13 January 2021

CAPITAL NEEDS ASSESSMENT

FOR

CAMPELLO APARTMENTS

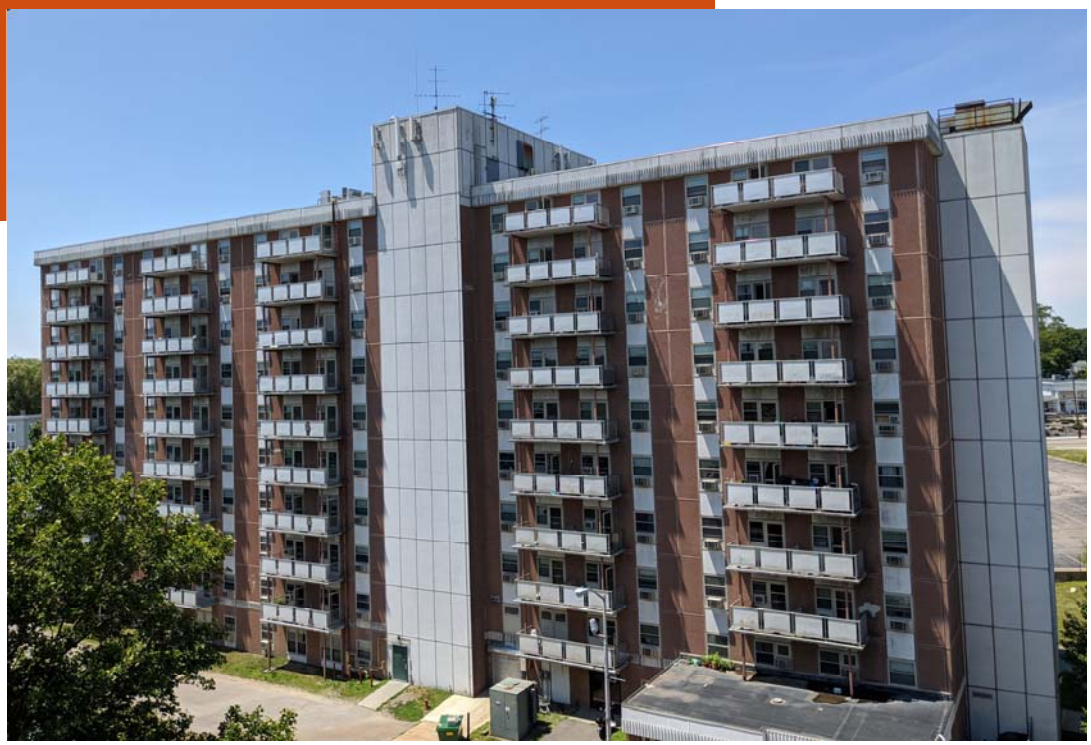
DRAFT

PREPARED FOR

BROCKTON HOUSING AUTHORITY

BWA ARCHITECTURE

BWA Project No. 2009A



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Executive Summary

The Brockton Housing Authority (BHA) retained BWA Architecture, Inc. (BWA) to prepare an comprehensive Capital Needs Assessment of Campello High-Rise Apartments, a two-building, 398-unit federally-assisted senior housing property in Brockton, Massachusetts. The purpose of the assessment is to assist BHA to plan and budget for future capital improvements and repair costs. In particular, BHA asked BWA to evaluate whether Campello may meet the criteria for obsolescence established by the United State Department of Housing and Urban Development (HUD). If found to be obsolete, there may be more funding avenues available to BHA to pay for capital repairs and improvements at the property.

Methodology

BWA assembled a team of consultants for this assessment, including Norian/Siani Engineering, Inc. (NSE) for mechanical, plumbing, and fire protection systems evaluation; Nangle Engineering, Inc. (NEI) for electrical, fire alarm, and telecommunications systems evaluation; PEDA Inc. for structural review; and Allen & Major Associates Inc. (AMI) for flood resilience review. BWA reviewed architectural finishes, accessibility, code compliance, energy conservation, and other general concerns. A hazardous materials assessment is in progress and will be included in the final version of this report. The Authority has extensive testing documentation from prior surveys; we have relied on those for this draft.

As part of the assessment, the BWA team reviewed existing building information provided by BHA, including limited original design drawings, various hazardous materials assessments, a *Physical Needs Assessment and Energy Audit* prepared by EMG dated 23 December 2016, a three-year work order summary (maintenance logs), and other property records. BWA interviewed property management and maintenance staff to learn about the maintenance history of the property, reported problems, and reviewed property maintenance records.

Reviewers from BWA and its team then conducted site visits in July through November 2020 and investigated building systems and components. The field investigations were led by Stephen Baker AIA, BWA Senior Principal, and included a team of reviewers from BWA; Norian/Siani Engineering (NSE) for plumbing, mechanical, and fire suppression systems; Nangle Engineering Inc. (NEI) for electrical, communications, and fire alarm systems; and PEDA Inc. for structural. United Environmental Consultants (UEC) performed hazardous materials survey and testing, and Allen & Major (AMI) evaluated drainage and flood plain concerns. The primary purpose of our inspections was to identify existing deficiencies, likely future problems due to aging or deterioration, and code violations that could trigger code compliance upgrades when other repairs are undertaken. Secondarily, the investigations also looked for opportunities

for improved energy performance in the buildings and for possible discretionary improvements, even if these improvement items are not acceptable as basis for determining obsolescence.

Prioritization

BWA assembled the results of the field inspections and used them to create a property information database. We identified more than 150 deficiencies for the property. For each, we drafted a recommendation for repair and corresponding cost estimate, and established a relative priority for completion. Each item is assigned a priority of **1** (highest or most immediate) to **4** (optional improvements and upgrades).

Priority 1 requirements include urgent repairs to and replacements necessary to protect the structure or life safety and to allow for continued occupancy. Building envelope and mission-critical components that that are critical to occupancy and have a high likelihood of failure within the next three years are assigned Priority 1. These items meet the HUD's definition of obsolescence. Note that Priority 1 also includes code-compliance work that we believe will be required as part of a renovation. While some code compliance recommendations may be seen as improvements to the existing structures, if a code compliance concern is likely to be mandatory (i.e., it will be required in order to obtain permits), it is included in Priority 1. **The Owner should address Priority 1 requirements within the next 3 years if possible.**

Priority 2 requirements include repairs to and replacements of components that are functionally obsolete, worn or damaged, or beyond their useful life, but continue to perform their basic function. **The Owner should plan and budget to address Priority 2 requirements within the next 3 to 7 years if possible.**

Priority 3: Priority 3 requirements include components that are serviceable and good working condition but are expected to reach the end of their useful life or function in the next 8 to 15 years or more. **The Owner should include in its capital plan sufficient reserves to address Priority 3 requirements at the appropriate future time.**

Priority 4: Priority 4 recommendations include optional or discretionary improvements that are enhancements to the project or will improve its function, but are not required to maintain the building in good working order or to meet mandatory building code provisions. Priority 4 recommendations may not meet HUD's definition of obsolescence.

In general, any work item listed as a **requirement** is not discretionary but may be categorized as Priority 1 through 3; recommendations are upgrades and improvements categorized as Priority 4. Prioritization is more fully explained in Part 3 of this report.

Property Condition

Overall, we rate the condition of the property as **Poor**: nearly all components are original to the structures, and all are aging and suffer from serious deferred maintenance due to the Authority's limited resources to maintain the buildings. It appears to us, from our visual inspection and review of maintenance records, that many building components are now either failing or are in imminent danger

of failing; without major comprehensive replacements within the next 3 years, the continued habitability of the buildings is in jeopardy.

In addition, the buildings are significantly out of compliance with modern building code requirements, especially with regard to high-rise buildings. It is likely that any major modernization project will trigger dozens, if not hundreds, of code compliance upgrades that will increase the renovation cost. For this reason, in our report we identified code compliance concerns and included them in Priority 1 (urgent and immediate needs). It should be noted that many code compliance issues are not just an academic or theoretical issue: our inspection revealed serious concerns about fire safety that pose an immediate threat to the residents. Fire safety impairments and deficiencies should be addressed as soon as possible.

Another consideration is that the buildings lie within a 100-year flood plain; without significant flood-prevention work, their long-term viability is not assured. Again, this is not just pedantic: three years ago, Building B suffered a flood event that required sandbagging building entrances and came within inches of the main switchgear elevation. Had the switchgear flooded and been damaged, the building would probably have been rendered unhabitable for months.

We have identified **$84,264,756** in estimated capital improvement costs for this property for the next 20 years (uninflated), listed by priority as follows:

Priority	***Estimated Cost***
1	$ 71,179,157
2	$ 509,664
3	$ 492,850
4	$ 12,083,085
Total	**$ 84,264,756**

These estimates include direct (trade) costs and project general requirements only; they do not include General Contractor overhead and profit, bonds, permits or insurance.

Part 1 on this report contains a general summary of conditions, with emphasis on three major areas of concern: overall property condition, flood risk, and code compliance.

Part 2 of this report contains a detailed narrative assessment of building conditions and identifies major issues raised in our inspection, listed by building system. For each issue, a recommendation for repair or replacement is also provided.

Part 3 of this report is a summary listing of all identified concerns and capital improvement recommendations, with estimated costs for each, ordered by priority.

Part 4 contains supplemental specialist information, including the Structural and Civil Engineers' reports of findings.

Part 1 - General Information and Major Concerns

Property Summary

Campello High-Rise Apartments is a pair of almost identical 10-story buildings with 398 units of federally-assisted senior housing located at 1380 Main Street in Brockton, Massachusetts. The buildings, designated A and B, were constructed and initially occupied in 1972 and are thus about 48 years old. They are situated on an irregular 229,125 square foot (5.26 acre) parcel bounded by Main Street to the west, Plain Street to the northeast, and the Salisbury Plain river to the southeast (Figure 1.1). Building A is entered from Main Street, while Building B is entered from Plain Street.

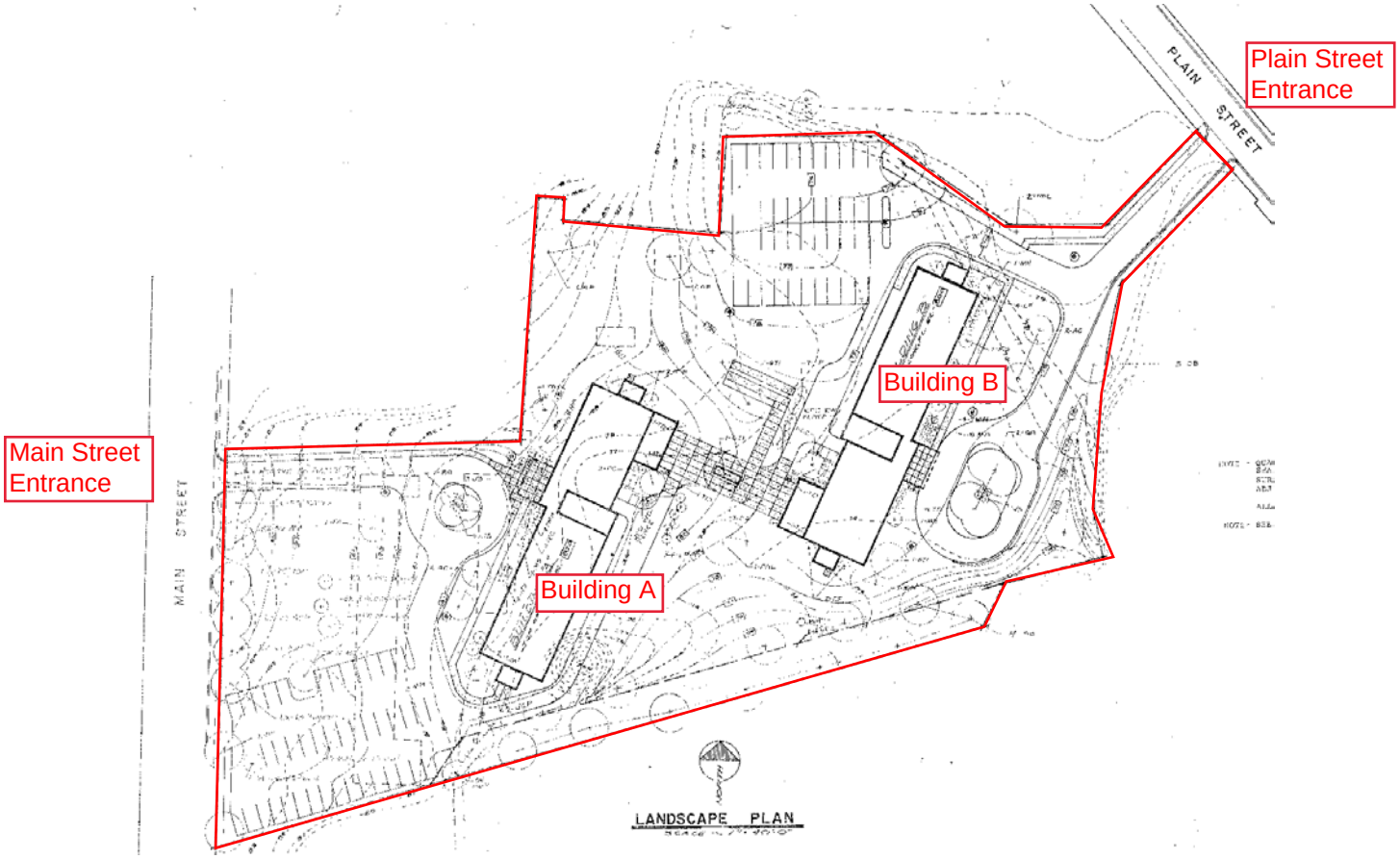

Figure 1.1: Site Plan

Each of the two buildings has a gross footprint of about 12,550 square feet; gross floor area for each building (excluding rooftop mechanical spaces) is approximately 126,500 square feet, together totaling 253,000 square feet. The buildings' average height above grade is approximately 95 feet and are therefore high-rise construction.

Each building contains a total of 199 units: 12 units on the first floor, 20 units on floor 2 and 4, and 21 units on floors 3 and 5 through 10. All but one apartment in each building is a one-bedroom flat; each building also contains one two-bedroom accessible apartment on the 4th floor that were created by combining

two adjacent one-bedroom units. In 2013, nine units spread between both buildings were renovated into accessible units. We did not observe any sensory adapted units. In addition, each building contains a community room, waiting lobby, maintenance, restrooms, offices, and community kitchen on the first floor. Each building contains a common laundry room on the second floor.

According to the City of Brockton Zoning Map, the building is in a General Commercial C-2 zone (Multifamily Residential); it is a conforming use within the zoning ordinance. We did not evaluate dimensional requirements for compliance, but unless a future addition or increase in massing or density is planned, this is not a concern.

Property Condition

Overall, we rate the property as poor: nearly all components are original to the structures, and all are aging and suffer from significant deferred maintenance. At 48 years old, nearly all original systems are failing or in imminent danger of failing and will need replacement in the near future, especially the envelope and mechanical and electrical systems. The property has suffered a history of pipe breaks and plumbing leaks, which has further damaged already tenuous and aging systems. We observed damage from numerous plumbing stacks and noted numerous reports of plumbing leaks in the Authority's maintenance logs.

Most apartment finishes are badly worn and tired; conditions in many units we reviewed do not meet minimum standards for habitation as enumerated in 105 CMR 410, the State Sanitary Code, which requires apartments to be kept in good working order. For example, original kitchen cabinets (present in about 75 percent of the apartments), are missing components or have broken parts, a sanitary code violation. Many unit accessories are missing or damaged, another sanitary code violation. Because lenses have yellowed, many lighting fixtures may not meet minimum illumination thresholds established in the code, especially in bathrooms. Poor VAT flooring in many units is not waterproof and sanitary, another sanitary code violation.

As such, the long-term viability of the buildings is now in jeopardy. As tenants turn over, the vacated units are updated with limited finish improvements, but omnipresent asbestos-containing materials in each unit, including transite exterior wall panels, drywall joint compound, VAT tile, and asbestos-containing flooring mastic prevent substantial updates during tenant turnover.

Flood Risk

Besides the current deteriorating physical conditions, the buildings suffer from numerous code and regulatory compliance concerns that threaten their long-term viability. The first and perhaps most significant concerns their siting: most of the property, including the entire footprint of Building B and about half of Building A, is within the 100-year flood plain (Zone AE) associated with the adjacent Salisbury Plain River. This determination is found in the property flood map published by FEMA in 2009, a map which is now out of date and probably understates the flooding risk. (See Figure 1.2 on next page.) Zone AE indicates a high probability of annual flooding, and management reports that much of the site floods regularly during high rainfall events. The buildings' siting in the flood plain creates risks that are not currently protected against through resiliency measures. Most notably, the power transformer and main electrical switchgear serving both buildings is at grade level and within in the flood elevation, as are

all first floor services, including property management and maintenance facilities. A severe storm could render both buildings uninhabitable for months. A flood event three years ago required sand-bagging entrances and exits at Building B to prevent water intrusion.

As the Authority considers what to do with Campello, the flood risk should be thoroughly considered: if major resiliency measures are not undertaken, any capital improvements could be in jeopardy. Resiliency improvements may include a combination of active measures, such as installing operable flood gates at building entries, and passive measures such as regrading to create flood barriers and relocating critical infrastructure.

Figure 1.2: FEMA Flood Map for the property; buildings are partially or completely within the flood plain

Code Compliance

Another concern is that the buildings are significantly out of compliance with modern building code requirements, especially with regard to high-rise buildings, structural capacity, and energy conservation. In some respects, especially fire safety, these code compliance concerns pose a potential threat to the safety of the residents. High-rise codes have advanced significantly over the past half century: while the buildings may have met code requirements when built, they are significantly under-served when reviewed against modern standards. To worsen matters, alterations to the buildings over the years have impaired fire safety. These include enclosing the smoke vestibules at the end fire stairs and removal of fire separation assemblies throughout the structures to access leaking pipes for repairs (Figure 1.3).

Figure 1.3: Unprotected open 10-story shaft adjacent to south stair in Building B.

Finally, life safety systems are impaired by age and deterioration and are unlikely to perform at the functional level they were designed for. As an example, the fire sprinkler systems may not have adequate pressure to properly function at the upper floors of the buildings. This is likely due to corrosion and sedimentation in aging pipes. We understand that the Authority has engaged a fire protection service company to test the system pressure for adequacy. Another concern is that original sprinkler heads are beyond their listed life span; code requires that sprinkler systems be replaced at the end of their rated life.

A second major code compliance issue concerns the load-carrying capacity of the structures. Our analysis found that the primary structural frames are undersized relative to current code requirements: they do not meet modern codes. In particular, the exterior perimeter framing cannot support the weight of the existing wall system, much less a new cladding system as recommended herein. The buildings have been standing for 48 years and are thus not in danger of collapse, but wind and seismic load requirements have been

tightened significantly over the years; some of these requirements will become salient in a renovation.

The problem is exacerbated by poor initial construction quality control: we noted numerous deficiencies in the steel framing that suggest the structures were not adequately inspected to ensure the buildings were constructed in compliance with the original design. (See Figures 1.4 – 1.6 below and on following page) In addition, we reviewed documentation prepared during construction that indicates that construction was stopped at least once by local officials due to concerns that required structural testing and inspections were not being adequately performed. As a result, already under-sized structural frames are further impaired by shoddy construction.

Since nearly all of the framing is concealed by covering construction, the exact extent of the problem cannot be determined, but our limited inspection indicates the number of deficiencies could be significant. As with the flood risk, this creates a conundrum for the Authority: without extensive exploratory demolition and then significant structural upgrades, any capital improvements will be installed on a questionable structural frame.

Figure 1.4: Metal decking is infrequently and poorly welded to bar joists (typical condition).

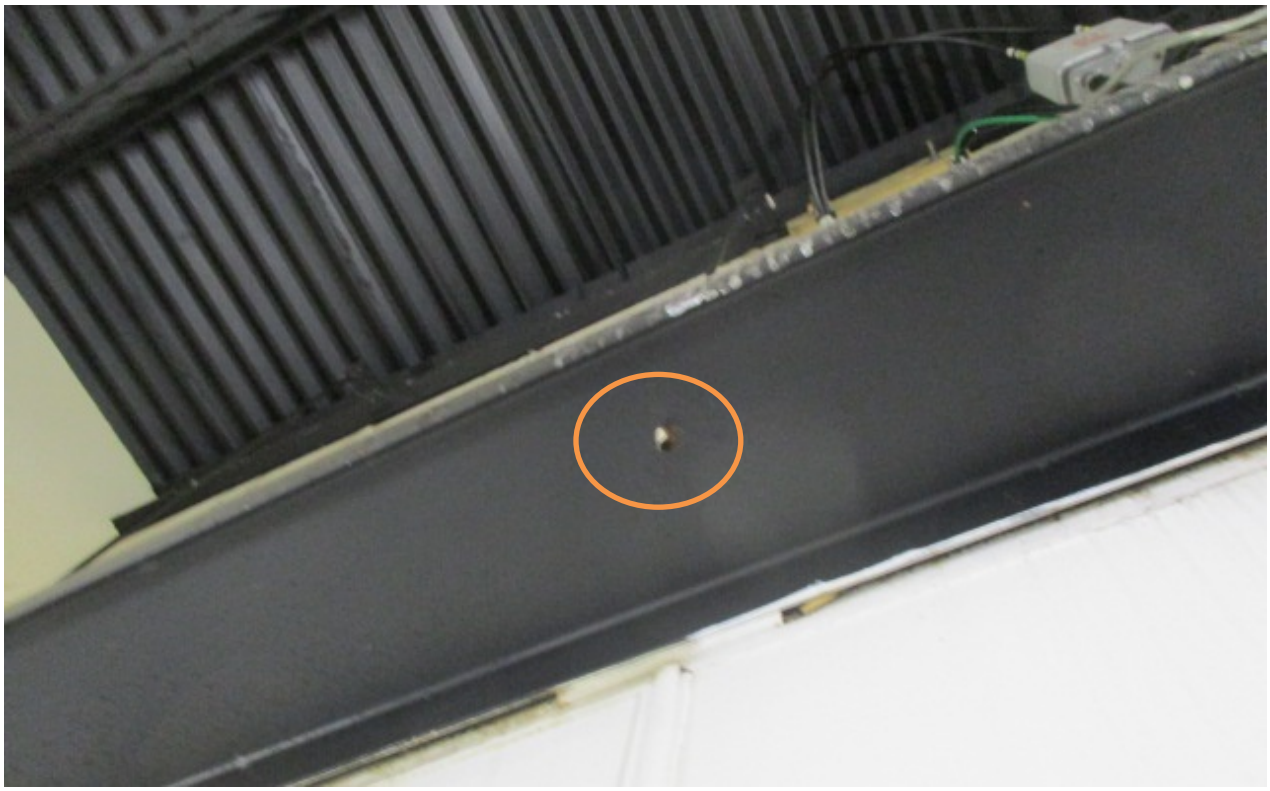

Figure 1.5: Missing sag rod at exterior wind girt.

Figure 1.6: Missing connection nuts and washers at sag rod at exterior wind girt.

A third major code compliance issue concerns energy performance. The buildings were constructed before energy efficiency was featured in most building codes, and Campello's construction reflects this lack of attention to energy efficiency. Exterior wall insulation is relatively minimal (less than R-10), and there is no air barrier to reduce convective currents. The balcony attachment details are an acute source of thermal bridging, as the exposed exterior steel connections connect directly to the interior steel frame without insulation or isolation. This is a source of both heat loss and condensation that is causing damage to interior finishes.

Mechanical systems original to the building are also highly inefficient. The units are heated by electric resistive heat baseboards, the least efficient heating system. Original plumbing fixtures and fittings are not water conserving (some have been replaced). Virtually all of the domestic hot water supply risers we were able to inspect are not insulated (see Figure 1.7). Lighting is generally relatively inefficient compact fluorescent.

In any renovation, the Massachusetts Energy Code, among the most stringent in the country, will apply. If repairs to the exterior envelope are taken as recommended, the envelope will have to be brought into compliance with the energy code. When plumbing and heating systems are replaced, they too will likely require energy code compliance. This will prohibit a simple like-for-like replacement of obsolete components.

Figure 1.7: Uninsulated domestic hot water riser (typical); also note heavy corrosion on piping.

In summary, when renovations are undertaken, many of these code compliance issues will have to be addressed. Based on our evaluation, it is likely that any major modernization project will trigger dozens, if not hundreds, of code compliance requirements. The cost will be significant. For this reason, in our report we identified many code compliance concerns and included them in Priority 1 (urgent and immediate needs).

Part 2 - Conditions Assessment

Accessibility

As publicly assisted housing, the buildings must comply with relevant sections of the Americans with Disabilities Act (ADA), 521 CMR (the Massachusetts Architectural Access Board's regulation, or "MAAB"), and HUD Section 504. ADA compliance is established in the Uniform Federal Accessibility Standard (UFAS). Because MAAB regulations are generally equal to or more restrictive than ADA/UFAS, compliance with MAAB is considered sufficient. As a federally assisted property, HUD Section 504 accessibility compliance is also required. Because it was constructed prior to 1991, it is exempt from federal Fair Housing Act accessibility regulations.

According to the Brockton Assessor's property database, the property was assessed in 2019, with a building value of $ 22,012,000; this figure excludes the property's land value as required by MAAB. In accordance with the building code and MAAB, any capital improvement project, or cumulative capital improvement projects over a three-year period, with a cost exceeding 30 percent of the assessed building value will require compliance with current code in most respects. For Campello Apartments, 30 percent of the building value is $6,603,600. Based on the estimated costs in this report, the 30 percent MAAB cost threshold will be exceeded, and as a result, full compliance with MAAB will be required.

There are numerous areas of accessibility noncompliance at the site. The exterior apron at the main entrance to Building B exceeds the allowable 2 percent cross slope. Because of settlement and frost heave, some exterior walkways and paving are not compliant. Exterior paving and walks exceed permitted cross slopes, and tripping hazards and non-compliant level changes occur at all building entrances and exits. The concrete aprons immediately outside the front and rear building entrances must be replaced for accessibility compliance.

There are a total of 21 units that are generally MAAB-compliant Group 2B (fully accessible) apartments; this meets the five percent threshold established in MAAB. From our inspection, the one-bedroom units appear to be compliant, while the two-bedroom units were deficient in several areas. We did not observe any other sensory adapted apartments; HUD Section 504 requires eight additional units be sensory adapted. If not present, these should be provided as part of the next modernization.

We noted numerous other relatively minor code violations that must be addressed when renovations are undertaken.

Requirements:

- Replace exterior concrete pavement at Building B entry apron with paving meeting maximum permitted slopes and cross slopes. Extend apron 5 feet from entrance door as required by access code.
- Install Section 504-compliant sensory adapted features in at least eight apartments.

- Replace all knob hardware throughout at unit entries and stair doors with lever type locksets. Appropriate panic hardware should be installed at stair doors.
- Replace hardware to utility and janitorial closets with knurled levers.
- Replace the worn main entry door and power operator (see Building Envelope section).
- Install MAAB-compliant operators on windows in common areas and accessible apartments.
- Reconfigure the common Kitchen and replace cabinetry with compliant construction.
- Install MAAB-compliant unit number signage in corridors and compliant signage for all rooms.
- Reconfigure and replace millwork in (2) two-bedroom unit kitchens, bringing them up to MAAB and HUD Section 504 compliance.
- Relocate the intercom panel at the vestibules to accessible height.

Site Work

The site is a 5.26-acre parcel in a built-up neighborhood in Brockton. It is bounded by Main Street to the west, commercial property to the northwest, BHA's equipment facilities to the north, Plain Street to the northeast, and Salisbury Plain River and French's Brook to the east and south. The site is low-lying, several feet below the adjacent streets and only an average of 6 feet above the river banks. There are parking areas scattered around the site and along drives entering off Main and Plain streets. Between the two buildings is Campello's site maintenance building and a brick plaza adjacent to trash storage. The plaza is interspersed with edge and island landscaping features. The portions of the site that are not paved are generally lawn with trees at the edges and in parking islands.

Topography and Flood Risk

As noted in Part 1, much of the site, including all of Building B, is in a 100-year flood plain, but there are no resiliency or mitigation measures at the property. Critical infrastructure (including the main electric transformer, switchgear, building management and maintenance facilities) is located at grade, within the flood zone in Building B. The ground floor elevation at Building A is 2 feet higher and is thus slightly above the 100-year flood elevation. The buildings are low lying, putting them at risk of repeated flood events. As noted above, a flood a few years ago came within inches of the Building B ground floor. If the buildings are retained and renovated, flood barriers or other protection measures are required to protect the Authority's investment. A combination of berms, stormwater detention structures, and flood gates will be necessary.

Roads, Parking Lots, and Walkways

The parking lot is asphalt paved, and most surfaces are worn and cracked, though portions of the parking area have recently been repaved. Minor ponding is present in various locations. The curbing and sidewalk along its south edge (abutting the north elevation of the building) is in poor condition, presumably from erosion and plow damage. Complete repaving and curbing repairs are recommended in about 10 years. Some paving work will be required sooner, as utility replacement and flood mitigation measures will disturb

existing surfaces. It should be noted that asphalt paving repairs may not contribute to the determination of obsolescence.

Walkways around the property are cast-in-place concrete in varying condition; a few cracks and tripping hazards are present, even in otherwise generally sound panels. (Figure 2.0) Because of frost heaving and subsidence or shoddy initial construction, some walkways are not accessible due to unacceptable cross slopes. (Also shown in Figure 2.0) Most site concrete appears to be original to buildings and in poor condition; these portions of walkways should be replaced in the near future. There are single riser steps at several of the stair tower discharge walks, which do not meet code and will require regrading for code compliance. (Also shown in Figure 2.0)

Figure 2.0: Steps at exterior exit discharge; heaved sidewalk panels create a tripping hazard and ADA violation

Site Utilities

Water services are provided by a municipal main located within Main Street (Figure 2.1). From Main Street, an 8-inch single main supplies a water pit on site, in which the service divides into separate 8-inch domestic water and fire protection service lines: both are ductile iron and original to the building. The combined fire service and domestic water main from the street to the pit does not meet the code requirement that fire service mains be independent of domestic water services. A new fire service main to Main Street is required for

code compliance. In addition, both the fire and domestic services have pressure drops between the two buildings, indicating that scaling or other obstruction is present in the piping. Replacement of both mains are needed as part of any major modernization project.

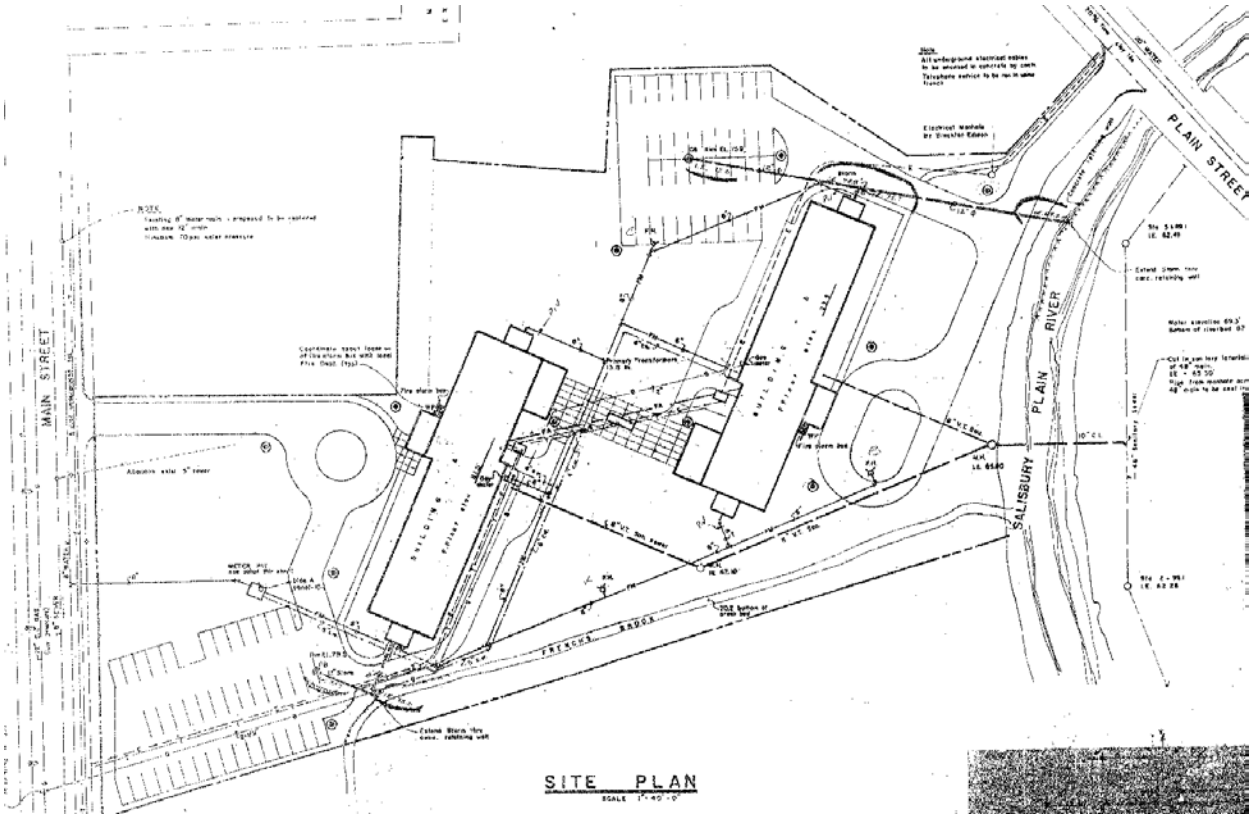

Figure 2.1: Site Utilities Plan

Electricity is provided by medium-voltage (13.8 kV) underground service from Plain Street to a ground-mounted transformer adjacent to each building; this service is set up in a pass-through configuration from one building to the next. (The medium-voltage lines continue up to secondary transformers on the roof; see Electrical below.) This system is vulnerable to flood damage; both transformers are located within the flood plain. (Figure 2.2 on following page) In addition, the transformers are too close to the buildings, creating a fire hazard in the event of transformer failure. The transformers should be relocated away from the buildings and elevated above the flood plain. This will require replacement of either the primary feeds from the street, or the secondary feeds to the building.

Gas service enters from Main Street at the west side of the property. Both services appear adequate in capacity to meet the needs of the building. Above-ground gas piping requires painting to prevent further corrosion.

Sanitary sewers are 8-inch vitrified clay pipe; they run from each building east to a manhole adjacent to the river; from there they run under the river to a municipal main. Management reports a history of back-ups in the sanitary

system. The BHA attempted to video scope the underground sanitary mains, but in both buildings the videographer encountered obstructions within feet of leaving the building; at Building B, the obstruction occurred at the transition from underslab cast iron to the vitrified clay pipe. This indicates that the clay pipe has either collapsed or is obstructed by tree roots, or both. Given the video findings and the history of flooding and back-ups, the sanitary sewer piping has almost certainly failed and requires replacement at least to the manhole adjacent to the river.

Figure 2.2: Building B transformer is located at grade level, within the flood plain and too close to building.

Stormwater drainage systems on the site are minimal: they include two catch basins at parking areas and the building rain drains, both of which discharge directly to the river via 12-inch concrete pipes. The building roof drains also tie into these pipes. We observed no evidence of gas traps or silt separators on the catchbasins. When the river floods in high rainfall events, the system surcharges and floods the site. Given the property's low-lying siting and history of flooding, significant drainage improvements are required. Changes in pollution control and water quality regulations will make the current system of discharge directly to the river unacceptable; improvements will be required to meet current standards.

Refer to the enclosed Flood Evaluation Memo in Part 4 of this report prepared by AMA for a more detailed assessment of conditions. Determining a solution to this problem is beyond the scope of this study, but costs are likely to be significant because of flood risks.

Fencing and Gates

Site edges are demised on the north and south edges with an 8' chain link fence, topped with barbed wire. There are no barriers at the edge of the property facing the river or at the Main Street entry. The fencing is aged but does not appear to be damaged. The property border to the northwest is delimited by a 3' concrete retaining wall and chain-link fence. This work may not contribute to a determination of obsolescence.

Site Improvements

There is an auxiliary structure maintenance building in the space between the apartment buildings and adjacent to the paver plaza and trash yard. This painted concrete masonry building appears to be in sound condition. The plaza itself is intended for passive recreation but is uninviting: amenities are minimal, the exposed trash dumpsters adjacent to Building B nearby are unsightly (there is a screened enclosure at Building A), and there is no shade. (Figure 2.3) We recommend that the waste bins be enclosed in screening, a pergola or trellis for shade, and improved site amenities like furniture. This work may not contribute to a determination of obsolescence.

Figure 2.3: Central resident plaza between the buildings lacks amenity and shade.

Landscaping
In recent years, the landscaping has been updated on portions of the site between the building and around parking lots. At balcony column connections at ground level, stone aggregate and stainless steel edging is present, but in poor condition. Most lawn is edged with granite or concrete curbs, but there are also transitions from paving to lawn there are no curbs or edging, contributing to soil erosion and dirt flowing onto the lots and drives.

Requirements:
- Provide flood mitigation measures, including active or passive flood barriers and stormwater management system.
- Apply sealer to asphalt paving to extend pavement life
- Regrade exterior walks to eliminate step at stair discharge.
- Regrade main entry walkway apron to comply with accessibility requirements.
- Replace sections of cast-in-place concrete walkways and front plaza paving.
- Replace domestic water and fire service mains.
- Replace sanitary laterals.

Recommendations for Improvements:
- Provide outdoor furniture at plaza and trellis structure for shade.
- Improve and expand trash storage areas. Create a screened enclosure adjacent to Building B and expand to include recycling.

Structure

The buildings are steel frame, and we have concerns with their both as-built condition and their design. There is noticeable movement in the building frame, and cracking from structural movement is evident in sprawling drywall cracks at exterior walls and ceilings. (Figure 2.4 on following page) Our initial analysis and field observations suggested that the primary steel frames are significantly under-sized relative to modern code requirements. We heard anecdotal reports from management and maintenance personnel that reinforced this impression: these included reports of noticeable movement in wind; uncovered construction that revealed deficiencies; and most interesting, that the building had been designed for a Texas climate in which snow drift loads may not have been properly considered.

Subsequent analysis by our structural engineer confirms that these concerns are warranted: the vertical and lateral and seismic load-carrying capacity of the superstructure, roof framing, and floor framing systems are all inadequate relative to current code. While the buildings are highly unlikely to suffer catastrophic failure or collapse, their under-design means that excessive movement is present, causing damage to other systems. Among other deficiencies, movement may be contributing to the frequent breaks occurring in waste stacks (see Plumbing), as building movement creates stresses on the cast iron pipe stacks. PEDA's memo summarizing its findings is appended to this report.

Figure 2.4: Ceiling cracking caused by excessive structural movement.

In particular, PEDA found that the exterior perimeter framing system will not support any added load. At present, the exterior wall panels appear to be self-supporting for gravity loads (stacked one on top of the other with all gravity load transferred internally to the foundation), with only lateral loads being tied back to and supported by the streel frame. A new exterior wall cladding system will either have to be internally load-bearing (imposing added loads on the foundation) or require reinforcement of the primary frame in each building.

Assuming no change in use or construction, the undersized floor system may not be a major concern, but other construction defects still require repair. Seismic loads will also have to be evaluated and addressed.

Substructure

The foundations (substructures) at the two buildings vary, presumably based on local soil conditions (Building B, being closer to the river, may have poorer bearing strata). At Building A, the foundation consists of 16-inch spread footings at perimeter walls and column pad footings, with a 4-inch slab on grade. The perimeter footings appear significantly undersized for a 10-story building: spread footings and pad footings are rarely used on tall buildings because of loads. Deep footings or mats are much more common, and a 16-inch spread footing is more appropriate for a 3- or 4-story wood frame structure

than a 10-story steel frame. If any renovation project adds weight to the structure (by recladding the building, for example), additional geotechnical investigation should be performed to verify that foundation bearing capacity is adequate. It is almost certain that some foundation enhancements will be required at the perimeter.

The foundation at Building B consists of grade beams which are supported on pile caps over piles. This is a fairly typical foundation system for tall buildings and appears to be fundamentally sound.

In both buildings, the 4-inch slab on grade is undersized; this slab is not adequate for the poor soil conditions that are assumed to be present under Building B. We observed obvious subsidence of the floor slab in the Community Room and in one of the stair halls; we did not see enough first floor spaces to determine if this is a localized condition or systemic. The subsidence in the Community Room may be due to the presence of collapsing underground transite ductwork in that space. At a minimum, some slab repairs are required. In the Community Room, this will consist of removing settled slab areas, excavating and replacing substandard fill with new structural fill, and placing new slabs.

Superstructure

Each building superstructure consists of a primary steel frame, bar joist floor and roof framing, 2½-inch lightly reinforced lightweight concrete floor slabs over 26 gage metal decking, and insulated transite wall panels at the exterior. The perimeter rim beams are MC10x21.9 channels; these are inadequate for modern lateral, seismic, and gravity loads. As noted above, the primary framing system is under-designed relative to current code, as are the floor and roof framing systems. The floor system is so light as to be highly vulnerable to impact damage, and we saw evidence of damage to the floor system in various locations that were open for inspection. (Figure 2.5) There is noticeable movement in the building frame (see Figure 2.4 above), especially at the ends of the buildings, which lack adequate lateral bracing (lateral bracing frames are located 60 feet in from either end. We also observed deflection in some of the insulated exterior wall panels, suggesting that gravity loads from the frame are being transferred to the panels.

We heard anecdotal reports that the bar joists supporting the floor system are not properly welded to the primary steel framing members; the limited number of connections we could see looked marginal at best (poor welding quality), but may be acceptable. This issue requires further investigation.

Figure 2.5: Damaged metal decking from impact to floor above; this is a fairly typical condition.

We did confirm, however, that the light-gage metal decking is not adequately secured to the bar joists and primary steel frame. PEDA reports that for decking of this weight, the deck flutes should be tack welded at a spacing of 12 inches o.c. maximum. Our inspection of limited areas where the deck was visible indicated that most decking is welded to the bar joists very infrequently (greater than 48 inches o.c. or more). (See Figures 1.3 and 2.5) The major concern with this deficiency is that the floor system typically is designed to act as a diaphragm against lateral movement. If the joists and deck are not properly secured, they do not perform the intended function.

If no additional weight is added to the structure, in theory the under-sized and poorly constructed framing would not be a concern. In reality, however, excessive structural movement is damaging interior finishes and is probably contributing to the significant number of pipe breaks occurring in the plumbing system. It makes little sense to replace the finishes and damaged piping without also addressing the underlying source of the problem. To address this, some improvement in lateral and seismic load capacity is required. As this work must precede other urgent repairs to be effective, it should be performed immediately.

Balconies

Exterior balconies are exposed steel with precast concrete deck; many are in poor or very poor condition and require immediate repair. The attachment details at the exterior balconies are highly suspect: they are vulnerable to ice and water damage, and we noted that many steel supports are badly corroded. The exposed exterior steel connections also act as a thermal bridge, transmitting cold to the structural frame and create condensation. Many steel and deck components require replacement now. Property maintenance records indicate that a number of balcony frames have already been replaced; many more will require replacement in the next three years. Water is entering at some attachment points. If the balconies are to be retained (see Building Envelope section for more on this issue), the exposed portions of the steel structure must be protected from further corrosion and water penetration.

Figure 2.6: Heavy corrosion at exposed balcony steel (typical); also note deterioration at wall penetration

The steel balcony railing stanchions are attached to the precast decks by partially embedded stanchion plates. This detail is highly vulnerable to water intrusion and freeze-thaw cycling. We noted number attachments, even in recently repaired balconies, that are cracking spalled or otherwise showing distress. (Figure 2.7 on following page.) Inadequate distance from the stanchion post to the edge of the precast plank may also be contributing to

cracking. In either case, the cracks indicate that the railing will no longer support its designed load; this is potentially significant life safety issue.

Figure 2.7: Spalling stanchion attachment in a recently repaired balcony.

Another concern with the balconies is that the first floor support columns are highly vulnerable to corrosion and vehicular impact from the adjacent parking areas and roadways. The columns lack raised footing to get them out of the water and salt zone; most are heavily corroded. (Figure 2.8 on following page) A vehicle hitting one of these columns could bring down the entire balcony stack above. If the balconies are maintained in their current configuration, bollards or other protectives are required; ideally they should be replaced with shorter columns on raised concrete footings.

Original Construction Deficiencies

Of even greater concern is the number of construction deficiencies we observed in the limited areas we could inspect; these include incomplete or absent welding of decking to the joists, inadequate welding of bar joists to beams, missing connection bolts at framing connections, missing sag rods at girts, damaged decking, and other issues. (See Figures 1.4 – 1.6 in Part 1 for examples of these conditions.) Extrapolating the deficiencies we observed in limited areas across the entire structures, there could be thousands of connections that required welding, re-welding, or additional bolting. These defects date to the

original construction and strongly suggest that proper construction control was lacking. Construction reports we reviewed confirm that this is the case: the City's inspectors stopped work at least once due to concerns with inadequate structural testing and inspection.

Figure 2.8: Balcony column bases are badly corroded and subject to vehicular impact.

This does not mean the building is unsafe, but based on our observations, there are serious enough concerns that further investigation is warranted. Uncovering and correcting these defects will be expensive and intrusive: major areas of finish and spray fireproofing will have to be removed for inspection of steel connections throughout the building. Note that this work is not an improvement or discretionary: it is necessary to verify that the structure as built will perform as originally designed and intended.

In summary, the existing structural frame is essentially obsolete. Significant reinforcing will be required to meet code, and existing initial construction

deficiencies, which cannot be ignored, will require extensive demolition to uncover and inspect.

Requirements:

- Undertake a comprehensive geotechnical review of both buildings prior to any renovation that adds weight to verify that foundations are adequate.
- Enhancements to Building A spread footings are likely required if any weight is added to the exterior wall system.
- Further investigate slab movement in Building B; repair minor areas of subsidence with self-leveling concrete. More serious areas of settlement, such as in the Community Room, will re-compaction of subgrade and replacement of the slab.
- Reinforce the primary structural frames to meet code requirements, including supplemental framing at perimeter beams and additional seismic and lateral load-resisting elements.
- Undertake a campaign of investigation and repair throughout both buildings, to include re-securing bar joists to primary frame, welding decking to joists, installing missing bolts and other components, etc.
- Repair or replace exterior balcony framing.
- Repair spalled foundation wall and slab at damaged area of Building B.

Building Envelope

Overall the envelope is in poor condition, with two primary components failing: wall panels and roofing. The transite wall panels are evidencing distress in many areas, and major repairs are needed to maintain the long-term viability of the structure. Given that the transite panels are asbestos-containing, options for repairs are limited. For the reasons explained below, it will be necessary to re-clad the building to ensure the long-term soundness of the envelope and meet energy code requirements.

Exterior Wall Enclosure

The exterior walls are constructed of insulated 3-inch transite structural panels. The panels have splined perimeter edges, between which a split-tail steel anchor is placed that is welded to the structural frame at each floor level; this system appears intended to allow for some vertical differential movement between the panels and steel frame, while theoretically preventing lateral deflection. The transite panels are laminated, having a painted aggregate at the majority of the building, and left smooth on stairwells. The panels are composed of 2½-inch expanded polystyrene (EPS) insulation laminated between two ¼-inch transite faces; this forms an insulated sandwich panel, with joints between the panels intended to have a concealed internal waterproofing spline gasket. There is no secondary air or weather barrier present: any water that infiltrates past the panel joint or any penetrations through the wall surface will migrate to the interior. The panel forms the painted interior surface of the apartment units, so any leaks are immediately evident.

This wall system, without any redundancy in weather barrier or internal drainage channel, is highly vulnerable to water intrusion, and the walls apparently leaked almost immediately after installation. In June 1977, all panel joints were sealed with a surface-applied silicone ribbon gasket. The silicone

has held up well for its age, but it is now losing adhesion and failing throughout the building. There are currently numerous failures and evidence of water infiltration at panel joints and at balcony steel penetrations.

The panels appear intended to be self-load-bearing: each one stacks on the one below, transferring the weight of the entire panel system to the foundation wall. As noted above, the rim beams are not intended to carry any wall gravity loads. The problem with this design is that any defect in or damage to any of the panels makes the entire wall unstable. Most of the transite panels are structurally sound, but we noted approximately 10 percent with evidence of damage, distress, or deflection. Due to the nature of this rigid, asbestos-containing material, these defects cannot be effectively repaired.

In addition, the wall system does not meet current energy code; we estimate the wall system to have an R-value of about 8 or 9, and there is no continuous air barrier. Any alteration of the exterior wall cladding system other than ordinary maintenance repair will likely trigger the energy code, which will then trigger a cascade of other structural reinforcing work as noted above.

For all of these reasons, we recommend that the exterior walls be reclad, either by removal and replacement of the panel system with a new panelized wall system, or by installation of an exterior insulation and finish system over the existing panels. In either case, the structural frame will require reinforcing.

If recladding is not feasible, an extensive campaign of sealant replacement and repairs to and refinishing of the transite panel faces will be required. Similar campaigns should be planned for every 15 years to maintain building integrity. If the restoration approach is taken, the energy code will require that insulation be added to the interior face of the exterior panels to increase thermal resistance of the wall assembly.

EIFS finishes at small one-story additions at both buildings have been damaged in places, presumably from vehicle impacts. Areas of damaged EIFS should be repaired and the panel recoated to match surrounding area.

Balconies

We heard anecdotal evidence that the balconies were not part of the original design and were added late in the design phase to address concerns with fire safety raised by local fire officials: the fire department reportedly wanted the balconies as a place of refuge. The design does suggest a hurried and not carefully detailed solution. The balconies are supported on 4-inch steel columns at the exterior corners and are braced laterally to the steel rim beam at each floor level, where two 4-inch steel tubes are welded to steel outriggers penetrating through the wall panel. This is an area of concern due to reliance on sealant to waterproof the joint through the wall; there is no redundancy or flashing in the system to prevent water intrusion when the sealant inevitably fails.

Based on exterior and interior observations, this joint appears to be failing in many balcony locations. Numerous units exhibit mold growth above the sliding balcony doors, indicating water infiltration at the balcony through-wall connections. Work order reports from the last three years indicate that this is a

common failure throughout both buildings. We estimate that about 50 percent of the balconies have deficiencies that require urgent attention and repair.

The balcony details are not appropriate for cold climates: exposed structural connections are subject to leaks, corrosion, and freeze-thaw cycling. Precast slabs form the floors for each balcony, and most show signs of cracking or spalling at railing and support steel attachment points. Balcony railings are comprised of 1" steel tube framing anchored to the precast slab. Laminated steel balustrade panels set into the rail are corroded and delaminating on several balconies; management reports that a number of these panels have detached from the building. In our inspection, we noted several that were in imminent danger of detachment, a serious life safety hazard to both the unit resident and pedestrians below. Maintenance reports that it is continually repairing or replacing corroded, delaminating, or falling guard panels.

The Authority has several choices here: the first is to comprehensively redesign the balconies to make them more weather resistant and structurally sound, including replacing deteriorated elements, covering/protecting structural components from the weather, and replacing the railing assemblies with more durable guards. The second, which we recommend, is to permanently address these problems by enclosing the open-air balconies (which are poorly utilized, especially on upper floors) and creating additional living space. We believe the structural costs of the two approaches may be relatively similar if the first option is done properly. Both of these solutions may be considered improvements rather than repairs.

The third choice, if the above improvements are not permitted, is to continue to repair deteriorated components as needed indefinitely. As noted, about 50 percent of the balconies need urgent repairs now. This will be a never-ending cycle of chasing deterioration, leaks, and structural failures, since the underlying causes of failure are not addressed by simple repairs.

Finally, the Authority could opt to remove the balconies altogether and permanently rid itself of the problem, but this would be a reduction in amenity and would require redesign of the exterior wall system to eliminate the balcony doors and patch the steel penetrations. This approach would require approval of local code officials.

Roofing

The roofs are single-ply fully adhered EPDM membrane over 3 inches of insulation and are in poor condition: a large area of Building A suffered a recent tear-off, and insulation is buckling in numerous areas on both roofs, which usually indicates the presence of moisture. The roofing was installed in 1995 and is out of warranty. A continuous leak is reported in both buildings near the penthouse door, and there is evidence of damage below the membrane, causing the substrate to swell. The curb height at the penthouse door is not tall enough and is allowing snow and water penetration.

The roofs are largely bare except for steel dunnage frames supporting make up air units. The penthouse roofs contain multiple antennae, most of which are no longer in use. Above the stairwell at each end of the building is a make-up air unit (MAU) with a gas supply. A grated walkway and guardrails surround the

MAU for maintenance and repair access. The dunnage for HVAC unit is set too low, creating inadequately flashed supports and does not allow for maintenance or repairs under the dunnage. The existing dunnage should be raised when units are replaced to allow for maintenance access and proper roof flashing. The existing supports for the gas piping have failed and should be replaced to properly secure the gas lines to the HVAC units.

Roof replacement should be planned for the very near future, within the next year or two. When replacement is planned, we recommend a high albedo PVC membrane and additional insulation to meet current energy code. The other deficiencies noted above should be corrected at the same time.

Exterior Openings

The main entrance doors are glazed aluminum storefront entrances with power operators. These doors are noisy and in poor condition. Finishes are highly worn, and there is minimal weatherstripping. The doors are beginning to sag causing alignment issues, requiring frequent maintenance calls. Replacement should be planned for within three years.

The stair egress and mechanical doors are flush steel in hollow metal frames; many are in poor condition. Two of the roof penthouse doors were frozen shut, and all penthouse door thresholds are too low, causing roof leaks. At least 50 percent of the exterior doors, including all six roof penthouse doors, should be replaced within three years or when roofing is replaced, if sooner. Penthouse door thresholds should be raised, since added roof insulation will worsen the curb-height problem.

The windows in apartments were replaced in 2012 and are in good condition. Bedrooms contain a single-hung aluminum window with an insulated panel below with an integrated a/c sleeve, mulled together as a single assembly. The living space contains one large assembly with a balcony door and single hung window sidelight with an insulated aluminum-faced panel below. We did not observe governors to limit sash opening on any windows. Hung windows are inappropriate for senior housing because of sash weight and difficulty in operation; they also pose a potential fall hazard without governors. When next replaced (in about 17 years), they should be replaced with an awning-type ventilator. If the wall system is replaced, the windows should be replaced then.

The Common Room and entry lobby windows are aluminum storefront in fair condition. No evidence of water infiltration was observed at the time of our site visits. Some interior damage was observed but does not compromise the performance of the assembly. Replacement of this storefront should be planned in the next 10 years.

Perimeter joint sealants at windows and doors are about 8 years old; they are in fair condition but are about midway through their useful life. We observed a few joints that were starting to fail, as evidenced by separation or loss of adhesion to substrates. Plan to replace perimeter joint sealants in about 7 to 10 years; if the building is re-cladded, this issue will be addressed as part of that work.

Requirements:

- Repair or replace exterior wall cladding. If repaired, replace 100 percent of panel sealant joints, repair exterior transite panels as needed (approximately 10 percent), refinish all panels, and insulate the interior face of the panels.
- Replace all balcony guardrails.
- Repair or replace the waterproofing detailing at all balconies.
- Replace the existing EPDM roofing with PVC.
- Perform other related roofing improvements as noted.
- Replace the aluminum entry doors and power operators.
- Replace 50 percent of exterior hollow metal doors and frames, including all roof doors.
- Replace apartment windows and balcony doors in about 17 years (Priority 3 work), or as part of building recladding work.
- Replace common area storefront in about 10 years (Priority 3 work).
- Replace exterior perimeter joint sealants at openings within the next 7 to 10 years (Priority 3 work), or as part of building recladding work.
- Repair all failing and damaged EIFS at entry additions.

Recommendations for Improvements:

- Clad the building with new exterior siding or panel system to address leaks and improve energy performance.
- Consider enclosing the balconies to capture for more interior space.

Common Interiors

Common areas in both buildings include the residential corridors and egress stairs on the upper floors; a common room, common laundry, restrooms, and kitchen; and various mechanical equipment spaces; all on the first floor. Building A also has and office suite for management and a maintenance storage room; Building B has a social workers' office and other tenant amenity spaces. With some exceptions, most spaces on the first floors are in fair or good condition, especially in Building A: most first floor common spaces in A appear to have been partially renovated within the past 10 years. Building B is in somewhat worse condition and has not received as much attention. But because required underground sanitary replacement (see Plumbing section), extensive disruption to the first floor finishes will be required.

Fire and Smoke Separations

Fire resistance-rated separations in the building do not meet current code requirements. Any repairs or modernization project should trigger the requirement for full compliance with current code. Even if they do not, this occupancy (senior housing) and building height mandate that all fire-rated assemblies should be brought into complete compliance: this is a fundamental fire safety issue. Most significantly, none of the original door openings in the building, including those on fire stairs, unit entry doors, and original mechanical and storage rooms, are labeled with a fire resistance rating. Most of the door hardware is similarly unlabeled. Replacement of these doors with properly labeled assemblies will be required in many locations.

The elevator lobbies are not separated from the residential corridors as required by code. Smoke-rated doors and walls are required to either side of the elevators to isolate them.

Finally, extensive fire-resistive construction (firestopping and fire-separation assembly reconstruction) is required to restore the original fire ratings of wall and floor/ceiling assemblies that have been compromised by almost 50 years of use, maintenance, and modernization work. (In many cases, it appears that the appropriate fire-resistive construction were never installed; another original construction deficiency.) At test cuts we observed, we consistently found missing or compromised firestopping assemblies, both at floor penetrations and partition walls. (See Figures 1.3 and 2.9 for two typical examples of missing firestopping and fire separation assemblies.) Other assemblies and spray fireproofing have been damaged by past plumbing leaks. When interior modernization work is undertaken, an extensive campaign of firestopping and fireproofing will be required for code compliance. This work must be coordinated with the structural repairs discussed above.

Figure 2.9: Missing firestopping below tub drain; missing fire separation wall behind tub head.

Stairs and Exits

The arrangement and number of exits and other components of means of egress are generally adequate, but the fire stairs at north and south ends as well

as the mid-building stair of the building require significant improvement. First, the north and south end stairs were designed with open air smoke vestibules; this was a high-rise requirement to prevent the stair shafts from filling with smoke. Because of pipe freeze-ups in piping passing through the open-air vestibules, these spaces were enclosed. If the enclosed vestibules are to be retained, an emergency smoke exhaust and stair pressurization system will be required (see HVAC recommendations). We are uncertain how smoke was originally intended to be exhausted from the center stair shaft, but it also requires a smoke management system. This work is not discretionary; the buildings are currently not in compliance with the code in effect at the time of their construction.

The doors to the stairs are 42 inches wide; this makes them very heavy, and their swing intrudes significantly into the required egress width at the stair landing, a code violation. These doors do not have vision lights allowing visibility into the stair hall during an emergency; another code violation. At a minimum, the doors should be replaced with 36-inch fire-rated assemblies. A majority of the egress doors do not have panic hardware, instead they have knob or lever hardware, which is not permitted by code for this size building. All hardware should be replaced with panic hardware. All doors lack appropriate identification signage; in some locations basic signage is provided but does not meet ADA requirements. Taken together, these violations constitute a significant threat to occupant life safety.

The stairs themselves are non-compliant in multiple respects. Stair stringers are MC10x6.5 channels; this framing does not meet current code requirements for live loads and should be reinforced. The stairs lack handrail extensions at the outside walls; these should be modified or replaced. At the inner edge of the stair, the guardrail/handrail assembly consists of two rails of pipe; the rail spacing is unsafe and the top surface does not meet the height requirements of a guardrail or handrail. The top rail is not continuous. Either this guardrail assembly should be removed and replaced with a code-compliant guard and handrail, or infill panels should be added, and a separate continuous graspable handrail provided. In addition, an open gap exists between the inside surface of the exterior wall panel and the stair stringer. This gap allows for the passage of a 4” sphere and can pose a safety hazard. Either an infill panel or guardrail should be installed in these areas.

The building domestic water supply enters the building in the center egress stair. Egress stairs are not allowed to house other functions of the building; the water service entry must be isolated from the stair.

Residential Corridors

In general, the finishes within residential corridors are in fair condition, but despite some recent improvements, many finishes are tired, worn, or damaged by plumbing leaks. While corridor finish improvements can be deferred a few years, because of the disruption and cutting and patching work that will be required in the residential corridors, it makes sense to upgrade corridors finishes when other required interior modernization work is performed.

The ACT ceiling grid in the corridors is relatively new and in good condition, but many ceiling tiles have been damaged by ongoing plumbing leaks. The ceiling grid is left open at each end of the corridor due to a wall mounted HVAC diffuser above the stair hall door; the ductwork does not extend down the corridor as required. Instead, the installation intends for make-up air to flow freely above the ceiling grid and then through open registers into the corridor below. This ceiling plenum created by this installation is a code violation; ductwork needs to be extended above the ceiling (see HVAC), and the ceiling grid needs to be terminated properly. Because this condition did not exist at the time of the building's construction, its correction is mandatory, not discretionary.

The VCT flooring in most residential corridors has recently been replaced and is in good condition. VCT in the elevator lobby area was not replaced and should be replaced with new durable flooring such as LVT. A wainscot railing is present along one side of the corridor. The handrail mounts are failing in a majority of locations. A more substantial handrail should be installed along with new blocking within the corridor walls. Corridor lighting is relatively new recessed lighting, and no change is recommended at this time.

At each floor, the sprinkler standpipe is located within the common corridor outside the egress stair. Fire Extinguisher cabinets are located nearby each egress stair door but are surface mounted and over 4 inches deep. These cabinets should be replaced with semi or fully recessed cabinets to comply with accessibility requirements. At the first floor, the sprinkler standpipe and check valve assembly is located by the egress door. The check valve assembly is fully exposed and creates safety concerns and an obstruction to egress.

Upper floor elevator lobbies are light and cheerful, but like the corridors, somewhat tired. Replacement of finishes especially flooring is recommended in the elevator lobbies. This work may not contribute to a determination of obsolescence.

Entrance and Lobby

In general, the finishes in the entrance lobbies are in good condition and create a pleasant building entry. The flooring in the lobby is a combination of granite tile and walk-off mat style carpet. The carpet is in generally good shape, but the transition between tile and carpet is missing. Mailboxes are in good condition and were replaced in a recent lobby renovation. The top key lock is approximately 64 inches above the floor. This places some mailboxes out of the accessible reach range, a code violation. So long as no ADA units are served from the non-compliant mailboxes, this condition may remain.

The main entrance vestibule in Building B is in poor condition. The VCT flooring in the vestibules are badly worn and in need of replacement. Water damage was visible on the flooring, storefronts and ceilings, flooding was reported by the owner in these areas from the nearby river and burst water piping. The fin tube radiators located in the vestibules are in poor condition and severely dented. The intercom in the vestibule is an updated intercom but does not meet accessibility requirements: it is mounted too high, and the upper buttons are not in reach range. This must be corrected.

Common Rooms
The first floor common rooms were partially modernized within the last five years. They are bright, cheerful and spacious. Lighting in the common rooms has been upgraded to 2x2 LED fixtures. The doors into the common rooms are in poor condition and lack the proper hardware for egress requirements. These doors should be replaced with panic hardware, and auto operators should be considered to assist residents.

Except for the entry doors, Building A's community room is in good condition and requires no major work. Building B's community room is in fair condition and needs some immediate repairs. The existing ACT and ceiling grid are in fair condition, but many areas of the grid are sagging; it appears the hangers above may have failed. Significant subsidence in the floor slab is present around the perimeter wall. The design drawings indicate the presence of underslab ductwork in this area (now abandoned); it is likely that this ductwork has collapsed, causing the floor to give way. The affected areas of the slab will need to be demolished, the substrate bearing repaired or replaced, and then a new slab and finish flooring installed.

The common kitchens off the common rooms in both buildings are in poor condition, and cabinetry and appliance layouts do not meet accessibility requirements. These kitchens should be reconfigured and reconstructed with complying fixtures and equipment. Plumbing leaks above have damaged wall and ceiling finishes in both kitchens. Of greater concern, the kitchen spaces are used by some residents as well as by community programs to reheat and serve meals delivered to the residents. If common meals are cooked in these kitchens (as opposed to reheating food cooked elsewhere), full kitchen sanitary facilities will be required.

The finishes in the two common restrooms located in the common corridor of Building B are aging and on poor condition. Wall and ceiling finishes are damaged by plumbing leaks and moisture. Toilet partitions are badly rusted from multiple floods from water supply piping leaks. These restrooms should be generally refreshed, with new paint, lighting, fixtures, and accessories. Existing ceramic tile flooring is cracked and damaged.

Management Offices
Most office spaces in Building A are in good condition, having been recently renovated as part of a larger first floor refresh project.

Requirements:

- Where rated assemblies are required by code, replace all unlabeled fire doors and frames with properly labeled assemblies, including correct door hardware. This includes all stair doors.
- Install smoke separation assemblies at all elevator lobbies.
- Perform firestopping and fire-resistive construction repairs at all fire-rated assemblies as required.
- Reinforce stair stingers with supplementary steel.
- Install wall-mounted handrails at all three fire stairs in each building.
- Add infill panels and handrails at stair guards.

- Reconfigure dropped ceilings in residential corridors to close off plenum created by the current layout of ACT.
- Update residential corridor finishes: replace flooring, provide new ceiling finish, and repaint walls. This work can be deferred but should be performed when other repairs are undertaken.
- Replace handrails in residential corridors.
- Replace all fire extinguisher cabinets in common areas and residential corridors.
- Replace vestibule entry doors and hardware, flooring, and ceiling finishes.
- Relocate intercom system in both buildings to meet accessibility requirements.
- Add proper transition strips at carpet in the lobbies.
- Repair finishes in the Building B Common Room.
- Replace Common Room kitchen cabinetry with MAAB-compliant cabinetry and layout.
- Replace finishes in the common laundry rooms.
- Replace finishes in the Building B common restrooms: paint, lighting, and toilet accessories.
- Restore finishes throughout the first floor disturbed by underslab piping replacement.

Recommendations for Improvements:

- Replace all older fluorescent lighting fixtures through common areas with higher efficiency fluorescent or LED lamping.
- Install occupancy sensors on lighting throughout common areas that do not already have them.
- Install sun control shades on the Common Room windows.

Unit Interiors

Except for a number of recently renovated ADA units, almost all apartments are of identical one-bedroom design (there are also two 2-bedroom apartments), and except for limited turnover work that has replace a few components as needed, all finishes, fixtures, and equipment are original and in poor or very poor condition. There have been no comprehensive upgrades undertaken to any of the unit interiors. As such, at 48 years old, most apartment interiors are now in need of major, comprehensive renovation. Many units we inspected do not appear to meet minimum standards for occupancy established in the State Sanitary Code.

The typical units are somewhat cramped, and except for the kitchens, are well-designed, with an efficient plan layout, have a reasonable amount of storage space, and windows that admit moderate light. Kitchens are small and inefficient with inadequate food preparation counter space.

Walls and Ceilings

Walls and ceilings are painted gypsum wallboard except for exterior walls, which are the interior face of the exterior transite wall panels. In general, wall and ceiling finishes are in fair condition, with only relatively minor deficiencies observed. A hazardous materials assessment found asbestos present in gypsum

board joint compound; this makes repairs problematic, as even minor patching must be performed under an asbestos management plan. For this reason, when units are modernized, we recommend replacing all gypsum board in the baths and kitchens to mitigate the complexities of future repairs and maintenance. Obviously, reducing the amount of asbestos in the apartments also enhances resident health and safety. In other rooms, where work will be less extensive, an asbestos management plan is recommended as indicated in the Hazardous Materials section.

Flooring

Flooring is typically vinyl asbestos tile (VAT) throughout the units, except at some units that have been renovated at turnover. In those units, most VAT has been left in place and encapsulated with VCT. In most of the apartments we surveyed, VAT is in very poor condition: it is marred (a potential resident safety issue), dented and broken, and is separating or lifting. Replacement or recovering is required in the very near term. If VCT is used, flooring replacement should be planned for every 10 years. A luxury vinyl tile (LVT) will be more durable and may pay for itself over the life cycle.

We recommend full flooring abatement (VAT and asbestos mastic removal) rather than encapsulation to permanently resolve the problem. One item to note is that the asbestos-containing mastic is acting as a vapor barrier at the first floor slab. When replaced, vapor mitigation is likely to be required prior to application of a water-based adhesive.

Doors and Carpentry

Unit entry doors are non-compliant with code requirements in multiple respects. Doors and frames are not fire labeled as required by code, and it appeared that at least some doors are hollow-core, a serious fire concern. Locksets are bored cylindrical locks with a single retractable latch; these are not secure, and entry locksets have a knob instead of levers, which does not meet accessibility requirements. Doors lack fire- and smoke-gasketing as required by code, and at present the doors admit corridor air into the apartment via an undercut. This is no longer permitted and should be corrected as part of the modernization project. Beyond code requirements, circulating air from common spaces into units creates the potential for distributing air-borne pathogens (e.g., Covid-19) into apartments.

Entry doors and locks should be replaced; entry door frames should be evaluated for reuse or replacement. Doors require smoke gasketing at all four edges, including the threshold.

Interior swinging doors are hollow-core flush, typically 30 or 32 inches wide. Bath doors should be undercut for toilet exhaust make-up. If dimensional clearance permits, the doors to bedrooms and bathrooms should be widened to 34 inches for building code compliance. Door knobs should be replaced with levers throughout the building.

In most units, closet doors are missing or have been replaced in bedrooms during turnover updates. Units that have not had a turnover in a long period of time have existing accordion doors. Where present these doors are in poor

condition and require replacement. A missing or non-functioning closet door is a Sanitary Code violation.

Carpentry work is minimal and in poor condition. Wood trim around the windows is in poor condition and badly deteriorated from prior water infiltration at the windows. Shelving in closets and storage nooks are in poor condition. The shelves are constructed of metal and are extensively rusted. Clothes rods and shelving inside bedroom closets are in good condition.

Kitchens
Kitchens are small and inefficient, with minimal useful counter space. They do not meet HUD minimum property standards. When modernized, the kitchens should be reconfigured as galleys or in another layout to increase counter space. The condition of the original kitchens is very poor; many do not meet state sanitary code requirements for habitation: they are missing cabinet fronts or other components, surfaces cannot be cleaned, and open joints are unsanitary. About 25 percent of kitchens have had some modernization performed on unit turnover.

Figure 2.10: Typical apartment kitchen. Note worn/delaminating door fronts, worn countertops, missing toe kick at sink base, lack of counterspace, lack of receptacles, and VAT tile floor in poor condition.

Kitchen cabinets have solid wood face-frames and door and drawer fronts; most are badly work and delaminating from 48 years of use. (Figure 2.10) We

observed numerous cabinet doors, drawers and cabinet shelving that have failed. (Figure 2.11) Countertops are plastic laminate, also of varying ages and condition; some were wearing through the finish surface or delaminating at edges. (See Figure 2.10 on previous page.)

Figure 2.11: Sink base in occupied apartment missing bottom shelf; this is a sanitary code violation.

Kitchen appliances include a refrigerator and a 21-inch wide range, both generally in poor condition, and none of the appliances are Energy Star models. Range hoods are in poor condition and are recirculating type.

Kitchen lighting is generally older circular fluorescent fixtures; many were yellowed with age. Because the light is centered in the room, the counter work surface is in shadow. Kitchen faucets have water saving aerators retrofitted but are in generally poor condition and were observed to not function properly. Flooring is mixed between VAT and VCT. Wall and ceiling finishes are generally worn and damaged.

About 75 percent of kitchens require a substantial modernization within the next three years, either as a stand-alone project or as part of a modernization project. Work should include new cabinets, countertops, sinks and water-sense faucets, LED lighting, and flooring. Wall and ceiling finishes should be replaced to eliminate the asbestos hazard. Appliances in all apartments should be replaced with Energy Star models for improved energy efficiency in the near future. Recirculating hoods should be replaced with ducted model exhausting to the exterior (see HVAC). Switched under-cabinet lighting to light the work surface is also recommended.

Bathrooms

Like kitchens, bath conditions vary due to isolated miscellaneous improvements in some units, but most are in poor condition and in need of significant

modernization work in the near future. Bath modernization should be combined with a plumbing modernization project, as removal of the bath wet walls will be required to access the plumbing risers for replacement.

Walls and ceilings are generally in fair to poor condition, with water damage evident throughout, and especially at ceilings and wet walls. As noted above, all bath wall and ceiling finishes should be removed when the baths are modernized in order to fully remove ACMs from these spaces.

Bathtubs are enameled steel in fair to poor condition: at most tubs the finish is scratched and worn. Some tubs have been refinished to extend their life, but in many refinished locations, the coating is wearing or peeling. Tubs are equipped with a mixing and diverter valve, some of which appear to have been recently replaced, but many are older. Tub surrounds are ceramic tile in varying condition; most are poor, with stained and unsightly grout joints. Mildew is present in many grout joints, evidence of inadequate ventilation. Some bathrooms have grab bars to assist residents in and out of the bathtubs. Tubs are not appropriate for many seniors due to the risk of falls; when baths are modernized, walk-in showers should be installed instead. Replacing defective tubs with walk in showers accomplishes two key objectives: first, it is a better and safer bathing solution for seniors, and second, a pre-molded shower enclosure less expensive than the cost of installing new tubs.

Most toilets are not low-flow fixtures. Wall hung lavatories are aging and in generally very poor condition, with corrosion and finish marring, and most are missing pop-up drain assemblies. Faucets are in poor condition: many have corrosion present around the control knobs and leak when in use. Plumbing fixture stops in bathrooms are frozen, and management reported entire risers need to be shut down to perform plumbing work inside a unit. All fixture stops should be replaced as part of the bathroom modernization.

Bath accessories are generally poor. Lighting is fair to poor fluorescent; some fixtures are original. Of significant concern is the presence of a non-GFCI electrical receptacle mounted adjacent to the wall mounted lavatory; this is a serious life safety issue that should be addressed immediately. In most baths, mechanical ventilation is very poor or non-existent; see the HVAC section.

In summary, unit bathrooms should be comprehensively modernized within the next three years, to include new finishes, fixtures, trim, LED lighting, and accessories. When modernized, the bathtubs should be replaced with walk-in showers for safety, and grab bars should be added at all shower enclosures. A water-resistant wainscot of tile or solid surfacing should be provided at the wet wall to protect finishes from water damage. VCT flooring should be replaced with a more water-resistant finish like ceramic tile or at least sheet vinyl.

Lighting

Residents complain of a lack of artificial lighting in all rooms and spaces. The lighting fixtures in the apartments are typically older, inefficient fluorescent fixtures; lenses are yellowed with age. Kitchen and bath lighting should be replaced as part of modernization projects with efficient LED lighting. A switched overhead light should be added to the living room to improve lighting.

Requirements:

- Remove all asbestos-containing materials from baths and kitchens (rooms that receive frequent maintenance).
- Prepare an asbestos management plan to manage asbestos-containing wall and ceiling finishes in other rooms. This will include cutting and patching for electrical and mechanical work.
- Replace vinyl tile flooring and resilient base; remove VAT and mastic if cost permits.
- Replace unit entry doors with fire-rated doors and interconnected apartment locks with deadbolts and lever hardware.
- Replace bath doors with 34-inch wide doors if dimensional clearance permits, and provide proper undercuts to allow make-up air to enter when door is closed. Replace bedroom doors with 34-inch wide doors if dimensional clearance permits.
- Replace about 75 percent of all bi-fold closet doors as needed.
- Repair or replace all closet specialties and built-in shelving as needed.
- Comprehensively modernize all kitchens; replace all wall and ceiling finishes to eliminate asbestos hazards; install new flooring, cabinets, fixtures appliances, lighting, and accessories.
- Comprehensively modernize all bathrooms as part of plumbing replacement project: replace all wall and ceiling finishes to eliminate asbestos hazards; install walk-in showers (similar in cost or less expensive than bath tubs), and replace lavatories; install new flooring, wainscot at wet wall, lighting, and accessories.
- Replace existing unit lighting.
- Install new switched overhead lights in all living rooms.

Waste Handling

Each building is served by a single horizontal waste compactor in the first floor compactor room that compacts into a wheeled container. From there, maintenance personnel transport the full containers to a central trash enclosure outside for pick up. Residents dispose of bulk trash items outside the exterior trash enclosure. This system is relatively efficient and generally works given the size and amount of trash produced, but there are numerous deficiencies with the compactor room and the waste handling system components that should be corrected.

First, the compactor rooms are undersized and are configured poorly. The rooms should be expanded into the adjacent electrical room after the electrical equipment is relocated (see Electrical). The compactors are offset from the waste chutes, with an elbow provided at the bottom of the chute; this elbow is subject to constant damage from falling trash. The chutes are in very poor condition and require replacement; management reports numerous maintenance calls to address problems, especially at the bottom elbows. The compactor hoppers should be located directly under the trash chutes; this may require a custom hopper configuration.

First floor residents dispose of their trash through an un-rated and un-sealed hopper door into a trash barrel in the compactor room; maintenance then empties the barrel into the compactor. Trash room odors permeate the

common corridor from this unprotected opening. At a minimum, this hopper door should be replaced with a fire-rated, gasketed door to prevent odor migration and meet fire code. A lower maintenance solution would be to install a mini-compactor at the first-floor hopper to minimize the need to empty barrels.

The compactor room in one building has recently been updated with new finishes. The trash room in the other building has yet to be renovated and is in poor condition. The compactors are old and leak garbage into the rooms. The required fire separation between the trash room and the base of the chute shaft is missing in both buildings; this should be corrected when the chutes are replaced.

Recycling is not provided at this property as is required by state regulations. The exterior trash enclosure should be relocated adjacent to each building and reconfigured to provide space for recycling containers.

The upper floor trash closets are not accessible, and disabled residents leave their trash in the common hallway. This can be readily corrected by enlarging the trash closets. That may also make space for recycling bins on upper floors if desired.

Requirements:

- Replace existing trash chutes and compactors.
- Expand and reconfigure the existing compactor rooms.
- Provide new screened trash enclosures outside of each building for resident access to dispose of bulk trash items.
- Provide space in the new trash enclosures for recycling containers for resident use.
- Enlarge upper floor trash closets to make them accessible. Create space for recycling bins if desired.

Elevators

There are two traction elevators serving the building. They were replaced in 2019 and are in very good condition; no improvements are required.

Requirements:

- Plan to replace the elevator cab flooring in about six years.

Fire Suppression

The original 1972 fire suppression system included only standpipes in hallways adjacent to each of the three stairways. In 1982 the system was upgraded to include fire suppression (sprinklers) in all apartments, hallways, offices and other common areas. First floor and other common area renovations in 2001 included matching changes to the local suppression system.

Each building is served by three separate dedicated 6-inch sprinkler service lines, each running from an 8-inch line on site that wraps around the buildings and originates from a manhole on site served by the municipal supply.

Upstream of the pit and close to the Main Street there is a Siamese connection with a riser from the ground that we assume is a site hydrant. No exterior fire department connections are provided at either building; two are required by

current code. Lack of fire department connections in these buildings is especially problematic because of the absence of a fire pump: the fire department cannot supplement the pressure in the standpipes. Because pressure is so low, this is a significant safety concern.

Each buried 6-inch line runs through a post indicator valve just outside of the building. One of the post indicator valves is damaged, and the condition of the buried valves is unknown but expected to be in poor condition given their age. One indicator shows separation of the electrical conduit at the connection to the tamper switch. Each 6-inch line runs beneath the slab and rises up adjacent to the stairways supplying a standpipe.

There is no double check back flow prevention either in the pit or at the buildings; any revisions to either the sprinkler or site utilities will require installation. There is no fire pump at either building or in the pit. Pressure at the top of the building was measured to be roughly 60 psi; code requires a minimum of 100 psi at full hose flow. This is clearly a non-compliant standpipe situation and a fire pump will be required to bring this system into code compliance.

We observed that one of the two 8-inch gate valves in the pit has been replaced, and one of the three 6-inch gate valves at the base of the standpipes in the building has been replaced. The rest are original or well over 25 years old. Tamper and flow switches are located at the base of each standpipe.

Each 6-inch standpipe has a 2-inch floor control assembly and a 2½-inch fire department hose valve with a 1½-inch reducer at each floor. There are no pressure regulators at either the floor control assemblies or fire department connections. Pressure regulators are required to provide code required minimum pressure at the hose valves while not exceeding code maximum pressure at the sprinkler heads.

CPVC sprinkler piping has been used in most areas and is left exposed to view within some limited locations, including the ends of corridor ceilings that have been left open and some apartment closets. Code requires that the piping be protected from melting during a fire and therefore piping can only be run exposed in areas with sprinkler coverage. Areas were observed with exposed piping and no coverage which is a code violation.

Closets are not sprinklered, nor are the stairways. Most heads are sidewall and a system of plastic soffits has been used for concealment in most locations. Sprinkler heads are of various ages should be surveyed for age and condition; most appear to be original (1982) and thus approaching the end of their listed life of 40 years. Code requires that all sprinkler heads be replaced at the end of their listed life.

Code Issues and Triggers

Lack of pressure in the standpipe system is a clear code violation and needs to be resolved. To resolve this issue a fire pump will be required, pressure reducing valves will be required at the hose valves and floor control assemblies, fire department connections must be added, and numerous other upgrades will be required. A single fire pump located above or adjacent to the meter pit

could serve both buildings, but the designer should assess whether using one for both buildings or two separate pumps is more cost effective.

CPVC piping has been run exposed in areas without sprinkler protection. This violates the listing of the pipes and either needs to be buried behind fire rated construction or sprinkler coverage needs to be added in these areas.

MGL Chapter 148, Section 26I requires that if a "major" renovation occurs to the building then the entire sprinkler system will need to be brought up to current codes. If a renovation exceeds 33 percent of the floor area and the cost to install sprinklers would be less than 33 percent of the total project cost, then the project is considered a major renovation and a sprinkler upgrade will clearly be required. Based on our understanding of the proposed project, we believe that a full sprinkler upgrade will be required.

In addition, NFPA 25 requires the existing standpipe systems to be replaced or tested to verify their structural integrity. It has been our experience that the NFPA 25 testing is quite invasive and requires significant amounts of destructive testing to analyze pipe samples. For this reason, we do not recommend this approach in a large occupied building. Furthermore, the costs for the destructive testing are, in our professional experience, commensurate with costs for piping replacement. We thus recommend all piping, pumps and sprinkler heads original to the building be replaced in kind.

Requirements:

- Provide double check back flow preventer at primary service entry.
- Provide fire pumps to serve both buildings.
- Replace post indicator valves.
- Provide at least two fire department connections at the exterior of each building.
- Replace all service entry valves that are older than 20 years. Test the rest to ensure proper function.
- Provide pressure reducing valves at each fire department hose valve and at each floor control assembly.
- Survey all sprinkler heads and replace as required.
- Provide piping and heads to serve all closets and at each floor stair landing.
- Cover all exposed CPVC piping for proper protection.
- Replace standpipes.

Plumbing

The plumbing systems are original to the building. Management reports frequent leaks and breaks on all piping systems (waste and vent, supply, and rain leaders). We observed evidence of numerous leaks throughout all areas of both buildings. Most waste stacks and rain leaders that were visible for inspection showed heavy corrosion and staining from leaks, and copper supply risers similarly exhibited pitting and corrosion suggesting imminent failure.

Waste, Vent and Rain Leaders

Waste and vent stacks are hubbed cast iron, while branch waste piping is copper. The has been suffering from multiple failures for several years at various locations, particularly at tub shoe traps and at the base of waste stacks at the sweeps. We observed heavy corrosion and staining on all 3 of the waste

stacks and vents we were able to inspect, confirming the presence of leaks in the stacks. (Figure 2.12) Management reports frequent back-ups that it believes to be caused by scale build-up at the sweeps at the base of the stacks; management has opened and replaced a few badly scaled sweeps. Scaling increases the frequency of clogs that require snaking/jetting.

Figure 2.12: Recently active leak at waste riser (note rust stains and streaks)

Our video inspection indicated numerous deficiencies with the underground sanitary piping, including heavy erosion of the pipe wall (the bottom of the pipe is visibly eroded, indicating that much of the pipe wall thickness has corroded away), collapses, dips and other obstructions. It appears to us that the underslab, not the sweeps, is the primary cause of sewer back-ups, but both may be contributing. The underslab sanitary requires immediate replacement.

The copper branch waste piping is also heavily corroded and pitted throughout all areas we could inspect. (See Figure 2.13 on following page.) In addition, management reports numerous failures of the tub shoe (drain fitting); many have rotted out or separate from the copper

Figure 2.14: Corroded and pitted copper branch waste piping; this is typical

Vent piping has also suffered leaks, and during past repairs has reportedly been used to connect waste lines to in order to make repairs less disruptive.

Rain drainage is provided by vertical leaders to an underground drain main that runs parallel to and in close proximity to the sanitary main. The underground drain exits at the end of the building and connects to the storm drain piping that outfalls to the river. Rain leaders have reportedly backed up occasion. The source of the drainage problems are unknown: our video inspection indicates that the underslab rain leaders are in fair condition and remain serviceable, but their very close proximity to the sanitary mains (which must be replaced) means that it will be more cost-effective to replace them than try to protect them during excavation and replacement of the sanitary.

All cast iron waste stacks, copper branch sanitary piping, vent piping, and rain leaders require replacement in the next three years; interior finish repairs should not be undertaken until the sanitary and drain piping problems are comprehensively addressed, since finishes will continue to be damaged by leaks, and wet wall replacement will be necessary to access the risers. Underslab sanitary piping must be replaced at the same time; this will require extensive slab trenching and disturbance of first floor finishes. As noted above, it may be

more cost effective to replace the underslab drain piping at the same time rather than preserve it, even though it is in fair condition.

Supply Piping

The potable water service is from the local municipal water department via an 8-inch ductile iron main from Main Street. The main runs through a manhole containing a recently replaced water meter with a remote reader; at the meter, the line divides into separate 8-inch fire service and 8-inch domestic water mains. There is no pressure booster system on the service to the buildings, and no pressure reducing valves were observed. It is highly unusual for a building of this height not to have a pressure booster system; it is theoretically possible that a consistent pressure of roughly 80 psi at grade can provide sufficient pressure to serve all floors, but pressure gages on the fire sprinker system indicate that water pressure at the top of the standpipes is only 35 psi (barely half the recommended minimum domestic pressure of 60 psi), and the fire service piping is significantly larger than domestic. It is likely that domestic water pressure at the top floors is less than 30 psi, or well below recommended minimum requirements. As part of a future renovation, a domestic pressure booster pump will be required to adequately serve low-flow plumbing fixtures.

Figure 2.15: Heavily corroded and pitted copper domestic supply riser (typical condition); also note lack of firestopping at slab penetration

Potable water piping is either Type L or M thin wall copper. The copper risers are experiencing multiple failures each year, and the copper is showing pitting and corrosion on both interior and exterior (Photo 1.7 and 2.15). Most domestic supply isolation valves have failed and do not hold properly, and

making repairs is therefore often very problematic. As with the waste and vent system, the entire domestic supply system requires replacement within three years. Because of the disruption to interior finishes, this work must be performed prior to or in conjunction with bath and kitchen finish repairs.

Domestic Water Heating
Domestic hot water (DHW) is heated by a pair of gas fired, condensing mode HTP boilers with approximately 94 percent combustion efficiency that are located in the mechanical penthouse. The system uses boiler water to heat DHW stored in the two adjacent HTP indirect fired, 120-gallon, stainless steel insulated tanks. Initial leakage problems at the installation caused corrosion and subsequent replacement of a small amount of copper piping and fittings, but the system is now working as expected and no changes are required.

A new variable speed DHW recirculating pump circulates DHW through the piping riser system and was installed 2 years ago. It was not clear why a variable speed pump was used.

The DHW tempering valve appears to be roughly 20 years old and is of the bimetallic actuator type (Leonard). The tempering valve should be replaced in the near future, as it is well beyond its service life of 10 years.

Gas Piping
A low pressure natural gas service separately metered for this building serves two gas fired make-up air units at opposite ends of the roof, the penthouse pair of boilers used to heat domestic hot water (DHW), and gas dryers in the communal laundry. Gas pipe is exposed on the roof surface. There is no gas booster, which, like the domestic water system, is highly unusual for a building of this height. A gas pressure booster should be provided to ensure the reliability of the critical infrastructure (domestic water heating and make-up air units) on the roof. The gas meter is exposed outdoors at grade and is 5 years old. All exposed gas piping should be painted.

Plumbing Fixtures
Existing plumbing fixtures are nearly all original, except for toilets which were replaced in 2012 to achieve water savings and use roughly 1.6 gpf. Shower valves have almost all been replaced in the past few years along with the shower heads that now use the telephone style with flexible hose attached. Tubs are enameled steel and in many cases the rust has penetrated the enamel at bottom and overflow drains causing further wastewater leak problems. All plumbing fixtures and fittings (except toilets) in original units should be replaced in the near future.

Accessible fixtures have been used in the nine apartments upgraded in 2011 and are in good condition.

Access to pipe chases is good, but many of the access panels in hallways are showing wear. This evidence of frequent use to access leaks and breaks.

Requirements:

- Replace the entire waste and vent system.
- Replace above-slab rain leaders and roof drains.

- Replace underground waste and storm drain piping. (Retain underground rain leaders if cost effective to do so.)
- Install a domestic water pressure regulator and booster system.
- Replace the entire domestic supply piping system, including all isolation valves.
- Replace main potable water stop valves and check valves located in the outdoor pits.
- Install a gas booster and pressure regulation system.
- Repaint and re-support gas piping on the roof.
- Replace all plumbing fixtures except for the toilets. Include new connections to all piping systems including fixture stops. Use low flow fixtures (Water Sense listed).
- Replace all roof drains.

HVAC

HVAC systems in the building are all almost entirely original, in very poor condition, inefficient, out of compliance with code, and in some cases, inoperative. Mechanical ventilation is minimal, and none of the required high-rise code features are present. Constructed just prior to the 1973 energy crisis, energy efficiency was not considered in system design.

We also noted that nearly all ductwork risers we inspected lack required firestopping at floor penetrations or into fire-rated shafts. (See Figure 1.7 for one obvious example.) It is unclear whether this was an initial construction deficiency or whether firestopping has been dislodged over the years, but this is a significant life safety risk and code violation that must be corrected.

In summary, the existing HVAC systems in the buildings are functionally and physically obsolete. A comprehensive reconsideration of the HVAC systems will be required as part of any significant modernization project, and is in any case recommended for safety, resident comfort, and energy efficiency.

Space Heating

All apartment space heating is provided by electric resistance heat in the form of electric baseboard controlled by a variety of thermostats, including mostly Light-Stats. All baseboards are original and are in poor condition and extremely energy inefficient. Many are badly corroded from water leaks at the exterior wall assembly.

Common areas are heated using a number of different electric resistance devices including baseboard, cabinet fan coils, radiant panels in stair vestibules, and three electric resistive heat furnaces unit serving offices, community room and other 1st floor areas. Two of the furnaces (Trane) appear original, but the unit serving the offices is relatively new (roughly 4 years).

Original construction included transite (asbestos) ducts buried below the 1st floor slabs to serve the original community room. The renovation in 2001 reduced the size of this room and deleted the function of a portion of that buried duct work system. However, it is still used to serve the now smaller community room. We recommend the abandonment of the transite ducts serving the community room, both due to the hazard of buried ducts absorbing ground moisture that promotes mold growth, and also because the transite

material contains asbestos. Provide replacement ductwork above grade or change the system approach to an air source heat pump system using ductless fan coils.

All heating system components with the possible exception of the new office split system should be replaced. At that time, system selection should be evaluated to determine the optimum replacement. Options may include a gas-fired hydronic system approach or an electrically powered heat pump system using either air or a ground source approach. Large energy savings of different amounts will result. In this location and at current utility costs the following can roughly be expected for reduction in heating costs: gas fired heating by 84 percent; air source heat pumps by 60 percent; and ground source heat pumps by 73 percent.

Cooling

Air conditioning is provided to apartments using through-wall units that are mounted in architectural wall sleeves. This system is relatively easy to maintain but is not at all energy efficient: besides the inherent inefficiency of distributed small cooling units, there are significant energy losses due to air infiltration at and around the through-wall unit sleeves. We noted extensive water staining and corrosion in finishes below many through-wall units; this indicates the current system is not effective at preventing wind-driven rain from penetrating the wall assembly. In addition, because they are controlled independently, there is nothing to prevent the heat and air conditioning from running simultaneously. For all of these reasons, the local through-wall air conditioners have failed and should be replaced with a more modern and energy efficient system.

Air conditioning is provided to common areas though the ducted furnaces that include DX cooling coils connected to a group of three separate outdoor condensing units: two-3 ton units and one-4 ton unit. A separate mini-split A/C unit serves the mechanical penthouse and appears to be less than 5 years old.

All air conditioning components should be evaluated as part of a larger HVAC modernization to determine the optimum approach. If an electric heat pump system is selected for heating, this will also address cooling needs. If a hydronic heat system is selected, a central electric chiller based hydronic system using a 2 or 4-pipe approach will be more efficient and comfortable than the current distributed system, but central systems will increase maintenance. With any of these options, significant energy and emissions savings will also accrue from the reduction in air infiltration at the through-wall units.

Ventilation

The ventilation system in the buildings is in poor condition, archaic, inadequate and non-compliant with multiple code requirements. Residential areas are served two roof-mounted, 100 percent fresh air make-up air units that pressurize the hallways on all residential floors via a supply grille at the end of the hallway. We were unable to measure the air flow at these registers but can state with near certainty that supply air does not meet ASHRAE minimum standards; this is a health and safety concern for the residents.

One uninsulated duct riser serves each end of the building. The make-up air units are 22 years old, are in very poor condition and inefficient by design. They rely on the open ceiling plenum to distribute air, a code violation. They offset toilet exhaust in the apartments via an undercut in the unit entry door, another code violation. (Current code does not allow hallways to be used as a plenum in this fashion.) They do not distribute air to the center portion of the building, another code violation.

If this ventilation concept is maintained, extensive changes to the supply ductwork will be required; it is likely that complete replacement will be needed: First, the ductwork must be insulated and extended down the corridors to distribute air throughout the building and supply air directly into each apartment. (Alternatively, each apartment could be provided with its own air intake.) The existing ductwork is probably not large enough for the additional air flow, but this needs study. A system of fire dampers at each floor were originally designed in the vertical duct work and each should be inspected for proper condition and function. UL555 requires testing of all functional damper components every four years; there is no specific age at which they become obsolete, but at 48 years of age, all operating components in ductwork should be replaced.

Ventilation air for the common areas served by the furnaces is provided only through the two older furnaces, and no outside air controls or dampers appeared to be in place. Mechanical ventilation with outside air is required to all occupied spaces in these buildings; ducted fresh air must be provided for code compliance.

There is neither a smoke evacuation nor stair pressurization system for life safety in case of fire. Current code requires stair pressurization at a minimum.

Exhaust

A set of 12 exhaust fans draw air from the apartment bathrooms. These exhaust fans are not offset by make-up air in the apartments and lack energy recovery. The fans were replaced within the past five years with units that draw more air flow than originally designed, but many exhaust registers we checked were pulling only a minimal amount of air; there may be obstructions in the exhaust ductwork. The exhaust branches at each unit lack fire dampers at the risers, a code violation. Because air flow was increased, the building is under negative pressure, increasing likelihood of wall leaks.

The existing bathroom ductwork may be used for apartment exhaust provided that ductwork is cleaned, repaired, sealed, and smoke and fire dampers installed. This approach would include roof mounted, insulated ductwork that would connect to a new energy recovery ventilation (ERV) system. If the Authority does not want to pursue this energy efficiency upgrade, at a minimum, new smoke and fire dampers will be required on the existing risers.

There are also smaller roof fans in each building for drawing exhaust from the stacked small utility rooms at each floor. These fans should also be connected to the ERV system if one is provided.

Many other spaces in the buildings should have mechanical exhaust added, including the rooftop mechanical rooms, main electrical rooms, trash compactor rooms, and trash closets. In addition, residential kitchen hoods should be mechanically exhausted as well. This work will be required by code if a comprehensive modernization project is undertaken.

Cogeneration
Depending on heating system selection, Campello may be an ideal candidate for a combined heat and power system (cogen). It is the right size building and has space available (in the rooftop transformer room) to accommodate the equipment. We recommend that the life-cycle cost of a cogen system be studied as part of the HVAC project.

Requirements:

- Replace the heating systems for all areas.
- Replace the air conditioning systems for all areas with either of the heat pump options or with an electric chiller based hydronic system.
- Eliminate remaining transite ducted system at Community Rooms.
- Replace the entire mechanical ventilation system.
- Provide a stair pressurization system.
- Replace or upgrade the existing bathroom exhaust ductwork.
- Add mechanical exhaust to unit kitchens and various mechanical spaces.

Recommendations for Improvements:

- Provide an ERV system on the roof to capture mechanical exhaust energy.
- Analyze co-generation for energy cost savings and applicability.

Electrical

The buildings' electrical systems are almost entirely original, with only limited and minor upgrades undertaken in various renovation projects over the years. At 48 years old, all original components are now well beyond their useful life, most in poor condition, and major systemic replacement work is required within the next three years.

Power Distribution
The main electrical service for each building consists of two pairs of independent services: the first pair are 120/208V, 3-phase, 3000A switchboards in the first floor Electric Room of each building fed by underground service from a ground-mounted transformer located outside. These services power the first through tenth floors of each building. The second pair of services are 277/480V, 3-phase switchboards with multiple disconnects located in the mechanical penthouses. They are fed from the three 13.8kV transformers in the rooftop transformer vault and powers the elevators, make-up air units, and heating systems. The rooftop services also provides the connection to the emergency generator and the standby power supply system (SPSS) in each building.

There are a number of safety concerns with this arrangement. The first is that code does not permit two independent electric services in one building: a shunt trip must be provided in the main electric room that allows fire personnel to cut the power to the rooftop system in an emergency. But since the rooftop service

is interconnected to the standby power supply system, the SPSS distribution panel must be refed to isolate it from the penthouse switchboard. Otherwise, when the power is cut to the roof, all emergency systems will be taken offline. The second concern is the inherent safety issue of having three 13.8kV transformers on the roof. They pose a fire risk that would be difficult to attack and require a significant amount of energy to be run via cable inside the building. Should pone of the feeders fail, it will do so explosively. The third issue is that the main switchboards at the ground floor, which are sitting directly on the floor slab, are highly vulnerable to flooding, especially in Building B.

In addition, the first floor switchboards are original to the building, are long past their expected working life (35 years), and have been damaged by periodic floods from the laundry room above. We did not see evidence that the switches have been periodically serviced to keep them in good repair; they may not provide the overcurrent protection for which they were designed.

For all of the above reasons, the main switchboards should be replaced and refed as required. The main Electric Rooms should be relocated to the current second floor Laundry Room in each building, where they will be well above flood level. Shunt trips must be provided in each building to de-energize the rooftop switchboards. For fire and life safety, the 13.8kV transformers on the roof should be relocated to near grade immediately, and the existing 480V rooftop equipment be re-fed from the second floor. Note that the rooftop power system used to serve an all-electric water heating system and electric make-up air units. Since those systems have been converted to gas, the rooftop service is significantly over-sized and can be reduced. The re-fed equipment will be substantially smaller than the current service.

From the main switches, power is distributed to old 2- and 3-phase power distribution panelboards located in the Electrical Room, the mechanical penthouse, and in other locations. Except for the mechanical penthouse panels related to the gas-fired heating conversion, these panelboards appear to be original to the building. All older panelboards should be infrared tested and replaced if required. All original panels require replacement due to age and condition, although some existing aluminum feeders may be salvable.

Finally, a campaign of permanent labeling is required to properly identify all equipment and circuits. Most of the electrical equipment we observed was either unlabeled or labeling was so faded or damaged as to be illegible.

Standby Power Supply System (Emergency Power)

The main switchboard also feeds a 100A automatic transfer switch, which connects to the 55 kW emergency generator and provides a parallel standby power supply system (SPSS), including generators, automatic transfer switches, feeders and branch circuits serving emergency life-safety loads, such as stair and corridor lighting. Besides aging, this system is significantly undersized and inadequate to satisfy current code requirements for an *emergency* power supply system (EPSS).

The engine-generators, ATSs, and SPSS panels are installed in the mechanical penthouses, a code violation for EPSS equipment. A separate emergency electric room is required to isolate EPSS equipment from the other services.

This could be located in the penthouse transformer vault if the transformers are removed as recommended, or the generators could be relocated to near grade, where they will be easier to service. Even if located on the roof, a grade-level oil or propane tank will be required for code compliance.

Both engine-generators are well beyond their useful life, are in very poor condition, and poorly installed. The generators lack an output circuit breaker as required by current code, they are poorly ventilated and exhausted, they lack an onsite fuel source, and each has a runtime of over 1,500 hours. Neither is large enough to handle the capacity of emergency systems that will be required: with the addition the fire pump and other new emergency powered equipment, the generators are significantly under-sized. The ATS will also need to increase in capacity.

In summary, the SPSS requires comprehensive replacement with an EPSS to meet code and provide for resident safety. This will require new generators, ATSs, other panels, and feeders. This work will be required by any substantial alteration.

Common Areas
Common spaces appear to have adequate power distribution to meet programmatic and code requirements, however any original devices should be replaced. Branch circuit wiring is aluminum. Aluminum branch circuiting has been blamed for numerous fires around the country, caused by thermal expansion and transmission of the conductors loosening the set screws on devices; this creates the potential for arcing. All small-gage branch wiring throughout the building should be replaced for fire safety.

Interior lighting is a mix of newer energy-efficient retrofit fixtures (primarily in the residential corridors) and older fluorescent fixtures with yellowing and damaged lenses in other areas. All older fixtures should be replaced with new LED lighting; the energy code will require this work as part of any substantial modernization.

Exterior lighting is primarily wall-mounted flood lighting. Most fixtures are aging an in poor condition. These fixtures should be replaced with new more efficient fixtures. When this work is performed, consideration should be given to installing pole-mounted lighting at the main entry and other public areas for a more residential and less institutional appearance. When the exterior lighting is replaced, a new astronomic timer controller should be installed to improve system efficiency.

Apartment Units
Unit load centers are original to the buildings, and many have been damaged by plumbing leaks. Based on our survey, at least half appear to suffer from some kind of damage in the past, and nearly all are in poor condition. Secondary feeders to the load centers should be evaluated; these are assumed to be original and should be replaced as part of the planned modernization project but may still be serviceable. Unit load centers have a mix of aging 15A and 20A circuit breakers, with one 50A 2-pole breaker for the range. There are no arc-fault circuit breakers (AFCIs). Arc-fault circuit breakers will be required on any remaining 20A power distribution circuits as part of any electrical project.

Kitchens and baths lack dedicated 20A power circuits as required, and most kitchens and baths do not have GFCI receptacles or breakers, a serious life safety concern. Receptacle spacing within the living rooms and kitchens do not comply with code. Branch circuit wiring is aluminum; we recommended that all branch wiring be replaced for safety when units are modernized. All original devices are in poor condition and should be replaced when units are updated; code will require tamper-proof receptacles in a substantial alteration.

Unit lighting improvements are included with Unit Interiors requirements.

Requirements:

- Replace the main electrical switchboards.
- Relocate the main switches to the second floor.
- Eliminate the transformer vaults at the penthouses and relocate to near grade (above flood plain) or a new second floor Electrical Room.
- Perform infrared testing and preventative maintenance of all distribution panelboards.
- Replace all aging panelboards if recommended by testing and servicing.
- Relabel all panelboards and circuits to comply with code.
- Replace SPSS with new larger EPSS, including new generators, ATSs, and distribution.
- Construct new 2-hour emergency power rooms in each building.
- Replace older devices and all branch circuiting in common areas.
- Replace inefficient lighting in common areas with new LED fixtures.
- Replace building-mounted exterior lighting with new energy-efficient fixtures.
- Comprehensively rewire all apartment units, including new load centers, circuit breakers, copper branch circuiting, and devices.
- Replace the secondary feeders to unit load centers in all apartments.

Recommendations for Improvements:

- Use pole-mounted fixtures for at least some site lighting to improve appearance.

Communications

Communication systems include telephone and cable TV wiring, intercom, emergency communications systems, and a closed-circuit video surveillance system. They are in various states of disrepair; none of the systems was fully functioning during our inspections.

Telephone and Data Systems

Cabling is POTS twisted pair, and the demark cabinet in the first floor of each building is in very poor condition. Replacement of these analog systems with modern digital demark points is required. All units should be provided with new CAT6e cabling for improved data transmissivity.

Cable television is provided by a single coaxial cable jack in each apartment. We did not observe any problems with this system.

Intercom
The building is served by a telephone-based intercom system that provides communication and door release functionality. Telephone-based systems have numerous challenges (what provision is made for residents who do not have telephone service, residents changing phone numbers, questions about responsibility for problems). We recommend a new three-button hard-wired intercom system be provided.

Emergency Communications Systems
The buildings do not currently have bi-directional antenna (BDA) systems to allow fire emergency personnel to communicate within the structure. Given its construction type (steel frame), a BDA system will be required by Brockton Fire Department as part of any significant modernization project. .

There are emergency call stations in each apartment connected to a local visual alarm outside the entrance door. (The recently renovated ADA units also have an annunciator panel in the main lobby.) Two of the three pull stations we checked were not working. This emergency system must be repaired or replaced to function as originally intended.

Video Surveillance System
The building has an existing closed-circuit video surveillance system, but management reports that only three cameras currently operate. The existing system should be evaluated, repaired, and extended as required. (We think appx 30 cameras will be needed between the two buildings to provide adequate coverage.) The existing front door security camera system should be checked for proper operation as well; code requires that residents be able to video monitor the front entrance, but that feature is not currently working.

Requirements:

- Replace the existing telephone infrastructure, including replacing the network interface and running new CAT6e cable to each apartment.
- Replace the hard-wired intercom, including new master panel, house panels, and cabling.
- Provide a BDA system.
- Replace the existing emergency call system in each apartment.
- Evaluate the existing video surveillance system; repair as required to function as intended.
- Troubleshoot the existing front door monitoring system to allow residents to view entrance video.

Recommendations for Improvements:

- Extend the existing video surveillance system to cover other areas.

Fire Alarm System

The fire alarm system in the building is relatively new (installed in 2018) but appears to not comply with code (NFPA 72) in multiple respects. Many features required by current code are not present, and in general the system appears to be a “like kind” replacement of an older system rather than one meeting current code requirements. It is not clear whether relief was obtained from the

Brockton Fire Department for a non-compliant installation (property management is unaware of any relief), but the system does not provide adequate protection and coverage for this high-rise occupancy. We noted the following potential concerns:

Survivability
Based on our inspection, the system lacks survivability as required by code. Fire alarm systems used for partial evacuation and relocation shall be designed and installed such that attack by fire within an evacuation signaling zone shall not impair control and operation of the notification appliances outside the evacuation signaling zone. In other words, a fire on the 4th floor should not be able to disable the notification appliances (speakers) on other floors. NFPA 72 requires that a high-rise have a system with level 2 or 3 survivability. Level 2 or 3 survivability requires fire protection for the riser wiring and system nodes beyond just metal conduit (2-hour enclosing construction or mineral insulating cable). While these features may be present in some areas, we did not observe them during our visit, and the system components we inspected were not protected. Further investigation is required to definitively determine if level 2 or 3 survivability features have been incorporated, but our inspection did not identify commonly installed survivability features.

Incomplete Coverage
The system lacks system detectors in the required locations. Detector spacing in the corridors exceeds 30 feet, which is the industry standard spacing. System detectors and A/V annunciators are not present in stair halls and stair vestibules as required by code.

Smoke alarms (either local or system detectors) are not present inside apartment sleeping rooms as required. The local smoke alarm in the unit living room (not part of the fire alarm system) is incorrectly located and appears to lack battery back-up.

Inadequate Functionality
The fire alarm system does not appear to have paging speakers in the stairwells. Current code for a high-rise fire alarm system requires an audio zone in the stairwells, to give direction to occupants being evacuated or relocated. Unless a variance was obtained, speakers should be present in the stairwells.

Requirements:

- The original alarm system designer or a code consultant should evaluate the system for survivability and make recommendations for improvements if required.
- Add smoke detectors in the corridors to meet code maximum spacing.
- Add system devices (detectors and signalers) in locations that lack them.
- Add local smoke alarms or system smoke detectors with sounder bases in sleeping rooms. One advantage of system detectors is that they provide supervision against tampering or disabling by a resident.
- Relocate the local smoke alarm (or add a system detector with sounder base) to the living room ceiling.
- Install voice paging systems in stair halls.

Energy Conservation

There are numerous opportunities to improve the property's energy efficiency. The following list of recommendations consolidates all energy efficiency recommendations summarized elsewhere in this report.

Requirements*:*

- If the building is re-sided, add exterior insulation to the wall assembly. This work will be required by the energy code.
- Use high-albedo (light colored) roofing for reduced solar heat gain.
- When kitchens and baths are modernized, install low-water use fixtures.
- When kitchen appliances are replaced, install Energy-Star rated appliances.
- Replace obsolete electric resistive heat with more efficient heating system.
- Replace inefficient window air conditioners with high efficiency central air conditioning.
- Replace old exterior and interior lighting fixtures with new energy efficient models.

Recommendations for Improvements (Not Required):

- Add energy recovery ventilators to building exhaust ductwork.
- Consider a combined heat and power system.
- Install occupancy sensors on lighting throughout common areas that do not already have them.

Hazardous Materials

BHA has commissioned a thorough hazardous materials survey that remains incomplete as of this date; it will be included in later editions of this report. Pervious asbestos testing has found asbestos-containing materials (ACMs) present at actionable levels in gypsum board taping compound, vinyl floor tile and mastics, and the exterior transite panel assemblies. Of these, the joint compound and exterior transite panels are of greatest potential concern, because whenever any wall or ceiling work is performed, there is potential to disturb this material.

An asbestos management plan should be developed to manage asbestos exposure risk during the planned construction project and future wall and ceiling repairs. When baths and kitchens are modernized, we recommend that all existing gypsum board be removed as asbestos waste; this will reduce the scope of future repairs requiring an abatement contractor. If budget permits, all VAT flooring and mastic should be removed as well. We also recommend the building be re-clad to cover (or replace) the transite panels as one benefit to re-cladding. The interiors should also be furred out to encapsulate the transite at the interior of units.

Requirements:

- Develop an asbestos management plan to manage and mitigate asbestos-containing materials during planned renovations and future repairs.
- Remove all ACM-containing materials from baths during bath renovations.
- Remove all ACM-containing flooring and mastic
- Encapsulate the transite panels at the exterior and interior.

Part 3 - Prioritized Capital Needs

Priority Ratings

Each item is assigned a priority of **1** (urgent and most immediate) to 4 (recommended but not required), as follows:

Priority 1: Priority 1 requirements include urgent repairs to and replacements necessary to protect the structure or life safety and to allow for continued occupancy. **Building envelope and mission-critical components that have failed or that are critical to occupancy and have, in our estimation, a high likelihood of failure within the next three years are assigned Priority 1**. These items meet the Department of Housing and Urban Development's definition of obsolescence.

Most Priority 1 items tend to be related to active water infiltration causing ongoing damage to the structure, impaired life safety systems, and expected failures of mechanical systems, all of which are required for continued occupancy. Some finish work may also be judged a Priority 1 repair if its condition is so poor as to not meet state sanitary code standards for occupancy.

Priority 1 items may also include improvements required by the State Building Code if, in our opinion, such code upgrades will be mandatory because of other Priority 1 repairs. For example, if alterations to the mechanical systems are significant enough, they will trigger compliance with current code, which may involve significant changes to the existing systems. While some might see these as enhancements, if they are mandatory, they will be categorized as Priority 1.

In addition to the above, we have included a number of interior finish work items in Priority 1, because other urgent repairs make them necessary or advisable to perform at the same time. For example, bath modernization is assigned Priority 1 because urgent plumbing work requires demolition of wet walls behind the baths.

The Owner should address Priority 1 requirements within the next 3 years if possible.

Priority 2: Priority 2 requirements include repairs to and replacements of components that are functionally obsolete, worn or damaged, or beyond their useful life, but continue to perform their basic function. Most interior finishes and equipment that are worn out will be assigned Priority 2, unless code requirements or other more urgent Priority 1 work require them to be performed sooner.

It should be noted that in many cases, it will be cost beneficial to perform Priority 2 repairs at the same time as Priority 1. This especially true for work within apartment units: if the apartment is vacated to perform urgent Priority 1 repairs, it makes little sense to leave Priority 2 issues unrepaired, only to have to return a few years later and relocate or disrupt the tenant a second time.

The Owner should plan and budget to address Priority 2 requirements within the next 3 to 7 years if possible.

Priority 3: Priority 3 requirements include components that are serviceable and good working condition but are expected to reach the end of their useful life or function in the next 8 to 15 years or more.

The Owner should include in its capital plan sufficient reserves to address Priority 3 requirements at the appropriate future time.

Priority 4: Priority 4 recommendations include optional or discretionary improvements that we believe are enhancements to the project or will improve its function, but are not required to maintain the building in good working order to meet mandatory building code provisions. For example, recommendations that improve energy efficiency, provide additional amenity to residents, or generally improve building function are assigned Priority 4.

Following is a summary of all capital improvement recommendations identified in Part 2, with estimated costs for each, ordered by priority.

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5955	Site	Domestic water service mains are 48 year-old 4 and 6 inch ductile iron. Pressure in the building is low, suggesting mains are obstructed by scale. Mains are located close to fire mains.	Replace domestic water mains. See related recommendation to replace fire service mains; perform this work together. Cost includes surface restoration.	$108,300
5842	Site	Asphalt paving in parking areas is generally poor. Some areas have been recently repaved.	Apply sealer to extend pavement life. Plan for full repaving in appx 5 years' time.	$13,500
5945	Site	Exterior walks have heaved in isolated areas, creating tripping hazards and ADA violations.	Replace walkway panels as required. Price assumes 600 sf of replacement.	$16,020
5954	Site	Sanitary mains are vitreous	Replace vitreous clay piping with SDR to manhole near river.	$93,280
5823	Site	Site floods in large rainfalls. Water backs up from the nearby river, surcharging existing storm drainage system on site. Critical building	Undertake flood mitigation measures, including active or passive barriers and stormwater management. Encourage City or State to improve downstream river flow to reduce flooding. Install pollution control measures as required.	$687,375
5887	Site	Exterior apron at main entrance at Building B exceeds 2% maximum slope permitted by ADA and MAAB.	Regrade main entry walkway and apron to comply with accessibility codes.	$12,000
5888	Site	South stair exit discharge walkways at both buildings have a step (riser) outside the door. This is a code violation.	Regrade exterior walks to eliminate tripping hazards and code violations.	$8,000
5898	Site	Underground fire service mains are 48 year-old 8 inch ductile iron. They are past their service life and will not carry added pressure of a fire pump.	Replace the existing fire service mains with new. See related recommendation to add a fire pump in a new pump shed above the meter pit.	$238,000
5822	Structure	Metal floor and roof deck is not adequately welded to bar joists in most of the locations we could inspect. Some bar joists are not properly secured (welded) to primary structural frame. Numerous other construction deficiencies were noted in the areas inspected.	Further investigation of the metal deck and bar joist attachment is required. Price assumes extensive remediation is required to decking attachment and other detailing; this work will require extensive interior finish removal to verify and correct. (Finish replacement included in other recommendations.)	$2,281,806

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5956	Structure	Foundations in Building A appear undersized, especially perimeter walls.	Perform geotechnical analysis as part of any project that adds weight to the structure. Some expansion of perimeter footing capacity will likely be required for a new cladding system. Price assumes footing retrofit is needed in Building A only.	$323,000
5936	Structure	Foundation/slab interface is damaged in at least one location on Building B. This appears to be a localized	Repair spalled foundation wall and slab at damaged area.	$2,400
5958	Structure	Metal roof deck is badly damaged in several locations within penthouse. Decking is very light gage.	Repair/replace deformed deck. Inspect rest of roof structure for similar damage; price is an allowance for repairs.	$50,200
5937	Structure	Primary structural frame is undersized for current code requirements. In particular, MC10x21.9 rim beams appear to be inadequate for both lateral wind loads and gravity loads, and wall panels show evidence of deflection.	A significant structural upgrade will be required when building is modernized. New cladding system will require reinforcing of rim beams.	$3,549,476
5889	Structure	Floor slab in the Building B Community Room has settled around the perimeter. This appears to be related to collapsing underslab ductwork that runs around the perimeter of the room.	Monitor slab for further movement. If stable, Apply floor leveler to level slab when Community Room is next updated. If settlement continues, excavate Transite ductwork, recompact subgrade and replace slab. See related recommendation to relocate HVAC to overhead.	$128,160
5858	Structure	We observed evidence of excessive structural movement (cracking) in a 4th floor corner unit.	Further investigation is required. Based on other observations, poor initial construction is likely to blame. See related recommendation to perform field repairs.	$0
5829	Bld Envelope	Roofs are single-ply EPDM, appx 24 years old, and failing. Roof insulation/coverboard is buckling due to moisture. A large area of Building A roof recently suffered a tear-off.	Replace roofing with 80 mil PVC for extended life and improved energy efficiency. Price includes added roof insulation.	$1,162,130

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5812	Bld Envelope	ACM structural wall panels are failing: several are cracked, and aggregate finish is delaminating. Appx 20% of panels are showing significant deterioration or failure. Panel system lacks redundant moisture barriers and is vulnerable to leaks.	Clad the building with new exterior siding or other finish system to encapsulate ACMs. See related recommendation to add weather barrier and insulation at exterior. Cost includes modifications to existing windows to integrate with new deeper wall thickness.	$10,965,780
5834	Bld Envelope	Laminated steel panels at exterior balcony guardrails are failing; panels are corroded and delaminating, and some have blown off (serious safety issue for residents and pedestrians below). We noted several that were about to fail.	Replace all balcony guardrail panels with new. See alternate recommendation to enclose the balconies.	$855,360
5845	Bld Envelope	Exterior wall system is composed of 3-inch structural wall panels. Insulation does not meet energy code requirements, and panel system does not provide redundancy against water infiltration. We observed numerous leaks, especially at balcony attachment points.	When comp mod is undertaken, improved thermal performance will be required by energy code. See recommendation to clad the building; provide new primary weather barrier and exterior insulation as part of new cladding assembly. Cost included with cladding.	$0
5853	Bld Envelope	Balcony steel attachment to main building structure is poorly detailed and highly vulnerable to water infiltration. We observed several leaks, including one unit with major mold growth as a result.	Inspect and repair all deteriorated sealants at steel penetrations through exterior walls; price assumes 80 percent require repair. See alternate recommendation to enclose the balconies, which will permanently address this issue.	$221,440
5839	Bld Envelope	Exterior balcony detailing is not appropriate for cold climates and is vulnerable to ice and water damage. Many precast slabs are cracking or spalling at railing attachment points, support steel is badly corroded at some locations, and structure penetrations through wall panels are leaking. Some balcony components (planks and steel supports) have been replaced in a past repair	In the medium term, balcony detailing should be reconsidered to make them more ice and water resistant, or balconies eliminated (see alternate recommendation to enclose balconies). In the short term, perform repairs to include patching spalls and crack repair at slabs, replacing badly corroded support steel, and replacing guardrail panels. Price assumes 80 percent of balconies need significant repairs.	$2,871,800

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5813	Bld Envelope	Sealant at exterior structural wall panel joints are more than 45 years old; sealant is failing in places. Panel system lacks redundancy against water infiltration; if sealant joint fails, water will enter.	See related recommendation to clad the building with new weather barrier and siding; this will permanently encapsulate the failing sealant joints and improve water resistance. (Cost included in other recommendations.)	$0
5934	Bld Envelope	Dunnage supporting HVAC units is set too low; roofing penetrations cannot be flashed, and roof under units is inaccessible for service.	Increase height of dunnage when roofing is replaced. Combine with HVAC modernization.	$16,000
5962	Bld Envelope	Many common exterior doors are in poor condition. Roof penthouse door thresholds are too low, causing leaks.	Replace appx 50 percent of exterior doors, including all 6 penthouse doors. Raise thresholds at roof penthouse doors.	$19,200
5821	Bld Envelope	Roof-wall joint at mechanical penthouses is highly vulnerable to water infiltration; vertical flashing is not tall enough to allow for snow build-up. This joint frequently leaks into the apartments below, especially at penthouse door sills.	When roofing is replaced, extend flashing up onto penthouse wall panel and finish with a term bar and sealant. See related recommendations to clad the exterior wall panels and raise door thresholds.	$0
5840	Bld Envelope	Thresholds at rooftop doors to penthouses are too low; water leaks under sill flashing into units below.	Raise door thresholds to at least 9 inches above roof surface. Will require door and frame replacement. See related recommendation to increase height of roof-wall flashing detail along the penthouse walls.	$12,480
5838	Bld Envelope	Roof insulation appears to be 3 inches thick, including coverboard. This does not meet current energy code.	When roofing system is replaced (see separate recommendation), increase insulation thickness to 5 inches to meet R-30 LTTR code requirement. Cost included with roofing replacement.	$0
5939	Bld Envelope	Rooftop gas piping supports have failed; piping is not adequately supported.	Replace pipe supports with fixed, secured pipe supports when roofing is replaced. Cost included with roofing replacement.	$0
5940	Common Interior	Electric room doors lack panic devices as required by code.	See separate recommendation to relocate electric rooms to second floor.	$0

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	R Required Repair ecommendation	Cost
5951	Common Interior	Shafts adjacent to egress corridors and stair enclosures are not properly fire rated; we observed numerous holes and	Restore fire ratings at all shafts. Price is an allowance for repairs,	$59,400
5914	Common Interior	Elevator landings lack smoke isolation vestibules as required by current code.	Install smoke doors at either side of elevator landings. Install hold-opens connected to fire alarm system.	$123,840
5953	Common Interior	Interior finishes throughout common areas are aging and tired. Some improvements have been made, especially to lobbies, offices, and	Refresh interior finishes throughout common areas as part of larger modernization project: repair damaged walls and trim, repaint, replace lighting. Price is an allowance. See related recommendations	$660,000
5950	Common Interior	Mechanical rooms at ends of buildings are open to shaft above, a code violation.	Install 2-hour rated ceilings to isolate mechanical rooms from shafts.	$2,112
5938	Common Interior	Electrical room exhaust fan lacks make-up air supply; air is being pulled from compactor room, a code violation.	See recommendation to relocate Electrical Room to second floor. Existing exhaust can be used to ventilate larger compactor room.	$0
5957	Common Interior	MC10x6.5 stair stringers appear to be undersized; they may not support 100 psf live load.	Verify load-carrying capacity of stair stringers; reinforcing is likely required.	$483,840
5920	Common Interior	Trash compactor rooms are too small, poorly configured, and in very poor condition.	Enlarge compactor rooms into adjacent main electric room space; reconfigure compactors to locate directly under trash chutes. See related recommendations to move electric rooms, replace trash chutes, provide ventilation, etc.	$80,000
5946	Common Interior	Rooftop mechanical rooms do not have waterproof floors. Boiler overflows risk flooding	Install resin flooring or other durable waterproof flooring in mechanical rooms.	$11,520
5865	Common Interior	Rail spacing at stair guards exceeds 4 inches. Guards are not tall enough: 36" vs. 42" as required by code.	Add 42" high barrier panels with intermediate balusters or WWM infill at stair guards. A substantial modernization will trigger this requirement. See related recommendation to provide continuous handrails at both sides of stair.	$291,600

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5890	Common Interior	Community room ACT ceilings are sagging; tiles are aging and deflected.	Replace ACT ceilings when HVAC work is replaced, Cost included in separate recommendation.	$0
5891	Common Interior	Community room kitchens are not accessible: dimension between countertops isn't wide enough, countertops are set too high, plumbing isn't accessible.	Address ADA violations when kitchens are updated (see related recommendation).	$0
5881	Common Interior	Residential corridor ceilings are ACT. Many tiles are stained from plumbing leaks. Ceilings act as a plenum, but cabling above is not plenum-rated, a code violation. Extensive above-ceiling work is required.	Replace ACT ceilings entirely when MEPFP upgrades are performed.	$166,656
5892	Common Interior	Community Room kitchens lack commercial sanitary code features. Manager reports that meals are prepared on site.	Upgrade kitchen to meet commercial requirements: grease trap, three-bay sink, handwashing sink, vent hood and Ansul system, etc. Kitchen footprint may need to be enlarged, See related recommendation for ADA compliance improvements.	$180,000
5867	Common Interior	Stair egress doors lack vision lights; this is a code violation and safety issue	Replace egress doors with doors with vision lights. A substantial modernization will trigger this requirement. Price includes new door hardware. Frames OK to	$194,800
5815	Common Interior	The upper floor trash closets are not accessible to persons with disabilities, Mobility-impaired residents leave trash outside of the closet.	Relocate enclosure wall and widen door to trash closet to create a 5-foot turning radius. See related recommendations to replace trash chutes and improve first floor hoppers. A substantial modernization will trigger this requirement.	$110,088
5864	Common Interior	Stair and egress doors lack exit devices; this is a code violation.	Install exit devices on all egress doors for code compliance. A substantial modernization will trigger this requirement. (Cost included in a separate recommendation.)	$0

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5894	Common Interior	Main electric rooms in both buildings are too small; service clearance around switchgear does not meet code. First floor elevations are within the flood plain, making main service vulnerable to flooding. Switchgear has been damaged by plumbing leaks from laundry rooms above and other flooding. Switchgear lacks housekeeping pads, but overhead clearance is minimal.	Relocate main electric rooms to second floor to increase size and system resiliency. Combine with other electrical modernization work. Relocate laundry rooms to another space.	$120,000
5949	Common Interior	Existing laundry rooms are significantly undersized relative to current code requirements (6 washing machines in each; 13 required).	Relocate laundry rooms to a larger space. See related recommendation to relocate main electric rooms to the laundry room spaces.	$233,480
5871	Common Interior	Floor slabs in compactor rooms are painted, in poor condition because of dumpster wheel damage.	Install a resin flooring for greater traffic durability and improved washability as part of compactor room reconfiguration. Cost included with separate recommendation.	$0
5863	Common Interior	Most door hardware throughout the buildings is not ADA compliant (knobs instead of levers).	Install ADA lever sets on all common area doors used by residents or the public. A substantial modernization will trigger this requirement. Egress door hardware replacement is included with a separate recommendation.	$13,248
5866	Common Interior	Stair handrails are not continuous at center newel posts and lack extensions at	Replace wall-mounted handrails with code-compliant handrails. Add continuous handrails at center newels. A substantial modernization will trigger this requirement. See related recommendation to add guards to center rail assemblies.	$285,120
5860	Unit Interior	Unit kitchen layout is inefficient and does not provide sufficient countertop work surface	When kitchens are modernized, revise configuration to provide space between the sink and side cabinets. Consider a U-shaped countertop. Cost is included in kitchen mod.	$0

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5859	Unit Interior	Most unit kitchens are original to the property (48 years old) and are in very poor condition: door faces are missing, countertops failing, lighting is poor, wall/ceiling finishes are poor, and flooring is very poor. Appliance ages vary.	Modernize all older kitchens, to include new cabinets, countertops, sinks, lighting, flooring, and finish repairs. Replace appliances as needed. Cost assumes 75% of kitchens require modernization. Cot includes a premium for asbestos management. See related recommendation to reconfigure kitchens, Combine this work with plumbing riser replacement.	$4,075,370
5844	Unit Interior	Asbestos is present in joint compound and flooring/mastic.	Recommend gut renovation of baths to remove all ACMs (cost is included with bath mod). Prepare an Asbestos Management Plan for other areas. Cost is for preparation of asbestos management plan.	$6,000
5885	Unit Interior	Some first floor metal door frames are rusting at base. It is not clear if this is due to poor environmental conditions or to past flooding.	Repair or replace metal door frames as needed. Price assumes 50 door frames are replaced.	$42,900
5857	Unit Interior	GWB finishes are poor in most baths due to aging and plumbing leaks from tub drains above. Joint compound	When baths are modernized, remove and replace all GWB. (Cost included with another	$0
5868	Unit Interior	Appx 75% of closet doors are old wood accordion doors, original to structure and in very poor condition. Many are missing and have been replaced with curtains. Management is replacing older doors on unit turnover.	Replace all remaining accordion doors with new. Price assumes 75% require replacement.	$728,208
5855	Unit Interior	Overhead lighting is poor and inefficient: fixtures are aging CFL, many lenses are broken or yellowed	Replace all overhead lighting fixtures with new LED. Cost assumes an energy efficiency rebate is available from local utility.	$382,080
5854	Unit Interior	Bath lavatories are original and in poor condition. Some are cracked. Many are missing pop-up drain assemblies; most drain fittings are rusting.	Replace lavatories as part of bath modernization project. (Cost included with another	$0

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5862	Unit Interior	Door hardware throughout apartments is not ADA compliant (no levers). Unit entry doors require levers; other doors should have levers	Replace door hardware on unit entry doors when doors are replaced (see related recommendation). Replace door hardware on unit bedroom and bathroom doors if budget permits. Cost is for bedroom and bathroom doors only; unit entry door hardware cost included with door replacement.	$194,500
5960	Unit Interior	2BR ADA unit kitchens are not fully MAAB compliant.	Make revisions to casework for full compliance.	$8,400
5933	Unit Interior	Unit entry door lacks maneuvering clearance at latch side; residents with mobility aids have trouble opening the	Consider eliminating the hall closet adjacent to door to increase clearance adjacent to the door. Review this issue with residents to determine if it is desirable. This recommendation has no added cost.	$0
5849	Unit Interior	Unit entry doors and frames are not fire-rated; doors appear to be hollow core. Doors lack self-closing hardware. Door hardware is not accessible (knobs, not levers).	Replace unit entry doors, frames, and hardware with fire-rated, labeled assemblies and lever sets. This work will be required as part of a substantial modernization project and is recommended for fire safety and accessibility in any case.	$1,088,928
5861	Unit Interior	Most VAT flooring is original to the structure and in poor or very poor condition. About 20% of units have had new VCT installed on turnover.	Replace VAT flooring with VCT in 80% of units. Price includes abatement and floor preparation.	$1,466,502
5929	Unit Interior	Interior window and door trim is in extremely poor condition; much of it is rotted and	Replace window and door trim with new painted MDF.	$265,298
5874	Unit Interior	Tile surrounds are in poor condition in many apartments; grout is stained and unsightly, and perimeter finishes are	Replace tub surrounds as part of bath mod (cost included with other recommendation).	$0
5847	Unit Interior	Bath tubs are in poor condition; many are scratched and rusting. Mgr. reports that tub drains and overflows are rusting out, causing leaks into units below. We noted evidence of water damage from above in most baths we inspected.	Replace all bath tubs as part of bath modernization project. (Cost included with another recommendation).	$0

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5930	Unit Interior	Dwelling unit walls and ceilings are in fair condition, although many are damaged by exterior water infiltration, overhead leaks, cracking, or general age and wear. Many have been poorly patched in past. Extensive cutting may be required for structural investigations.	Cut and patch GWB as required for structural investigation and when units are modernized. Price is an allowance of 40 hours per unit for GWB repairs. See separate recommendations for structural repairs and to paint units.	$1,848,528
5959	Unit Interior	We did not observe any sensory adapted apartments; MAAB and Section 504 require at least 8 units be sensory adapted for people with audio/visual limitations.	Convert 8 apartments to sensory adapted units by adding A/V signalers.	$16,800
5848	Unit Interior	Bath finishes and fixtures are 48 years old and generally worn out. Fixtures and lighting are in poor condition, and many wall and ceiling surfaces are damaged by leaks. Some flooring has been replaced, but in many baths the original VAT is still present and most flooring is in very poor condition. Asbestos is present in joint compound, flooring, and mastic.	Perform comprehensive bath modernization project, to include full abatement, new finishes, fixtures, accessories, and trim. Combine this work with plumbing riser replacement. Cost includes a premium for full abatement.	$8,558,000
5846	Unit Interior	Plumbing fixture stops in baths are frozen. Manager reports that an entire riser or the entire building must be shut down to replace unit plumbing fixtures.	Replace fixture stops as part of bath modernization project. (Cost included with another recommendation.)	$0
5884	Unit Interior	Closet shelving is old metal; most is dented and many are rusting. Management is replacing with wire shelving on unit turnover.	Replace all original metal shelving when units are modernized. Price assumes 80% of units require this work.	$269,184
5931	Unit Interior	Units are painted on turnover; most need painting now.	Repaint all units as part of comprehensive mod project. Bath and kitchen painting included with those mod costs.	$477,600

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5816	Waste Disposal	Trash chutes are in very poor condition and poorly configured: 45 degree elbow at bottom of chute takes impact from falling waste and separates from the vertical. Both have been repaired in past.	Replace trash chutes. See related recommendations to reconfigure ground floor compactor rooms to position the compactors directly under the chutes and enlarge upper trash closets.	$63,720
5928	Waste Disposal	1st floor residents do not have access to trash chute; trash is disposed of through an unrated door into a barrel. This is a code violation and increases maintenance.	At a minimum, install a fire-rated hopper door at first floor. We also recommend installing a mini sausage compactor at these locations to reduce trash handling maintenance	$54,840
5817	Waste Disposal	Waste compactors are well beyond useful life and in very poor condition,	Replace waste compactors. See related recommendation to reconfigure ground floor compactor	$42,660
5897	Fire Protect	There are no fire department connections at the building exterior.	Add fire department connections at each standpipe. A substantial modernization project will trigger this	$16,800
5913	Fire Protect	System smoke detector spacing exceeds 30 feet in corridors. Most detectors are UL-listed for a maximum 30 foot spacing.	Listing of existing smoke detectors should be verified. Relocate existing detectors and add additional detectors as needed. Price assumes 4 new detectors per corridor.	$42,712
5915	Fire Protect	The buildings lack a fire command center (FCC).	Install an FCC in each building, including all required firefighting monitoring equipment. A substantial renovation may trigger this requirement.	$250,000
5901	Fire Protect	Sprinkler system floor control valve assemblies (FCVAs) lack pressure reducing valves.	Install pressure reducers on FCVAs. This work will be required when a fire pump is added.	$63,000
5899	Fire Protect	Post indicator valves (PIVs) at each standpipe service entrance are in poor condition. One appeared to be non-functional.	Replace PIVs when fire mains are replaced (see related Recommendation).	$19,320
5900	Fire Protect	4 of 6 gate valves at the base of the standpipes are very old and in poor condition; it is likely they are frozen. 2 have been recently replaced.	Replace 4 aging gate valves.	$10,880

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5895	Fire Protect	Buildings lack a fire pump. Hydraulic pressure at top of the standpipes is only 35 psi; code requires a minimum of 100 psi.	Provide a fire pump in a new shed above the water meter pit that serves both buildings. Cost includes a new meter/pump shed building. See related recommendations to replace all underground fire mains and provide a DCVA. This work is highly recommended for fire safety and will be required if a substantial modernization is undertaken.	$302,400
5902	Fire Protect	Fire department hose valves at each floor lack pressure reducing valves.	Install pressure reducers on hose valves. This work will be required when a fire pump is added.	$59,880
5835	Fire Protect	Buildings are fully sprinklered, but closets lack coverage, a code violation. CPVC piping is exposed in closets.	A significant modernization will require the sprinkler system to be extended into all closets.	$311,444
5836	Fire Protect	Sprinkler system was installed in 1982. Original QR sprinkler heads are now approaching their rated service life of 40 years and require will replacement in 2 years.	Replace all original sprinkler heads with new. Appx 40% of sprinkler heads have already been replaced.	$138,674
5876	Fire Protect	Fire alarm system was recently replaced. Survivability of the system is suspect: cabling and equipment does not appear to be properly protected.	Confirm code compliance of the existing system. A substantial modernization project may trigger upgrades for survivability. Price assumes some improvements will be required.	$253,534
5924	Plumbing	Community kitchens lack grease interceptors, 3-bay sinks, and other commercial plumbing equipment.	Install code-required commercial plumbing equipment in community room kitchens. This work will be required by a significant	$32,000
5923	Plumbing	Manager reports frequent leaks from waste and vent piping, especially at tub shoes. Piping is original to building and beyond its useful life. We observed evidence of numerous leaks and rotting cast iron piping throughout the building.	Replace all cast iron waste and vent piping as part of comprehensive modernization project.	$2,002,919
5922	Plumbing	Exposed gas piping is corroding.	Repaint all exposed gas piping.	$8,160

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5921	Plumbing	Main 8-inch water service entry valves (in water meter pit) are in poor condition.	Replace main service stop and check valves.	$12,446
5926	Plumbing	Buildings lack domestic water pressure booster pumps.	Add booster pumps and pressure regulating valves as part of comprehensive modernization to ensure reliability of domestic water	$63,384
5925	Plumbing	Roof drain leaders are beyond useful life and have leaked in	Replace drain leaders as part of comprehensive modernization,	$259,200
5872	Plumbing	Mgr. reports that many riser isolation valves are frozen and cannot be closet. Since fixture stops are also frozen, to replace a plumbing fixture on some risers requires a complete building shutdown.	Replace all riser isolation valves as part of comp mod project. Cost included with other	$0
5828	Plumbing	Property manager reports that underslab elbow sweeps at base of each stack are clogged with pipe scale; frequent jetting/augering/cleaning is required to prevent back-ups into first floor units.	Video scope stacks to determine severity of problem and whether other underslab piping is contributing to back-ups. Elbow replacement recommended due to pipe age; combine with waste and vent replacement.	$96,000
5826	Plumbing	Copper DW supply piping is beyond useful life. Manager reports frequent pipe breaks; we observed numerous signs of piping leaks and pitting on exposed sections.	Replace all copper supply piping as part of comprehensive modernization. Combine with bath and kitchen modernization since wet walls will have to be opened (see related recommendations).	$2,580,976
5927	HVAC	Electric baseboard radiation is aging, in poor condition, and very inefficient.	As part of comprehensive modernization, replace electric baseboard with new heating and cooling system. System selection to be determined in design phase. See related recommendations. This work will be required by energy code as part of a substantial alteration.	$7,098,952
5935	HVAC	Common corridor ceilings act as plenums for corridor make-up air units; cabling is not plenum rated. This is a code	If make-up air system is maintained, extend ductwork down corridors above ceilings. Combine with other above-ceiling work and replace ACT.	$259,200

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5932	HVAC	Air handlers for community rooms are original to building and in very poor condition. Underslab ductwork is uninsulated Transite; this is a significant environmental concern. Slab has settled in places, indicating duct collapse.	Replace HVAC systems in community rooms with new split systems and above-ceiling ductwork. Cost includes replacing community room ceilings. Cost to repair collapsed floor slabs included in separate recommendation.	$148,572
5825	HVAC	Existing ventilation system is energy inefficient: toilet exhaust energy Is not captured, and corridor make-up air units are 100% outside air.	When ventilation system is replaced, add ERVs at rooftop to capture exhaust energy. Cost included with recommendation to replace ventilation system.	$0
5824	HVAC	Ventilation in building is poor: make-up air units are in very poor condition, there is no make-up air in apartments, and no toilet exhaust. Add returns in corridors. Corridor ventilation is 100% outside air. Unit entry door undercuts are inadequate to allow corridor air to enter apartments; this is a code violation in any case.	Comprehensive replacement of make-up air in apartments to offset ventilation system is required. Add corridors to recirculate corridor air.	$2,535,340
5870	HVAC	Environmental conditions in the compactor rooms are very poor; rooms lack ventilation, and odors are overwhelming.	Install mechanical exhaust in both compactor rooms. See related recommendation to reconfigure compactor rooms.	$10,400
5967	HVAC	Building lack combined heat and power units (cogen).	These buildings appear to be ideal candidates for cogen. Study whether cogen makes economic sense as part of a larger HVAC modernization.	$180,000
5948	HVAC	Mechanical penthouses lack ventilation, Heat build-up shortens equipment life.	Install thermostatic exhaust fans at penthouse mechanical rooms.	$10,400
5873	HVAC	Smoke control vestibules at end stairs have been enclosed to prevent pipe freeze-ups; this is a code violation. Central egress stair lacks a smoke	Add emergency smoke exhaust and stair pressurization systems for code compliance. A substantial modernization will trigger this requirement.	$1,267,670
5827	HVAC	Make-up air units on roof are 22 years old and in very poor condition.	Replace make-up air units as part of comprehensive HVAC improvement project. Cost included with other recommendations.	$0

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5904	Electrical	Power distribution system and panelboards are aging. Feeders are aluminum.	Replace distribution feeders and panelboards throughout as part of a comprehensive electrical modernization project. See related	$570,452
5941	Electrical	480V service in the penthouse lacks a shunt trip in main electric room as required by	Provide shunt trip when switchgear is modernized. Cost included with switchgear.	$0
5880	Electrical	Unit load centers and circuit breakers (CBs) are original to building and beyond service life; many have been damaged by plumbing leaks. A few have been replaced. CBs are not AFCI.	Replace old CBs with new; provide AFCIs where required by code. See related recommendation to install GFCI receptacles and replace feeders and branch circuit wiring. Price assumes 90% require replacement.	$684,936
5968	Electrical	Electrical panels and circuits are not properly labeled.	Relabel all equipment and circuits as required.	$25,353
5942	Electrical	Service clearance at penthouse 480V electrical distribution panels is inadequate.	When ATS and emergency electrical equipment is relocated from penthouse, reconfigure/relocate 480V service panels for clearance. Feeder replacement included in a separate recommendation; cost is just for local wiring revisions.	$9,600
5878	Electrical	There are no GFCIs on bath and kitchen power receptacles.	Install GFCI receptacles on bath and kitchen receptacles as soon as	$107,778
5910	Electrical	Receptacles in apartments are not tamper-resistant as required by current code.	Replace all dwelling unit receptacles (except new GFCIs) with tamper-resistant receptacles. Combine this work with unit rewiring and GFCI installation in baths and kitchens,	$260,690
5903	Electrical	Main switchgear is beyond service life, in poor condition, and has been damaged from plumbing leaks above. Switchgear sits directly on floor slab and is vulnerable to flooding. Electrical Room is too small.	Replace and relocate main switchgear as part of comprehensive electrical modernization project. Price includes new feeders from transformer. See related electrical recommendations.	$486,785
5906	Electrical	Medium voltage transformers in rooftop penthouses are potential fire hazards and an environmental concern. Transformer demand is much reduced now that DWH is gas-fired.	Remove medium voltage transformers from penthouses; provide grade level 480V transformer to serve elevators. Repurpose penthouse spaces for emergency power systems. Combine this work with other mod projects.	$109,650

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5879	Electrical	Branch circuit wiring in building is aluminum, original to the building. 15A bath and kitchen power circuits do not meet current code.	Replace aluminum wiring with new copper conductors. Combine with other unit mod work, new receptacles, and load center replacement. Price includes cutting and patching.	$2,371,344
5909	Electrical	Unit kitchens do not have dedicated power circuits.	Install new power circuits as part of unit rewiring. Cost included with other recommendations.	$0
5911	Electrical	Electrical receptacle spacing in living rooms and kitchens does not meet current code.	When units are rewired (see separate recommendation), add at least one additional receptacle to living room and kitchen.	$406,116
5916	Electrical	Wall-mounted smoke detectors in living rooms are not properly located and are of varying age; many have been replaced on unit turnover.	Relocate smoke detectors to ceilings. Replace older models; price assumes 50% replacement. See related recommendations to add detectors in bedrooms and replace all local smokes with system detectors.	$108,455
5917	Electrical	Bedrooms lack smoke detectors as required by code.	Install smoke detectors in all bedrooms. A substantial modernization will trigger this requirement. See related recommendation to install system	$170,000
5908	Generators	The emergency generators lack output circuit breakers as required by code to protect the building power system.	When generators are replaced, add output circuit breakers.	$5,606
5830	Generators	Generators are very old and well past their expected life. Penthouse location makes them difficult to fuel and service. Generators are located in Mechanical Rooms; this is a code violation.	Replace emergency generators at grade level in fenced enclosures. Cost includes pads, enclosures and new feeders. See related recommendation to isolate and protect other EPSS components in ire-rated construction,	$286,222
5832	Generators	Generators are fired by natural gas; they lack an independent fuel source as required by	Provide ground-level propane or fuel oil tanks for generators; see related recommendation to relocate generators to grade.	$7,200

Prioritized Capital Needs - Priority 1

Rec ID	System	Issue	Required Repair	Cost
5833	Generators	Generators, ATS, feeders, panelboards, and other emergency power supply system (EPSS) components are not isolated and protected from fire.	Construct new emergency power rooms in former transformer vault in penthouses and relocate ATS and other EPSS components. (See separate recommendations to relocate transformers and generators to grade.) Isolate emergency power distribution panels by enclosing in 2-hour construction. Replace circuiting with fire-rated cabling where rated enclosure is not possible.	$633,835
5831	Generators	Generator in Building A is not properly vented to exterior.	See related recommendation to relocate generators to grade.	$0
5850	Communication Systems	Existing master intercom systems are broken. Residents use a telephone-based system to talk to visitors and unlock the main entry door.	Replace old intercom systems with new, including master panels and 3-button apartment stations.	$258,700
5841	Communication Systems	Buildings lack two-way fire department communication systems (BDA) as required by code.	Install a BDA system as part of a comprehensive modernization	$19,200
5919	Communication Systems	There are only 3 cameras in each building, some of which are not operational. Entrance doors are not currently	Expand CCTV system to cover all entrance and exit doors, stair halls, and common areas for enhanced building security. Perform this work as part of a comp mod project; it will not be cost effective to do on its own. See related recommendation to troubleshoot existing system.	$54,600
5944	Communication Systems	Existing emergency call system is aging and in poor condition. One of two pulls we tested did not initiate the corridor alarm annunciator.	Replace emergency call system when units are modernized.	$317,843
5851	Communication Systems	Existing CCTV video feed of main entry door does not work in either building.	Repair or replace video monitoring system to allow residents to monitor the video feed from within their apartments. Investigate source of problem and repair. See related recommendation to expand CCTV system. (Price is an allowance for troubleshooting.)	$9,600
			Total for Priority 1	**$71,179,157**

Prioritized Capital Needs - Priority 2

Rec ID	System	Issue	Required Repair	Cost
5961	Bld Envelope	Main and secondary (rear) entrance doors are aging.	Plan to replace main entrance doors within 5 to 7 years. Price includes replacement of power operators.	$60,000
5893	Common Interior	Common toilet rooms are generally tired: lighting is poor, toilet partitions are rusting, floor and base is worn, etc. Emergency battery units are failing; one was inoperative.	Plan for toilet room refresh project in about 5 years (or sooner). Replace finishes, fixtures, and accessories.	$168,000
5947	Common Interior	Buildings lack parcel storage. Packages are left in lobby and are subject to theft.	Provide parcel storage system when buildings are modernized.	$47,200
5820	Unit Interior	BHA Architect reports that mold has been found in wall cavities in some first floor apartments. This is believed to be due to poor ventilation and a very high water table causing ground vapor transmission through the slab.	Further investigation is required. If mold is present, remove GWB and replace with paperless GWB. Improve ventilation (see related recommendation). Consider applying a vapor barrier to the floor slab when flooring is replaced. Cost is for vapor barrier only.	$62,248
5869	Unit Interior	Most electric baseboard covers in apartments are rusting; this indicates poor ventilation, water infiltration, and high moisture.	See related recommendations to improve ventilation, eliminate water infiltration, and replace electric baseboard with a different heating system. Cost included with those recommendations.	$0
5877	Unit Interior	Heavy corrosion is present on many lavatory P trap drain assemblies; fittings cannot be opened for service.	Replace all fixtures and fittings as part of comprehensive bath mod; see separate recommendation.	$0
5819	Waste Disposal	Residents dispose of bulk trash and furniture in exterior 3 cy dumpsters. Dumpsters are not properly enclosed or screened; result is unsightly.	Create a screened trash enclosure adjacent to each building. Include space for recycling barrels.	$30,240
5818	Waste Disposal	There are no recycling facilities in the buildings.	When exterior trash enclosure is improved, provide space for recycling barrels. Cost included in other recommendation.	$0
5896	Fire Protect	Fire service main lacks a double check valve assembly (DCVA). Service entry valve is located in meter pit and is inaccessible for service.	Install new DCVA in new pump shed building. See related recommendations to install a fire pump and replace underground fire mains. A substantial modernization project will trigger this requirement.	$15,600

Prioritized Capital Needs - Priority 2

Rec ID	System	Issue	Required Repair	Cost
5882	Fire Protect	There are no fire alarm annunciators, paging speakers, or detectors in the egress	Extend the fire alarm system devices into stairs; provide smoke detectors and speakers at each landing and annunciators on alternate landings. A substantial modernization project will trigger this requirement.	$87,480
5883	Fire Protect	Stair halls and smoke vestibules lack sprinkler protection.	Extend sprinklers into stair halls at each floor landing. A substantial modernization project will trigger this requirement.	$26,140
5966	Plumbing	Gas distribution system lacks pressure booster pumps.	Verify whether gas pressure is sufficient; provide a booster pump and pressure regulators if required. Price assumes one pump for each Building.	$12,756
			Total for Priority 2	**$509,664**

Prioritized Capital Needs - Priority 3

Rec ID	System	Issue	Required Repair	Cost
5943	Site	Asphalt paving in parking areas is generally poor. Some areas have been recently repaved.	Plan to repave all parking and roadways in about 10 years' time.	$182,010
5963	Bld Envelope	Storefront framing in Community Rooms and lobby areas is serviceable but aging.	Plan to replace storefront framing and glazing in about 10 years, or sooner if combined with entry door replacement. (See related recommendation.)	$164,640
5965	Bld Envelope	Perimeter sealants at openings is 8 years old. Some minor deterioration is evident.	Replace joint sealants in about 7 to 10 years time, or sooner as part of cladding project.	$146,200
			Total for Priority 3	**$492,850**

Prioritized Capital Needs - Priority 4 (Improvements)

Rec ID	System	Issue	Recommendation	Cost
5843	Site	Outdoor space for passive recreation/enjoyment is poor. Central plaza between the buildings is unfurnished and lacks shade. Adjacent open trash storage makes the area uninviting.	Provide outdoor furniture at plaza; consider adding a trellis structure for shade. Relocate and enclose trash storage (see separate recommendation).	$83,200
5814	Bld Envelope	Exterior balcony detailing is not appropriate for cold climates and is vulnerable to ice and water damage. Some balcony components (planks and steel supports) have been replaced in a past repair project.	As an alternative to repairs (see separate recommendation), consider enclosing balconies to increase livable unit area and eliminate water intrusion issues.	$7,776,000
5964	Bld Envelope	Aluminum windows are 8 years old an in good condition. Hung windows are inappropriate for senior housing. Residing the building will require window replacement.	Replace aluminum windows and balcony doors in about 17 years time, or sooner as part of cladding project.	$3,216,400
5875	Unit Interior	Wall finish at interior face of exterior walls is ACM transite; it cannot be fastened to or altered without creating a hazardous condition.	Consider adding GWB on metal stud furring at exterior walls to encapsulate transite panels. See alternate recommendation to remove and replace exterior wall panels.	$409,805
5918	Fire Protect	Units lack system smoke detectors. Existing local detectors are inadequate and incorrectly located.	As an alternative to installing new local smoke detectors, install system detectors with local sounder bases. This will provide supervision and reduce maintenance.	$449,600
5912	Fire Protect	Buildings have a separate CO monitoring and alarm system, despite having only 2 monitoring points per building. Typically CO monitoring is part of fire alarm system.	Current design is acceptable, but duplicate systems increase cost and complexity. We recommend tying CO detectors to the fire alarm system.	$4,800
5969	Comm Systems	Existing telephone service is twisted pair. This is unsuitable for data services.	Replace telephone cabling with CAT 6e cable for enhanced data transmissivity. Combine this work with electrical modernization.	$143,280
			Total for Priority 4	**$12,083,085**

Part 4 – Specialist Reports

4A PEDA Structural Analysis

4B AMA FEMA Flood Hazard Analysis

PEDA Inc.
CONSULTING ENGINEERS

September 21, 2020

Mr. Stephen D. Baker, Senior Principal
BWA ARCHITECTURE
132 Lincoln Street, Unit #4
Boston, Ma. 02111

Re: BHA – Senior Housing Buildings
Structural Investigation

Dear Mr. Baker:

In accordance our Proposal to you dated July 29, 2020, we are pleased to present the results of our Structural Investigation of the above referenced project. For reference, the following materials were used:

1. Massachusetts Building Code, 9th Edition.
2. International Existing Building Code, 2015 Edition.
3. ASCE/SEI 7-10, Minimum Design Loads for Buildings and Other Structures.
4. BOCA Basic Building Code, (Building Officials and Code Administrators).

The original building construction structural drawings were prepared by Devries Associates Incorporated, Architect and Engineers, Muskeegan Michigan. The drawings have no completed date but list Revision 1 at 6/16/70 and Revision 2 at 11/3/70. Several field measurements were taken to confirm generally representative structural elements of the size and characteristics of the structural steel primary frame and floor system. These field measurements were taken by Mr. Craig S. Donahue and Paul E. Donahue, P. E. on Sept. 17, 2020. An additional site visit was conducted by Craig S. Donahue on Sept. , 2020.

In general, this preliminary structural investigation is to provide a preliminary assessment to understand whether a major structural retrofit would be required if a significant renovation is planned. The following structural information is provided for your use in accordance with the format of our Proposal. The report answers the questions of the Architect and the Authority.

In general, the site visit of September 17, 2020 revealed many structural deficiencies in the exposed structure of the stairs and mechanical penthouse. Due to the fireproofing of the columns, beams, bracing and "hard" ceilings, it was not possible to secure detailed measurements.

Using the Typical Wind Bent Elevation shown on drawing S-4, a computer model of the vertical bracing was constructed and various loading conditions considered. The structural analysis was performed by structural software named STAAD Pro, by Research Engineers of California. Included in the program, there are "built in" Building Codes, including AISC, with appropriate section properties for standard shapes. Based upon the computer model, the program analyzes each of the individual load cases, combination of load cases and then performs a Code Check to identify members that comply with or are deficient. Deflections and stresses are produced for each load and combination of loads and are available for review.

Based upon these analyses, it is our opinion that additional vertical bracing is required.

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Mr. Stephen D. Baker, Senior Principal Page 2 of 5
Re: BHA – Senior Housing Buildings September 21, 2020

SPECIFIC ITEMS FOR REVIEW

1. Does the vertical load-carrying capacity of the typical floor assembly meet the Building Code requirements for live load and dead loads?

A. Original Building Design Live Load Live Load, 1970

- It is our opinion that the "Minimum Allowable Live Load" original building design Building in 1970, for this Occupancy, as required by the BOCA and Uniform Building Code, is forty (40) pounds per square foot. These codes were commonly used by State and local municipalities.

B. Present International Building Code Live Load, Building Design, 2020

- From Table 4-1, of ASCE 7-10, Minimum Uniformly Distributed Live Load, Occupancy or Use
  Residential, All Other Residential Occupancies, Private rooms and corridors serving them; 40 pounds per square foot.

Typical floor structure:
2 ½" inch thick lightweight concrete slab on 26 gage metal form deck. The slab is reinforced with 6x6 No. 10xNo. 10. Concrete design strength is 2,500 psi.

Allowable Load on 2 ½" thick, reinforced concrete slab, 3 span condition:
3'-6" span; load per foot = 88 psf
4'-0" span; load per foot = 67 psf

Dead Loads

- Building Codes require that the weight of actual materials utilized in the floor system be used for Design Floor Dead Loads. Included in the dead load per square foot are

a.	Finish floor materials	3 psf
b.	Floor structure, deck	25 psf
c.	Structure	4 psf
d.	Piping and utilities, insulation	2 psf
e.	Ceiling materials	2 psf
	Total	36 psf

C. Secondary Structure – Open Web Floor Bar Joists
Based upon the "Minimum Allowable Live Load": LL = forty (40) psf and Dead Load of thirty-six (36) psf for a total uniform live load of 76 psf. Original building design Building in 1970, for this Occupancy, as required by the BOCA and Uniform Building Code, is forty (40)

- Typical Floor Joist 14H3 @ 3'-3" spacing maximum. "H" Series Floor Joists have a minimum of steel strengths of 50 ksi. The typical joist spans vary from 20' to 21'.

- Standard ASD Load Table for open web steel joists, H-series, based upon 50 ksi yield strength at a 21' span, total safe uniformly distributed load-carrying capacities, in pounds per linear foot; total lf/ft = 322#/'; nominal load per linear foot of joist that will produce a 1/360 deflection of the span

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- Maximum spacing of floor joists is 322/(40+36) = 4.24'. Actual spacing is 3.25'.

- Spandrel Beam is C10x21.9. Max Allowable Moment = 13.3 ft kips. Actual = 12.6 ft kips.

D. Primary Structural Steel Structure – Wide Flange Beams
Based upon the "Minimum Allowable Live Load": LL = forty (40) psf and Dead Load of thirty-six (36) psf for a total uniform load of 76 psf x 21 = 1.6 kips plf.

- End span floor girder is W8x13 with a span of 13'-4". Maximum load = 41 ft kips. Actual load/ft is 39.1 ft kips.

- Interior Beam is W12x19 with a span of 24' Maximum load = 91.8 ft kips
The steel strength is noted as 45 Fy.

It is our opinion that the existing building floor construction does not comply with the present Building Code requirements.

A note of caution is that it is common for the placement of lightweight concrete by "pumping" compresses normal weight sand into the expanded shale coarse aggregate causing the in-place concrete density to be greater than the stated concrete design mix. This increase in density is greater at the upper floors of the building.

2. Does the vertical load-carrying capacity of the roof frame meet code (snow and dead) loads)?

The roof structure is basically similar to the floor structure. The deck is constructed of 2 ½" lightweight concrete on conform metal deck. The roof framing consists of steel joists with structural steel beams and girders. The roof joists are typically spaced at 4'-0" on center.

Original Building Design, 1970
- The Minimum Allowable Live Load utilized for this Building in 1970 is thirty (30) pounds per square foot based upon information from BOCA.
- The Typical Roof Dead Load per square foot is the weight of the actual construction materials.

Present Building Design, 2020
- From 780 CMR State Board of Building Regulations and Standards, Table R301.2(5) Massachusetts Ground Snow Loads, Pg
Brockton 35 pounds per square foot.

- The actual design snow live load is based upon the ground snow load modified by several factors:
A. Flat Roof Snow Loads: Exposure Factor, Thermal Factor, Importance Factor and Others
B. Sloped Roof Snow Loads: Slopes, Unbalanced Loads, Sliding Loads, Drifting Loads.

It is our opinion that the existing building roof construction does not comply with the present Building Code requirements for "drifting and sliding snow" loads.

3. Does the lateral load-carrying capacity of the building frame meet code?

The original building structural design criteria, as required by the local Building Code, did not include lateral forces required to comply with seismic design. The structure indicates only "Typical Wind Bents"
Or vertical bracing at column lines "E" and "K". There are no indications of vertical bracing at the ends of the building.

The present building code requires that the structural design for lateral loads include increased forces due to wind loads at the corners of a building.

It is our opinion that the existing building construction does not comply with the present Building Code requirements for wind and seismic loads.

4. What is the wind load capacity of the exterior wall system, assuming the structural rim beam governs? The exterior walls are structural panels attached to the rim beam, which is a C10x21.9.

Building Construction Drawings were prepared by: Devries Associates Incorporated, Architects and Engineers, Muskegon, Michigan; dated March through April 1970, Project No. mass 24-6. The drawings are date stamped by Diesel Construction Aug 5, 1970.

Drawing No. 13, Wall Section 2/13 is a Typical Wall Section; shows the exterior metal wall panel supported directly on the concrete foundation beam, the metal wall panel joints below the finished floor at each level, with the roof detail indicating a structural steel angle fastened to the top of a channel. The top detail indicates lateral support of the panel only.

Drawing No. 14, Wall Section 2/14 shows the exterior wall panel supported directly by the concrete foundation beam with the roof detail indicating a structural steel angle fastened to the top of a channel. The top detail indicates lateral support of the panel only.

The insulated metal wall panels are self-supporting and connected to the reinforced concrete exterior grade beam. The basic building foundation is classified as a "deep" foundation with pile caps and grade beams. There are "tie-beams" connecting the interior pile caps with the perimeter pile caps.

The vertical alignment of the metal panels is accomplished by a series of metal clips, attached to the panel metal top edge and welded to the spandrel channels, C10x21.9, located at each floor level and at the roof. These clips also transfer the wind load to the building structure. The typical section indicates the clip at approximately three (3") inches from the top of the channel. This location will transfer the wind load basically directly into the floor diaphragm system.

P. O. Box. 724 **Pembroke MA 02359**
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The C10x21.9 is structurally capable of supporting the vertical floor load and transferring any wind load.

5. What is the wind load capacity of the exterior wall system, assuming the structural rim beam governs?

The design of the exterior wall panels is based upon complete and full bearing of the panel on the foundation wall. The exterior foundation grade-beam stipulates that a 3 ½" notch be installed to accept and support the panel. The panels are stacked and fully supported by the panel beneath. The attachment of the panel to the building occurs at each floor and roof level to allow the lateral transfer to the floor or roof system.

A visual inspection reveals that the present condition has the panels extending beyond or overlapping the grade beams.

Due to the age and normal deterioration of the exterior panels, it would be necessary to perform a lateral load test program on several selected exterior panels.

6. How much weight could be added to the structure without structural retrofit.

Based upon our structural analysis of the design of the structural framing of the roof and floor members, there is minor excess live load or superimposed load capacity. It is also cautioned to add any additional vertical load to the potential that the existing floor load weight is greater than originally designed for.

It is NOT recommended that any additional superimposed be considered.

7. **Is the rim beam sufficiently sized to allow for recladding the building?**

Presently, the exterior wall panels are self-supporting. The bottom panel is supported directly on a continuous notch in the foundation wall. The spandrel channel has been designed to support the floor live and dead load only.

The exterior wall panel transfers the wind load to the attachments at each floor level. This attachment is located to allow the "direct" wind load to be resisted by the diaphragm action of the floor or roof slab.

Any new cladding will have to be self-supporting. A new support for a new exterior lightweight wall panel can be attached to the existing foundation wall.

If there are any questions concerning the above, please do not hesitate to call.

Very truly yours,

Paul E. Donahue, P. E.

cc: Craig S. Donahue, Project Manager

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MEMO

To:	BWA Architecture 132 Lincoln Street, #4 Boston, MA 02111	**From:**	Allen & Major Associates, Inc.
		A&M Project #:	1298-17
		Date:	January 13, 2021
		Re:	FEMA Evaluation
			Campello Apartments
Copy:	Brockton Housing Authority		1380 Main St., Brockton, MA

Introduction

The Brockton Housing Authorities Campello High Rise housing development is located at 1380 Main Street. The subject property (Site) is a 5.26 acre development with vehicular access from Main Street to the west and Plain Street to the north.

Directly adjacent to the Site, on the east, is the Salisbury Plain River. There is minimal buffer between the property and the river. Located on the Site, to the south, is French Brook.

The majority of the Site is situated at a lower elevation than the neighboring properties and developed areas extend close to the waterbodies bounding the property. Much of the Site is located within a Federal Emergency Management Agency (FEMA) Flood Zone. Both the City of Brockton and the Site have a history of flooding. It is A&M's understanding there have been some flood events on Site that have almost reached the building entry closest to the Salisbury Plain River.

On December 28, 2020, Katherine Andruchuk (Allen and Major Associates, Inc.) met with Tim Smith and Chris Barry (Brockton Housing Authority) on Site to become familiar with the location and observe current conditions. This memo outlines highlights of A&M's findings, observations, and considerations based on preliminary review of the Site.

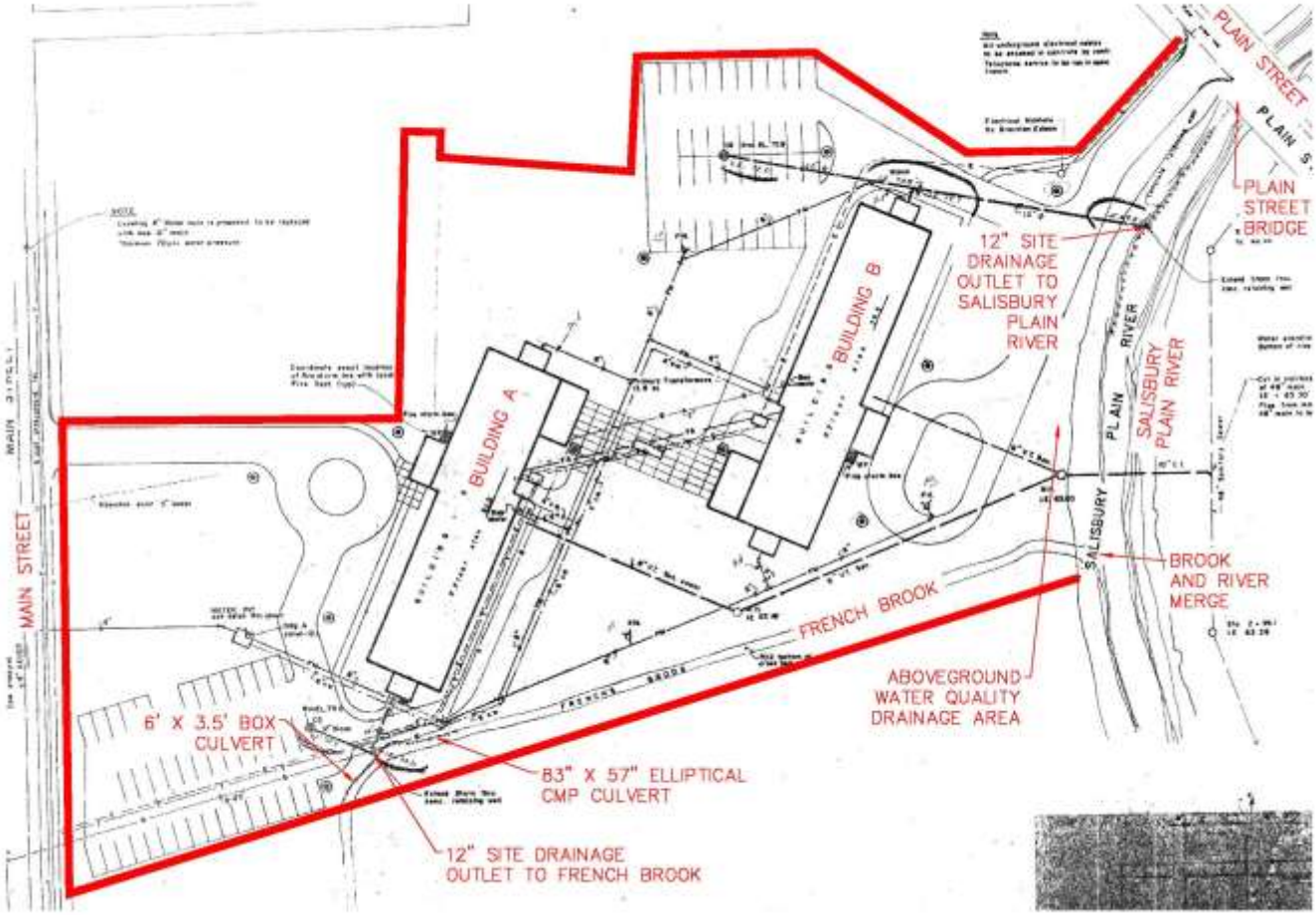


Image Source: Modified Site Plan dated May 7, 1970, 6-11-70, 10-13-70

Floodplain

The majority of the Site, including the two (2) onsite buildings, are located within the FEMA *Zone "AE" or FEMA Zone "A" Special Flood Hazard Area Subject to Inundation by the 1% Annual Chance Flood* (a.k.a. 100-year floodplain).

Zone AE areas have a Base Flood Elevation (BFE) determined within the Special Flood Hazard Areas (SFHAs). Zone A areas have no Base Flood Elevation determined within the Special Flood Hazard Areas. The latest official Flood Insurance Rate Map (FIRM) for the Site is Map Number 25023C0167J and has an effective date of 07/17/2012. The FIRM is included at the end of this memo.

Per the FIRM and the corresponding FEMA Flood Profile Data, the Base Flood Elevation in the area of the subject parcel has been determined to be elevation 77 (NAVD 88) upstream and elevation 76 (NAVD 88) downstream of the Salisbury Plain River located directly to the east of Site. Therefore, the subject parcel base flood plain elevation is 77.0 (NAVD 88).

There are limitations in the scale or topographic detail of the source maps used to prepare a FIRM that may cause small elevated areas to be included in a SFHA. To change the flood hazard designation for properties in these areas, FEMA has established the LOMA process for properties on naturally high ground and the LOMR-F process for properties elevated by the placement of fill. LOMAs and LOMR-Fs are letter determinations that officially amend an effective FIRM. They can establish that a property is not in an SFHA and, by doing so, remove the Federal flood insurance requirement. Included at the end of this memo is the FEMA How to Request a Letter of Map Amendment (LOMA) or Letter of Map Revision Based on Fill (LOMR-F).

A topographic survey of the Site would help establish elevation 77 (NAVD 88) and the Site areas located within the limits of the 100-year flood plain and the various flood year events.

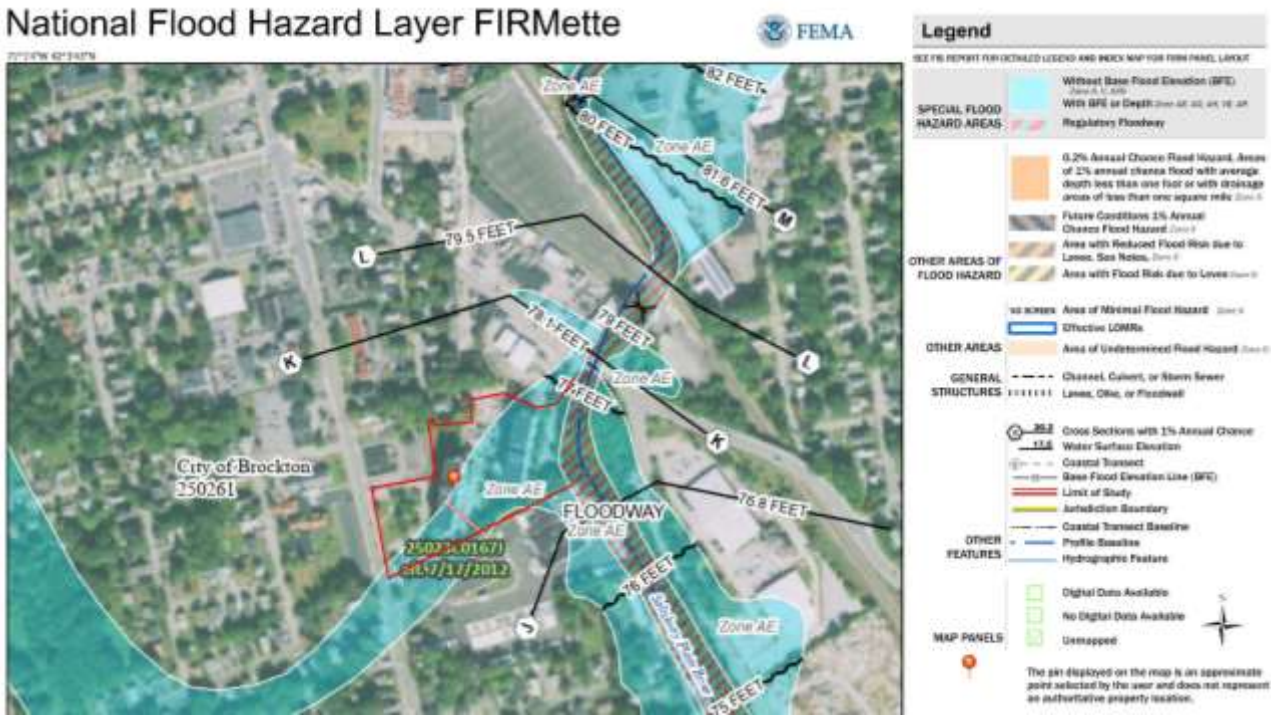


Image Source: Modified FIRM Map Number 25023C0167J

Floodway

The Floodway is the channel of the stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood (100-year flood) can be carried without substantial increases in flood heights. Work within the Floodway is more closely scrutinized than floodplain and may require an updated computer model of the stream profile to demonstrate a "no-rise" situation. The FIRM shows the Floodway close to, and possibly within, portions of the easterly Site entrance from Plain Street, parking spaces, and turnaround located along the Salisbury Plain River. Any modification to the hardscape or existing grade change in this vicinity would be considered work within the Floodway.

FEMA Flood Table and Profile for Salisbury Plain River

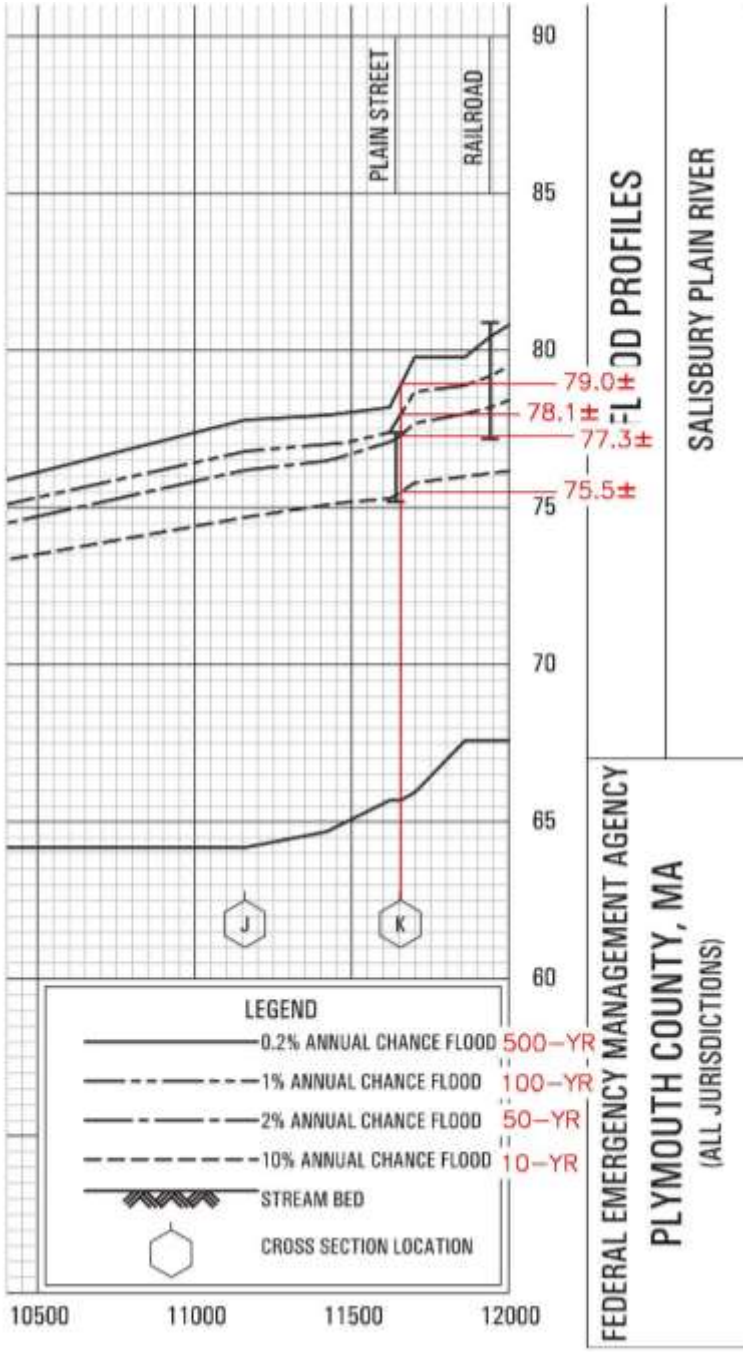
In 2016, FEMA conducted a countywide revision, floodway analysis using detailed hydraulic models. Located directly north and south of the Site, two (2) Cross Sections with 1% Annual chance (100-year flood) were analyzed along the Salisbury Plain River.

As shown on the Site's FIRM, just north of the site, Cross Section K is located at the upstream opening of the Plain Street Bridge. Cross Section J is located just downstream of where French Brook flows in to the Salisbury Plain River.

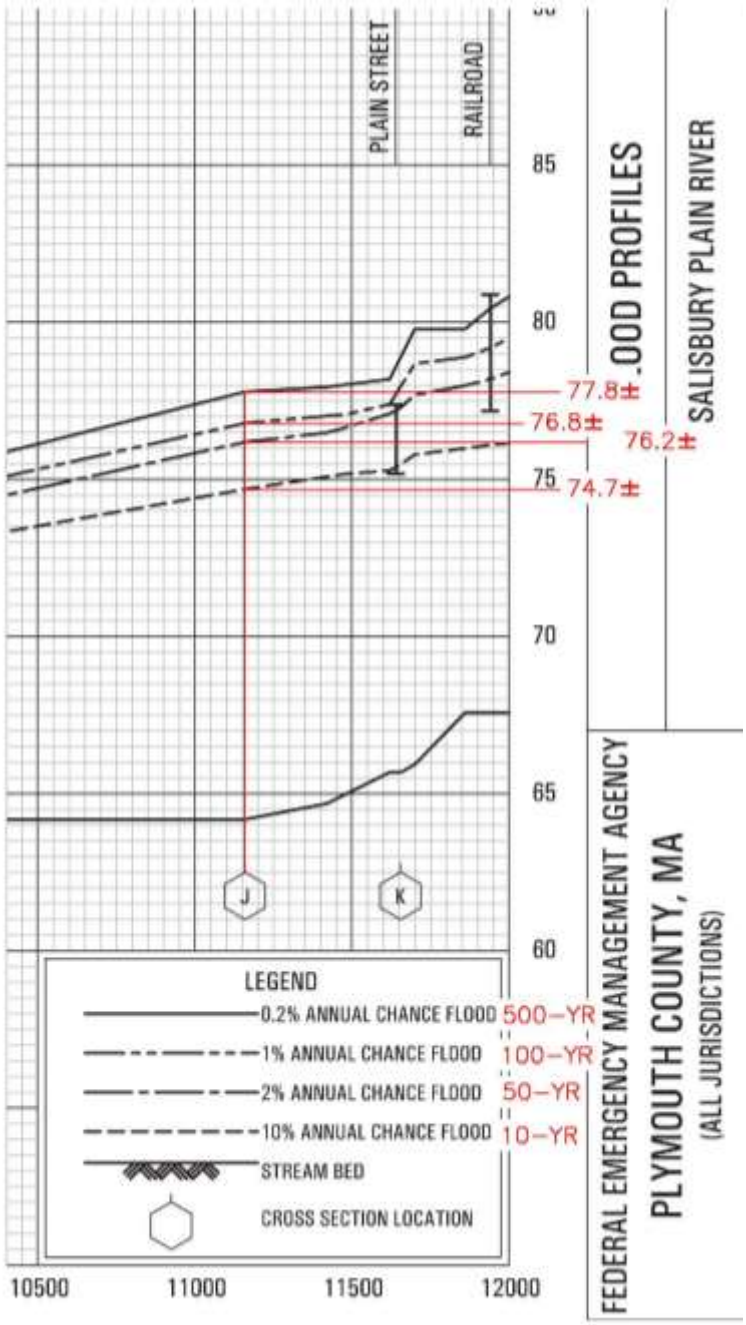
The following is an excerpt from Table 15 FEMA Plymouth County, MA Floodway Data for Salisbury Plain River:

Flooding Source		**Floodway**			**Base Flood Water Surface Elevation (feet NAVD 88)**			
Cross Section	Distance	Width (feet)	Section Area (square feet)	Mean Velocity (feet per second)	Regulatory	Without Floodway	With Floodway	Increase
J	11,162	168	689	5.1	76.8	76.8	77.2	0.4
K	11,655	25	318	6.8	78.1	78.1	78.4	0.3

The following is an interpretation of Profile 100P FEMA Plymouth County, MA Flood Profile for Salisbury Plain River:



FIRM Cross Section K – Upstream from Site				
Flood Size	**10-year** 10% Annual Chance	**50-year** 2% Annual Chance	**100-year** 1% Annual Chance	**500-year** 0.2% Annual Chance
Elevation in Feet (NAVD88)	75.5±	77.3±	78.1±	79.0±



FIRM Cross Section J – Downstream from Site				
Flood Size	**10-year** 10% Annual Chance	**50-year** 2% Annual Chance	**100-year** 1% Annual Chance	**500-year** 0.2% Annual Chance
Elevation in Feet (NAVD88)	74.7±	76.1±	76.8±	77.8±

Included at the end of this memo is the full Table 15 FEMA Plymouth County, MA Floodway Data for Salisbury Plain River and Profile 100P FEMA Plymouth County, MA Flood Profile for Salisbury Plain River

What are the Odds of being flooded?

The term "100-year flood" is often thought to mean "once every 100 years." This is incorrect. A 100-year flood could occur three times in one year, four years in a row, or six times over the time period of 100 years, or more.

A way to look at flood risk is to think of the odds that a 100-year flood will happen sometime during the life of a 30-year mortgage; a 26% chance for a structure located in the Special Flood Hazard Area (SFHA).

Chance of Flooding over a Period of Years

Time Period	**Flood Size**			
	10-year	**25-year**	**50-year**	**100-year**
1 year	10%	4%	2%	1%
10 years	65%	34%	18%	10%
20 years	88%	56%	33%	18%
30 years	96%	715	45%	26%
50 years	99%	87%	64%	39%

However, the numbers above do not convey the true flood risk because they focus on the larger, less frequent, floods. If a structure is low enough, it may be subject to the 10- or 25-year flood. During a 30-year mortgage, it may have a 26% change of being hit by the 100-year flood, but the odds are 96% that it will be hit by a 10-year flood. Compare those odds to the only 1-2% chance that the structure will catch fire during the same 30-year mortgage.

Information Source: National Flood Insurance Program (NFIP), Floodplain Management Requirements, A Study Guide and Desk Reference for Local Officials – FEMA 480, February 2005

Compensatory Storage

Loss of floodplain storage, from construction of a wall, structure, raising existing grade, or development similar in nature resulting in loss of storage within Bordering Land Subject to Flooding (BLSF) shall be compensated for in accordance with 310 CMR 10.57(4)(a).

An example of compensatory storage would be excavating land at the same elevation as the filled floodplain to compensate for the lost off floodplain.

Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project within Bordering Land Subject to Flooding, when in the judgment of the issuing authority said loss will cause an increase or will contribute incrementally to an increase in the horizontal extent and level of flood waters during peak flows.

Compensatory storage shall mean a volume not previously used for flood storage and shall be incrementally equal to the theoretical volume of flood water at each elevation, up to and including the 100-year flood elevation, which would be displaced by the proposed project. Such compensatory volume shall have an

unrestricted hydraulic connection to the same waterway or water body. Further, with respect to waterways, such compensatory volume shall be provided within the same reach of the river, stream or creek.

Work within Bordering Land Subject to Flooding, including that work required to provide the above-specified compensatory storage, shall not restrict flows so as to cause an increase in flood stage or velocity.

Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions. Except for work which would adversely affect vernal pool habitat, a project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 5,000 square feet (whichever is less) of land in this resource area found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. Additional alterations beyond the above threshold, or altering vernal pool habitat, may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60.

Information Source: 310 Mass. Reg. 10.57

Site Drainage

Observation of the existing surface drainage infrastructure, during a site visit held on December 28, 2020, showed no indication the current drainage system has been recently cleaned or maintained. Catch basins where full of debris and standing water. The aboveground water quality drainage swale showed the inlet and outlet pipes half exposed and the water quality swale unmaintained, limiting the infrastructures effectiveness.

Aging infrastructure and lack of maintenance may worsen flooding during heavy rains. Drainage-driven flooding is an ongoing City-wide issue and the Site may also be falling victim.

The Site drainage sheet flows offsite (to French Brook or Salisbury Plain River) or it is collected via onsite catch basins and outlet thru a closed drainage system to either French Brook or Salisbury Plain River. A record plan from 2000 shows drainage improvements to capture parking lot stormwater runoff in the closed drainage system and directing it to an aboveground water quality swale prior to discharging to the Salisbury Plain River.

The parking area located along the westerly area of the Site, with access from Main Street, outlets to French Brook. This area is located at a higher elevation. It is A&M's understanding this area is less prone to flooding. Portions of this area are located in FEMA Zone A which does not provide a Base Flood Elevation.

The remaining onsite closed drainage system outlets to Salisbury Plain River. During the December 28, 2020 site visit, the invert of the outlet pipe was near the water surface elevation of the Salisbury Plain River. If the river rose a foot or two, the outlet pipe would become partially submerged. As the river rises, the water from the river may back up in to the Site's closed drainage system.

Salisbury Plain River and Site drainage oulet.

Aboveground water quality drainage swale.

Aboveground water quality drainage swale with clogged inlet and outlet culverts.

Aboveground water quality drainage swale with clogged inlet culvert.

Catch basin full of water and debris.

French Brook 6'x3.5' Box Culvert (inlet) and Site drainage 12" culvert (inlet) entering 83"x57" Elliptical CMP (outlet).

Existing Building and Electrical Protection

There are few options for protecting the existing building from possible damage during high flood and heavy rain events. Options include raising all electrical at least 1-foot, if not more, above flood elevation level. Anchoring and elevating all outdoor equipment and installing flood gates at doorways and windows.

Removable barriers at doors and windows can easily be placed during anticipated heavy rains and flooding. Product examples can be found on either of these two websites:

https://www.psfloodbarriers.com/product/ezdam-flood-barriers/

https://www.tmhardware.com/Door-Dam-Flood-Barrier-Shield.html?sku=TH5127-10

City Planning

A $47,000 Municipal Vulnerability Preparedness (MVP) grant was awarded to the City of Brockton in 2018. The City of Brockton partnered with Fuss & O'Neill to complete a comprehensive, baseline climate change and natural hazard vulnerability assessment and to develop a list of priority actions for the City to take. In January 2019, Fuss & O'Neill presented the City with a Community Resilience Building (CRB) Workshop – Summary of Findings. The report is included at the end of this memo.

The report identifies Brockton Housing Authority properties, the Campello Neighborhood, and the Salisbury Plain River as top hazards and vulnerable areas of concern. Assessment of City-wide infrastructure, environmental, and societal topics are discussed then further prioritized in to highest, moderate, and lower priority recommendations.

Flood resiliency is a City-wide high priority. Restoration of wetland and river channels, green infrastructure, stormwater runoff reduction, increased flood storage capacity, field inventory of culverts and bridges, maintenance of stormwater mitigation infrastructure, and the development and adoption of wetlands and stormwater management ordinances are some of the priority actions recommended to the City.

The current progress and timing of these action items is currently unknown, or if / when these recommendations may start to positively affect the Site, however, a plan with the City has been set in motion. The report acknowledges there was an attendee from the Brockton Housing Authority present at the CRB Workshop. It is recommended the Brockton Housing Authority continue to be involved with the City as they start to prioritize the vulnerable areas and advocate for the Housing Authorities properties.

City Regulations

At the time of the CRB Workshop Summary of Findings – City of Brockton, prepared by Fuss & O'Neill, dated January 2019, the report notes the City of Brockton lacked local wetlands and stormwater ordinances. Historic and ongoing development has minimized flood storage capacity by filling wetlands and floodplains making the City even more vulnerable during heavy rain and flooding events.

The Revised Ordinances of the City of Brockton, Massachusetts version May 19, 2020. Under Part II Revised Ordinances, Appendix C – Zoning, includes outlining the floodplain, watershed, and wetland protection zones for the City.

The Brockton Planning Board has adapted a Redevelopment Project Stormwater Policy for projects with a 10% increase in impervious surface up to a maximum of 20,000 square feet and the City's Massachusetts Stormwater Management Manual Ordinance No. 496 has been released and is dated February 14, 2020.

Moving forward, it is anticipated the City of Brockton will become more active in the regulation and enforcement of post development drainage, water quality, and projects near wetlands and within floodplains.

Conclusion

Clean the existing onsite closed drainage system and establish a maintenance schedule. Assess and camera the drainage pipes, stormwater structures and conveyances to determine their current condition.

Perform a topographic land survey and determine the limits of the floodplain for the various flood year events.

Evaluate the existing Site drainage system.

Evaluate proposed Site drainage system with best management practices (BMPs). Investigate if drainage improvements are feasible. Drainage improvements will not take the Site out of flood zone, but may provide some relief during rain and flooding events.

Consider raising all electrical at least 1-foot above flood elevation. Anchor and elevate outdoor equipment. Install flood gates at doorways and windows.

Stay involved with the City and the actions they take to implement the Community Resilience Building (CRB) Workshop recommendations.

The City will continue to revise, adopt and enforce stricter regulations on critical and vulnerable areas during development and redevelopment projects.

Attachments:

FEMA How to Request a Letter of Map Amendment (LOMA) or Letter of Map Revision Based on Fill (LOMR-F)

Flood Insurance Rate Map (FIRM) Map Number 25023C0167J, effective date of 07/17/2012

Table 15 FEMA Plymouth County, MA Floodway Data for Salisbury Plain River

Profile 100P FEMA Plymouth County, MA Flood Profile for Salisbury Plain River

City of Brockton community Resilience Building Workshop, Summary of Findings, dated January 2019, prepared by Fuss & O'Neill