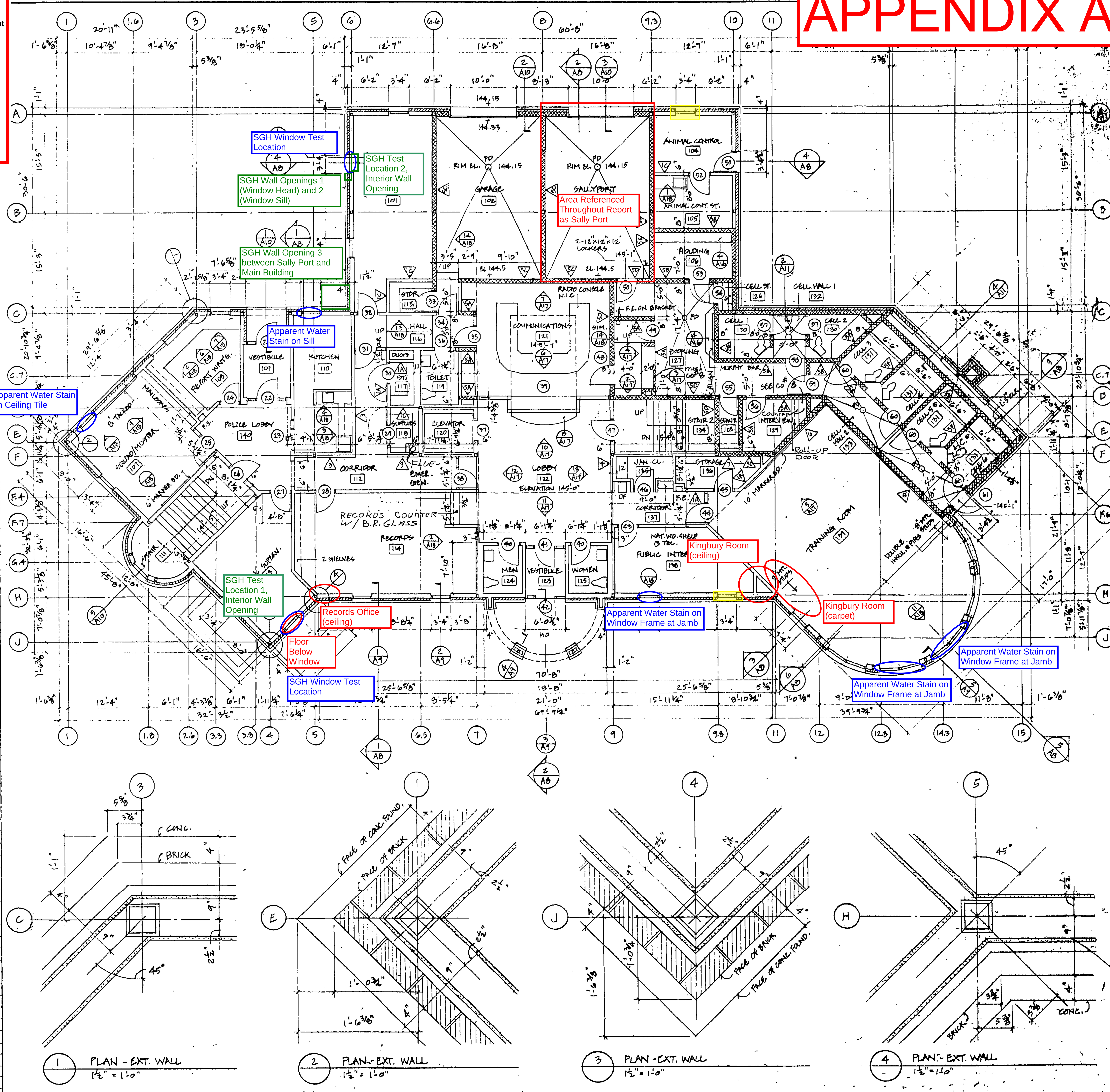
		RUBBER TILE	WAINSCOT 1	"	GWB	A-15	RUBBER TREADS
		CARPET	WAINSCOT 2	"	ACOUST. T. 2	8'-8"	
		"	4" VINYL	"	ACOUST. T. 2	"	
		"	"	"	"	"	
		VCT	"	GWB / CMU	"	8'-1"	7 SHELVES
		CARPET	WAINSCOT 2	"	"	8'-8"*	* LOW END OF RAMP
		"	4" VINYL	GWB	"	8'-0"	7 SHELVES
		"	"	"	"	"	"
119	TOILET	CERAMIC T.	C.T.	CERAMIC TILE	ACOUSTIC T. 2	"	
120	ELEVATOR	TERRAZZO TILES	—	—	—	—	
121	COMMUNICATIONS	CARPET TILES	4" VINYL	GWB / SPCMU	ACT 4 / GWB	SEE A-17	ACCESS FLOORING
122	LOBBY	TERRAZZO	WAINSCOT 1	GWB	ACOUST. T. 1	"	
123	VESTIBULE	VINYL LINK	"	"	GWB	"	
124	MEN	CERAMIC T.	C.T.	CERAMIC T.	"	8'-0"	
125	WOMEN	"	"	"	"	"	
126	CELL ST.	CONC. TOPPING W/ HARD'R.	NONE	CMU	GWB*	8'-8"	EPOXY PT. * 2 LAYERS, 3 STL. SH
127	BOOKING	" **	"	4" VINYL & LAND'G	" *	"	** VCT / VINYL T. & R. & WD. LAND'G
128	SHOWER	CERAMIC T.	C.T.	CERAMIC T.	GWB*	"	* 2 LAYERS, M.R.
129	INTERVIEW	CONC. TOPPING W/ HARD'R.	NONE	CMU	"	"	EPOXY PT. * 2 LAYERS
130	CELLS 1 & 2	"	"	"	STEEL PLATE	"	EPOXY PAINT
131	CELLS 3-6	"	"	"	"	"	"
132	CELL HALL	"	"	"	GWB*	"	" * 2 LAYERS
133	"	"	"	"	"	"	" "
134	STAIR 2	RUBBER TILE	PTD. STEEL	GWB / CMU	GWB	SEE A-15	RUBBER TREADS, NAT. CHAIR R.
135	JAN. CL.	CERAMIC T.	C.T.	GWB / CT*	ACOUST. T. 2	8'-0"	* 4'-0" HI @ SINK
136	STORAGE	CARPET	4" VINYL	GWB	"	"	7 SHELVES
137	CORRIDOR	TERRAZZO	WAINSCOT 1	"	ACOUST. T. 2	8'-8"	
138	PUBLIC INTERV.	CARPET	"	"	ACOUST. T. 2	"	
139	TRAINING RM.	"	"	"	ACT 2 / GWB	9'-8"	
140	POLICE LOBBY	RUBBER TILE	"	"	ACOUST. T. 2	9'-8"	

DOOR SCHEDULE

DR. NO.	LOCATION	DOOR: ELEVATION	DOOR: WIDTH	DOOR: HEIGHT	DOOR: MATERIAL	FRAME: ELEVATION	FRAME: FRAME MATERIAL	FRAME: WALL MATERIAL	FRAME: WALL THICKNESS	FRAME: JAMB DTL.	FRAME: HEAD DTL.	FRAME: SILL DTL.	UL LABEL	HW SET	REMARKS
21	VESTIBULE 109	FG	3'-0"	7'-0"	ALUM.	E1	ALUM.	GWB						12	
22	"	"	"	"	"	"	"	"						11	
23	KITCHEN	F	"	"	PTD. WD.	D1	HM	"						7	SIDELT.
24	REPORT WRIT'G.	"	"	"	"	A	"	"						2	
25	SQUAD/MUSTER	"	"	"	"	D1	"	"						2	SIDELT.
26	STAIR 1	ST	"	"	HM	A	"	"					C	8	
27	PATROL SUPERV.	F	"	"	PTD. WD.	"	"	"						2	
28	RECORDS	"	"	"	"	"	"	"						2	
29	SUPPLIES	"	"	"	"	"	"	"						3	
30	STORAGE 117	"	"	"	"	"	"	"						3	
31	HALL 116	"	"	"	"	D1	"	"						2	SIDELT.
32	LIEUTENANTS	"	"	"	"	A	"	"						2	
33	STORAGE 115	"	"	"	HM	"	"	GWB/HM					B	3	
34	GARAGE	"	"	"	"	"	"	"					B	2	
35	COMMUNICATIONS	"	"	"	PTD. WD.	D1	"	CMU						9	SIDELT.
36	TOILET	"	"	"	"	A	"	GWB						6	
37	ELEVATOR	—	"	"	HM	SEE A17	"	"						—	BY ELEV. MFR. TRANSOM
38	CORRIDOR 112	FG	"	"	NAT. WD.	C	"	"					C	9	SIDELT.
39	COMMUNICATIONS	—	—	—	—	G	"	CMU						—	5 WINDOWS
40	MEN/WOMEN	F	3'-0"	7'-0"	NAT. WD.	A	"	GWB					C	6	2 DRS.
41	VESTIBULE 123	FG	"	"	ALUM.	E	ALUM.	"						12	
42	"	"	"	"	"	"	"	"						11	
43	PUBLIC INTERV.	F	"	"	NAT. WD.	B	HM	"					C	9	
44	TRAINING RM.	"	"	"	"	C	"	"					C	9	SIDELT.
45	STORAGE 136	"	"	"	PTD. WD.	A	"	"						3	
46	JAN. CL.	"	"	"	"	"	"	"					C	3	
47	STAIR 2	ST	"	"	NAT. WD. MIN. C.	B	"	"					C	9	
48	BOOKING	F	"	"	HM	A	"	CMU					A	SH2	SECURITY HM DR & F
49	"	"	"	"	"	"	"	"						SH2	SECURITY HM DR & F
50	SALLYPORT	"	"	"	"	"	"	"					A	SH3	"
51	ANIMAL CONTROL	"	"	"	"	F	ALUM.	GWB						13	
52	"	"	"	"	"	A	HM	"						1	
53	HOLDING	SE	"	"	"	"	"	CMU						SH2	SECURITY HM DR & F
54	CELL ST.	F	"	"	"	"	"	"						SH2	
55	SHOWER	"	2'-8"	"	"	"	"	"						SH2	
56	INTERVIEW	SE	3'-0"	"	"	"	"	"						SH2	
57	CELLS 1 & 2	C	"	"	STL.	"	STL.	"						SH1	2 DRS DETENTION DR & F
58	CELL HALL 132	SE	"	"	HM	"	HM	"						SH2	SECURITY HM DR & F
59	CELL HALL 133	"	"	"	"	"	"	"						SH2	"
60	CELLS 3-6	C	"	"	STL.	"	STL.	"						SH1	4 DRS DETENTION DR & F
61	CELL HALL 133	F	"	"	HM	F	HM	"						SH2	SECURITY HM DR & F
62	NOT USED														



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WELLESLEY POLICE STATION

First Floor Plan
Door and Finish Schedule

As Builts

A-2

APPENDIX A

Past Leak Location as Reported in Wellesley Facilities Maintenance Department Request For Proposals #WFMD-RFP-FY16-001 Wellesley Police Station Roofing and Envelope Feasibility Study and Wellesley Police Department Staff

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2 October 2015
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Scott A. Tomlinson

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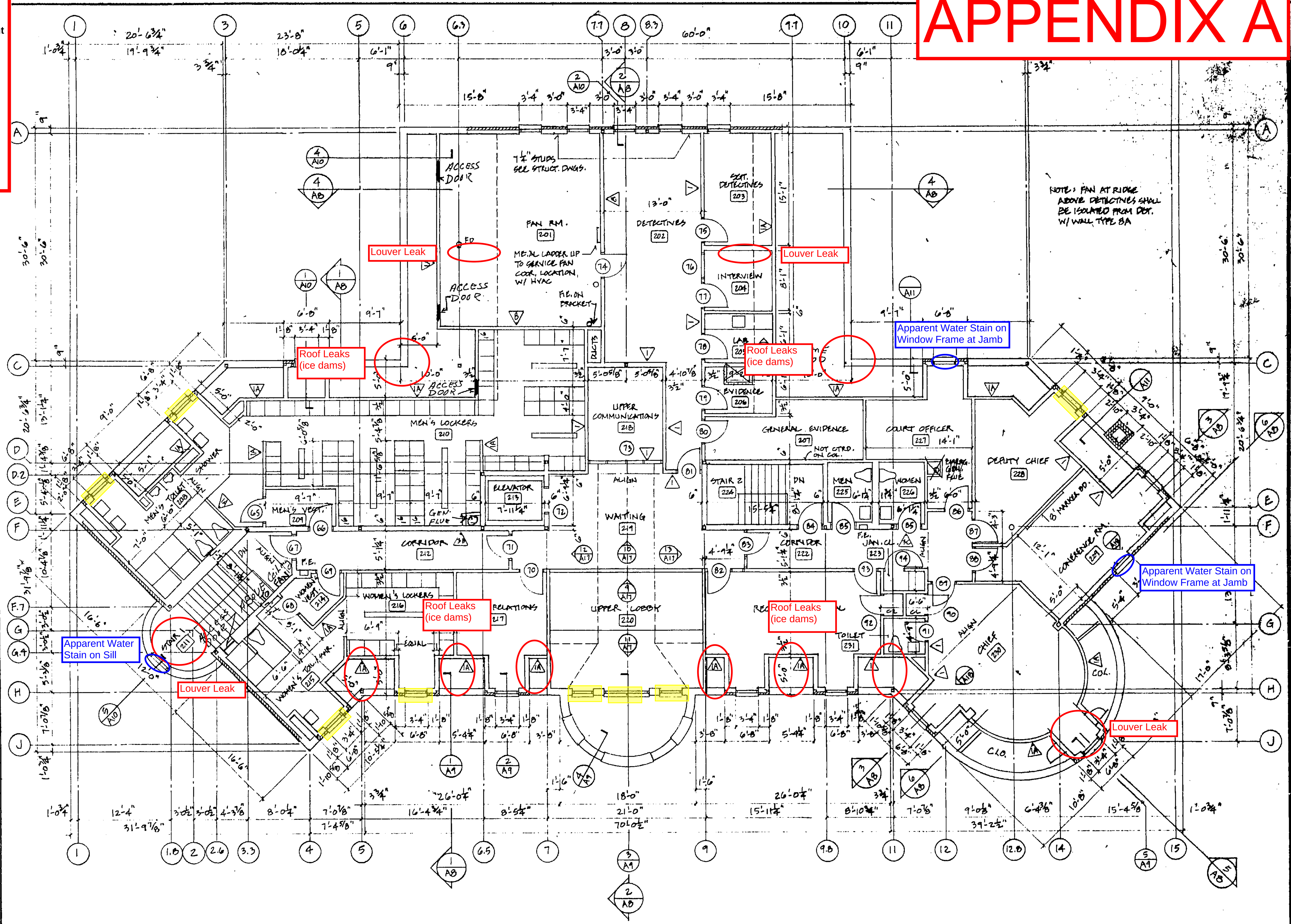
		"	"	"	ACOUST. T. 2 AND	"	
		RUBBER TILE	WAINSCOT 1	"	GWB	SEE A-15	RUBBER TREADS
		CARPET	4" VINYL	"	ACOUST. T. 2	8'-0"	
		—	—	"	"	SEE A-16	
		CARPET	4" VINYL	"	ACOUST. T. 2	8'-0"	
	...R	CERAMIC T	C.T.	CT*/GWB	ACOUST. T. 3	"	* CT @ SHOWER
	...S	CARPET	4" VINYL	GWB	ACOUST. T. 2	"	
	...S	"	"	"	"	"	
218	UPPER COMM.	—	—	"	GWB	SEE A-17	
219	WAITING	CARPET	NAT. WOOD	"	ACOUST. T. 1	8'-8"	NAT. WD. CHAIR RAIL
220	UPPER LOBBY	GWB* OVER 1/2" PLYWOOD	—	"	ACOU. T. 1/GWB	SEE A-17	* ABOVE TOILETS/VESTIBULE
221	RECEPTION/CLER.	CARPET	4" VINYL	"	ACOUST. T. 2	8'-0"	
222	CORRIDOR	"	NAT. WOOD	"	"	"	NAT. WD. CHAIR RAIL
223	JAN. CL.	CERAMIC T.	C.T.	GWB/CT *	"	"	* 4'-0" HIGH @ SINK
224	STAIR 2	RUBBER TILE	PTD. STL.	GWB	GWB	SEE A-15	RUBBER TREADS NAT. WD. CHAIR RAIL
225	MEN	CERAMIC T.	C.T.	CERAMIC T.	ACOUST. T. 2	8'-0"	
226	WOMEN	"	"	"	"	"	
227	COURT OFFICER	CARPET	4" VINYL	GWB	"	"	
228	DEPUTY CHIEF	"	"	"	"	"	
229	CONFERENCE RM.	"	WAINSCOT 1	"	"	"	
230	CHIEF	"	NAT. WOOD	"	"	"	NAT. WD. CHAIR RAIL
231	CHIEF'S TOIL.	CERAMIC T.	C.T.	CERAMIC T.	"	"	

DOOR SCHEDULE

DR. NO.	LOCATION	DOOR ELEVATION	DOOR WIDTH	DOOR HEIGHT	DOOR MATERIAL	FRAME ELEVATION	FRAME MATERIAL	WALL MATERIAL	WALL THICKNESS	JAMB DTL.	HEAD DTL.	SILL DTL.	UL LABEL	HW SET	REMARKS
65	MENS VEST.	F	3'-0"	7'-0"	PTD. WD.	A	HM	GWB						7	
66	"	"	"	"	"	"	"	"						7	
67	STAIR 1	ST	"	"	NAT. WD. MIN. C.	"	"	"					C	8	
68	WOMENS VEST.	F	"	"	PTD. WD.	"	"	"						7	
69	"	"	"	"	"	"	"	"						7	
70	COMM. RELATIONS	"	"	"	NAT. WD	"	"	"					C	1	
71	CORRIDOR 212	ST	"	"	"	"	"	"					C	2	
72	ELEVATOR	—	"	"	HM	"	"	"						—	BY ELEV. MFR.
73	UPPER COMM.	—	—	—	—	J	"	"						—	4 WINDOWS
74	FAN RM.	F	3'-0"	7'-0"	HM	A	"	"					C	14	ACOUST. SEALS & PROP
75	SGT. DETECTIVES	"	"	"	NAT. WD.	"	"	"						1	
76	INTERVIEW	—	—	—	—	H	"	"						—	WINDOW
77	"	F	3'-0"	7'-0"	PTD. WD.	A	"	"						2	
78	LAB	"	"	"	"	"	"	"						2	
79	EVIDENCE	"	"	"	HM	"	"	"						5	
80	GEN'L. EVIDENCE	"	"	"	"	"	"	"						5	
81	DETECTIVES	"	"	"	NAT. WD	"	"	"					C	2	
82	RECEPTION/CLER.	FG	"	"	"	D	"	"					C	2	SIDELT.
83	CORRIDOR 222	F	"	"	"	D1	"	"					C	2	"
84	STAIR 2	ST	"	"	NAT. WD. MIN. C.	A	"	"					C	8	
85	MEN/WOMEN	F	"	"	NAT. WD.	"	"	"						6	2 DRS.
86	COURT OFFICER	"	"	"	"	"	"	"						1	
87	DEPUTY CHIEF	"	"	"	"	"	"	"						1	
88	CONFERENCE RM.	ST	"	"	"	"	"	"						1	
89	CHIEF	F	"	"	"	"	"	"						1	
90	"	"	"	"	PTD. WD.	"	"	"						4	
91	TOILET	"	"	"	"	"	"	"						10	
92	RECEPTION/CLER.	"	"	"	"	"	"	"						4	
93	"	"	"	"	NAT. WD.	"	"	"						2	
94	JAN. CL.	"	"	"	PTD. WD.	"	"	"						3	



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WELLESLEY POLICE STATION

Second Floor Plan
Door and Finish Schedule

SCALE: 1/8" = 1'-0"
DRAWN BY: J.H.
DATE: 2/14/95
REVISED:

As Builts

A-3

TRIM LINE

Charrette

APPENDIX A

- Past Leak Location as Reported in Wellesley Facilities Maintenance Department Request For Proposals #WFMD-RFP-FY16-001 Wellesley Police Station Roofing and Envelope Feasibility Study and Wellesley Police Department Staff
- SGH Observed Apparent Evidence of Leakage at Windows During On-Site Investigation (29 - 31 July 2015 and 3 August 2015)
- SGH Openings During On-Site Investigation (29 - 31 July 2015 and 3 August 2015)
- SGH Did Not Observe Condition of Window During On-Site Investigation (29 - 31 July 2015 and 3 August 2015)

SGH Project 150841.00
2 October 2015
Siena B. Mamayek
Scott A. Tomlinson