LANDMARK CENTER REDEVELOPMENT

Notice of Project Change

PREPARED BY

vhb

99 High Street
Boston, MA 02110

In association with:
Elkus Manfredi Architects
Goulston & Storrs PC
Suffolk Construction
Cosentini Associates
RWDI
McPhail Associates, Inc.

SUBMITTED TO

Boston Planning & Development Agency
One City Hall, Ninth Floor
Boston, MA 02201

PROPONENT

Fenway Enterprises LLC
on behalf of Landmark Center Ventures LLC
Samuels & Associates
136 Brookline Avenue
Boston, MA 02215

August 2017

goulston&storrs
counsellors at law

August 30, 2017

Brian P. Golden, Director
Boston Planning & Development Agency
One City Hall, Ninth Floor
Boston, Massachusetts 02201

Re: Landmark Center Redevelopment Project – Notice of Project Change

Dear Mr. Golden:

On behalf of Landmark Center Ventures LLC, Fenway Enterprises LLC (a Samuels & Associates entity) is pleased to submit this Notice of Project Change (NPC) for the proposed mixed-use redevelopment of the Landmark Center (the "Project") located at 201 Brookline Avenue within the Brookline Avenue Community Commercial Subdistrict of the Fenway Neighborhood Zoning District (the "Project Site"). The Project was previously reviewed by the BPDA and approved by its Board on January 16, 2014. Market conditions have changed considerably since 2014, prompting the Proponent to reevaluate the previously approved project and propose appropriate alterations to both the program and site plan. Portions of the project are moving forward as previously approved, and are referred to as "Phase I." This includes a much-anticipated 1.1-acre open space on Park Drive, construction of which has commenced and is anticipated to be completed in 2018. The changes to the previously approved project that are the subject of this NPC will be implemented under "Phase II." For this NPC, the "Project" includes Phases I and II combined.

The Project establishes a destination food hall at the base of the existing historic Landmark Center building; provides over two acres of new high quality, publicly accessible open space with connections to the Emerald Necklace; delivers unique street-oriented retail opportunities; and transforms the site surrounding a large-scale existing mixed use building into a modern employment hub for knowledge workers in high-tech, medical and academic fields. The Project will deliver 1,484,200 square feet of retail and office/lab space, nearly two-thirds of which is located within in the existing historic Landmark Center building. The existing above-grade parking structure will remain, and will continue to provide up to 1,500 parking spaces.

A main goal of the Project is to enhance existing, and create new, pedestrian experiences for the public. The Project will create vibrant streetscapes along Park Drive, Brookline Avenue and Fullerton Street by expanding the retail uses, enlivening storefronts, reducing surface parking and expanding open space for public use. The Project will also add a new LEED certified office/lab building that incorporates features contrasting with, but also complementing, the original character of the existing historic building on the Project Site.

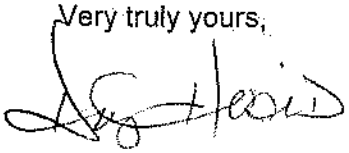
Changes from the previously approved project include an approximately 10 percent (160,000 sf) decrease in building area and the replacement of residential uses with office/lab uses. Rather than four new buildings, only one new building is now proposed. These changes will result in an approximately 47 percent decrease in weekday vehicle trips and 30 percent decreases in water use and wastewater generation rates. All other impacts remain substantially the same as those anticipated for the previously approved project.

This NPC contains a detailed project change description; an update on the Project's urban design elements; analysis of traffic and transportation impacts; and assessments of the Project's anticipated environmental impacts.

We are grateful to the neighborhood and the City officials who have provided us with continuous input over the months preceding this filing. We believe that the revised Project program and site plan represent a major step forward in improving the public realm throughout the Project Site and in the continued renaissance of the Fenway District.

We look forward to working with you and your staff during your review of this proposed project change. If you have any questions or if any additional information would be helpful, please do not hesitate to contact me.

Very truly yours,



Douglas M. Husid
Attorney for Fenway Ventures LLC

Landmark Center Redevelopment

201 Brookline Avenue

Boston, Massachusetts

SUBMITTED TO **Boston Planning & Development Agency**
One City Hall, Ninth Floor
Boston, MA 02201

PROPONENT **Fenway Enterprises LLC**
on behalf of Landmark Center Ventures LLC
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WSP USA
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August 30, 2017

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Executive Summary

In accordance with Article 80B of the Boston Zoning Code, this Notice of Project Change (NPC) is being submitted by Fenway Enterprises LLC (a Samuels & Associates entity), on behalf of Landmark Center Ventures LLC (the "Proponent"), to describe the proposed changes to the Landmark Center Redevelopment project. Landmark Center is bounded by Park Drive, Brookline Avenue, Fullerton Street and the MBTA Green Line (Riverside Branch) right-of-way in Boston's Fenway neighborhood (the "Project Site"). A previous redevelopment proposal consisting of new retail and residential uses was approved by the Boston Redevelopment Authority (BRA) Board on January 16, 2014 (the "previously approved project"). The initial phase consists of a new 1.1-acre public open space, extensive landscaping and streetscape improvements, interior renovations and a destination food hall—all of which were proposed in the previously approved project. These portions of the Project are moving forward as previously approved, and are referred to as "Phase I."

This NPC addresses changes to the previously approved project that will be implemented under "Phase II." The terms "Project" and "proposed Project" refer to Phases I and II combined. The NPC provides a description of the proposed changes to the Project, including urban design considerations. It also provides an analysis of the traffic and environmental impacts associated with Phase II, and compares them to those anticipated as part of the previously approved project. In all respects, the traffic and environmental impacts are equivalent to, or have been reduced compared to the previously approved project.

A. Background

The Landmark Center was constructed in 1928 as a distribution center and warehouse for Sears Robuck & Co (Sears). It was renovated into a retail and office complex in the late 1990's by the Abbey Group after completing Article 80 review in accordance with and pursuant to M.G.L. 121A and the approvals thereunder, and issued by the BPDA (the 121A Agreements). The Abbey Group proposed additional redevelopment of the Project Site in 2010. While that proposal was under review, the Proponent purchased the building and decided to pursue a modified and more comprehensive redevelopment strategy.

The Proponent's modified plan was the subject of an Expanded Project Notification Form (EPNF), filed October 4, 2013, which proposed the redevelopment of the Project Site with a mix of uses, including expanded office and retail space, a new grocery store, new residential buildings and replacement of the existing above-grade garage structure with underground parking.

During the public review for the EPNF, the Proponent received constructive feedback from neighborhood groups and BPDA design staff regarding certain aspects of the proposal, which resulted in adjustments to the design, massing and mitigation commitments that were ultimately approved. The final approved program included approximately 725,000 SF of additional development, including a new retail podium and four new residential buildings with a total of 600 units. This program was approved by the BPDA Board on January 16, 2014. Appropriate amendments to the previously approved MGL Chapter 121A Approval were also authorized.

Market conditions have changed considerably since 2014. The Proponent has succeeded in bringing new types of office tenants to the office component of the Van Ness, located at 1325 Boylston Street, including technology companies, data analytics, and lab tenants. With the successful lease-up of the Van Ness, the Fenway has emerged as a business hub for tenants seeking knowledge workers. In response to this trend, the Project has been revised to ensure its feasibility. The following planning goals of the previously approved project have been preserved and, in some cases, enhanced in the revised configuration presented herein:

- Creating active public open space to complement the Muddy River restoration;
- Activating streetscapes with engaging retail;
- Creating connectivity and permeability through the building at the ground floor level;
- Enhancing access to the Fenway MBTA station;
- Adding uses and vitality to the building along Fullerton Street through vertical expansion; and

Bringing a destination food hall to the Project. There are two basic changes to the Project outlined in this PNF. First, the original program included four new residential buildings over a retail podium along two sides of the building (at Fullerton Street and the MBTA right-of-way (ROW)). The current program includes one new office/lab building along the Fullerton Street side of the building only. Second, the original program required demolition of the garage and replacement of the parking below grade. The current plan no longer requires demolition of the garage, which will minimize disruption and shorten construction timeframes. Overall, the impacts of the current plan are less than, or comparable to, the previously approved plan, as demonstrated herein.

This NPC describes the proposed changes in detail in the following four chapters:

- Chapter 1. Project Change Description
- Chapter 2. Urban Design

- Chapter 3. Traffic and Transportation
- Chapter 4. Environmental Protection

B. Project Overview

The Proponent is undertaking a phased transformation of the historic Landmark Center with the goal of creating a diverse urban village and dramatically improving the public realm. As previously proposed, the Project establishes a destination food hall at the base of the existing building; provides over two acres of new high quality, publicly accessible open space with connections to the Emerald Necklace; delivers unique street-oriented retail opportunities; and transforms the area surrounding a large-scale existing office building into a modern employment hub for knowledge workers in the high-tech, medical, and academic fields. The Project introduces a new approximately 506,000 sf office/laboratory building in place of the residential uses. The remaining 978,200 sf is located within the existing structures. New underground parking is no longer proposed: The existing above-grade parking structure will remain, and will continue to provide up to 1,500 parking spaces. A summary of the currently proposed development program compared to the previously approved project is detailed in Table A below.

TABLE A. SUMMARY OF PROJECT CHANGES

Project Element	Previously Approved	Proposed Project	Change	%Change
Building Area	Up to 1,644,000 sf	1,484,200 sf (506,000 sf new)	-159,800 sf	-10%
Residential	Up to 464,000 sf	0	-464,000 sf	-100%
Retail[a]	Up to 400,000 sf	308,000 sf	-92,000 sf	-23%
Office/Laboratory[b]	Up to 705,000 sf	1,176,200 sf	+471,200 sf	+67%
FAR	Up to 5.0	4.95	Negligible	--
Number of New Buildings	4	1	-3	-75%
Building Height	197 ft (existing tower) 205 ft (new bldg.)	197 ft 208 ft 6 inch.	0 +3 ft 6 inch.	0% +2%
Parking	Up to 1,500 (no new)	Up to 1,500	0	0%
Off-Street Loading Bays	Min 8	Min 8	0	0%

[a] May include grocery use, subject to market conditions. Accordingly, some or all of the proposed grocery use may occur in Phase I and/or be replaced with retail uses.
[b] Laboratory use is new to Phase II

Sustainability is integrated throughout the Project Site. Phase 1 of the project is under construction and the project is registered under LEED 2009 under the U.S. Green Building Council's Green Building Rating System. A main goal of the Project is to enhance existing, and create new, pedestrian experiences for the public. The Project will create a new vibrant streetscape along Park Drive, Brookline Avenue and Fullerton Street by expanding the retail uses, reducing surface parking and expanding open space for public use. The new building incorporates features contrasting with, but also complementing, the original character of the historic building on the Project Site.

Phase I

The Proponent is providing many of the public benefits of the overall Project in Phase I, including significant investments in public open space and other public realm improvements. The following activities are part of Phase I, and were previously reviewed and approved through the Article 80 process:

- Convert the former Best Buy surface parking lot to an approximately 1.1-acre open space along Park Drive.
- Gain an additional 0.5 acres of open space along Park Drive and Brookline Avenue in areas reclaimed from currently inactive and unattractive service facades and entrance ramps.
- Reconfigure existing surface parking and vehicular access along Park Drive, including access realignment in coordination with the Army Corps' Muddy River Restoration Project.
- Improve the streetscape along Park Drive and Brookline Avenue (from Park Drive to the existing Cinema).
- Re-tenant space previously used as large format retail (Best Buy) as a destination food hall featuring local chefs.
- Reconfigure and re-tenant the Brookline Avenue frontage with new tenants, engaging storefronts and outdoor seating areas.
- Widen the sidewalk on Brookline Avenue, removing pinch points and barriers caused by existing stairs and retaining walls.
- Improve public circulation to the MBTA's Green Line Fenway Station.

Construction of Phase I is currently underway; completion is expected in spring 2019.

Phase II

Phase II will dramatically enhance the Fenway's position as a vibrant 24/7 mixed-use district through the following activities:

- Demolish the retail building (a non-historic addition) at the southwest corner of the Brookline Avenue intersection with Fullerton Street, currently occupied by the art materials retailer Blick (anticipated to be relocated elsewhere on the Site). This building is problematic as it is unattractive, contains blank facades, and overhangs the sidewalk on Fullerton Street.
- Construct a new 14-story mixed-use building with retail and office/laboratory uses at the southwest corner of Brookline Avenue and Fullerton Street.
- Create a new public plaza at the southwest corner of Brookline Avenue and Fullerton Street, which will contribute to a total of approximately 0.24 acres of new open space.
- Improve the streetscape along Brookline Avenue (from the existing cinema to Fullerton Street) and Fullerton Street.
- Modify and improve the Fullerton Street roadway and the intersection of Fullerton Street, Kilmarnock Street and Brookline Avenue.

- Reconfigure the existing parking garage, including removing exterior ramps and adding green roofs.
- Build a multi-use path along the ROW between the MBTA station and Fullerton Street, design of which will be coordinated with the City and State.

Based on the recent demand for space for knowledge workers, the Proponent expects to start construction on Phase II in 2019. The actual commencement will be determined by leasing activity. Project construction is expected to last approximately 18 months from start of demolition through completion of the core/shell building.

Future Phases

Future phases of development are possible on the portion of the Project Site that has not been redeveloped under the previous two phases; however, these areas are currently occupied by retail tenants with long-term leases. The configuration of future phases will be determined at a later date, as the space becomes available and based on market conditions. Any future phase will be the subject of an additional NPC filing at that time.

C. Project Benefits

The Project will transform the Fenway by creating public gathering places, green spaces, active retail storefronts, regional economic development benefits, and a destination food hall within an historic building. With its location in a mixed-use neighborhood, stocked with knowledge workforce talent, the reimagined Landmark Center has already become a hub of economic activity, capable of drawing new employers. A technology and medical academic innovation community already exists at the Project Site, spurred by the Hatch technology incubator that is home to 12 companies and approximately 500 employees. At full-build, the Project will create and/or retain several thousand transit-served office and retail jobs as well as temporary construction jobs. The City and the region will benefit from new open space, job creation, and additional city and state tax revenues generated by the Project. Also, the Project will further the goals of the City's Fenway area planning initiatives. Anticipated benefits include the following:

- Neighborhood Design Benefits
  - Creates a total of 2.2 acres of open space, including conversion of a 1.1-acre surface parking lot to a public open space serving as a gathering place to the entire Fenway neighborhood.
  - Creation of a public plaza at the Brookline Avenue and Fullerton Street intersection.
  - A destination food hall serving gourmet local food offerings.
  - New and engaging pedestrian connections between the train station and the district, including new connections through and around the building.
  - Transforms the Park Drive, Brookline Avenue and Fullerton Street frontages of the Site, drawing active retail uses down Fullerton Street from the intersection with Brookline Avenue.

- Provides improved pedestrian connectivity between the MBTA's Green Line Fenway station and the Fenway district by constructing a multi-use path and reducing auto/pedestrian conflicts within the property boundaries.
- Improves streetscapes with generous sidewalks, streetscape improvements, new lighting, street trees, vibrant retail and quality architecture.

- Transportation Benefits
  - Improves pedestrian access, comfort, and safety along well-traveled paths between the MBTA Fenway Station and the neighborhood.
  - Improves conditions for vehicles entering and exiting the Site at the intersection of Fullerton Street and Brookline Avenue.
  - Contributes $100,000 towards the long-term maintenance fund of the reconstructed Audubon Circle Road Improvements.
- Construction of a multi-use path adjacent to the building. Environmental & Infrastructure Benefits
  - Improves water quality, reduces runoff volume, and controls peak rates of runoff by incorporating new stormwater management and treatment systems.
  - Reduces heat island effects by incorporating green roofs.
  - LEED Gold certification of the existing building and expansion.
  - Encourages alternative transportation and reduces Greenhouse Gas (GHG) emissions by providing appropriate bicycle storage facilities on-site.
  - Mitigates temporary construction-related impacts through the implementation of a Construction Management Plan.
- Economic and Community Benefits
  - Enhances the economy within the Fenway neighborhood by meeting the increasing demand for office and laboratory space, providing new job opportunities, and serving as a source of customers for local retail and service establishments.
  - Creating approximately 3,000 new transit-served office and retail jobs
  - Creates temporary construction jobs in all trades.
  - Creates a public art program for the new public open spaces, estimated to be valued at up to $1,000,000.
  - Contributes a total of $100,000 to the Emerald Necklace Conservancy to support projects and programming in the Back Bay Fens area of the Emerald Necklace park system.

D. Impact Summary

Due to the proposed changes in the program, the proposed Project is forecasted to result in 1,747 fewer daily weekday trips, use 30% less water, and generate 30% less waste water than the previously approved project. All other environmental impacts remain substantially the

same as those projected under the previously approved project, as shown in Table B below and further detailed in Chapter 4, Environmental Protection.

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TABLE B. SUMMARY OF PROJECT IMPACTS

Project Element	Approved	Proposed	Change	%Change
Trip Generation	3,702 vt/d[a] weekday 8,867 vt/d Saturday	1,954 vt/d weekday N/A	-1,747 vt/d weekday N/A	-47%
Pedestrian Wind	No adverse impact	No Change	No Change	--
Shadow	No new shadow on Muddy River Restoration	No Change	No Change	
Daylight	Fullerton 70.3%	Fullerton 73.1%	+4%	+4%
Solar Glare	No adverse impact	No Change	No Change	--
Air Quality	Complies	No Change	No Change	--
Water Quality	Complies	No Change	No Change	--
Flood Hazard	Complies	No Change	No Change	--
Groundwater/Geotech	No adverse impact	No Change	No Change	
Solid & Hazardous Waste	Complies	No Change	No Change	--
Noise	Imperceptible increase	No Change	No Change	--
Construction	Temporary	No Change	Reduced[c]	--
Green Bld/Sustainability	Retail: LEEDv3 Silver certifieded/Residential: LEEDv3 Gold certifiedied	LEEDv3 Gold certifieded	Improved Sustainability	--
	Meets Stretch Code	Meets Stretch Code	No Change	
Zoning Relief	121A Approval previously issued	See Chapter 1	See Chapter 1	--
Water Use	241241,867 gpd[b]	168,799 gpd	-73,068 gpd	-30% gpd
Wastewater Generation	219219,879 gpd[b]gpd[b]	153,454 gpd	-66,425 gpd	-30% gpd

[a] vt/d = vehicle trips per day

[b] Based on program as ultimately approved by BPDA board memo

[c] Temporary impacts related to construction actives will be reduced since garage demolition, excavation, etc. has been removed from the previously approved project

E. Mitigation Summary

In order to further lessen the impacts of the Project on the surrounding area, the Project will include the mitigation actions described below.

Transportation

The Proponent will implement the specific transportation commitments included in the Project's Transportation Access Plan Agreement (TAPA) for Phase I. The roadway improvements described below will be constructed as Part of Phase II and future phases.

- Widen Kilmarnock Street to help alleviate congestion on the northbound approach to Brookline Avenue.
- Widen Fullerton Street to improve vehicle turning movements at the intersection of Brookline Avenue/Kilmarnock Street/Fullerton Street.

- Provide on-street bicycle accommodations on Fullerton Street adjacent to the Site.
- Sponsor a second Hubway Station at the Landmark Center.
- Design and construct a portion of the City's planned multi-use path adjacent to the Site.
- Install a new traffic signal and pan-tilt-zoom (PTZ) camera at the intersection of Park Drive with Brookline Avenue and Boylston Street.
- Provide new sidewalks, streetlighting and street trees on Fullerton Street adjacent to the Site.
- Submit a Construction Management Plan identifying construction parking and traffic impacts, and specifying mitigation measures to be implemented during construction.
- Comply with approved Transportation Access Plan Agreement (TAPA).

The Proponent has also committed to a set of mobility actions aimed at the tenants and users of the Site, including providing electrical vehicle charging stations, providing improved bicycle parking and storage, and implementing a Transportation Demand Management (TDM) plan to discourage single-occupancy vehicle trips.

Wind

At locations where the Project design results in uncomfortable wind conditions, appropriate vegetation and/or porous vertical wind screens will be incorporated to reduce wind energy.

Economic Impacts

The project will create more than 3,000 new transit-served office, research and retail jobs, offering employment opportunities to workers of a wide variety of backgrounds and skill levels.

As described in the draft Cooperation Agreement between the Proponent and the BRA, in order to demonstrate commitment to providing job opportunities, the Proponent will enter into with the BRA and the Boston Employment Commission (the "BEC") a Boston Residents Construction Employment Plan, which will set forth the Proponent's plans to use Best Efforts to to meet the following Boston Residents Construction Employment Standards: at least 51% of the total employee work hours in each trade shall be by bona-fide residents of the City of Boston; at least 40% of the total employee work hours in each trade shall be by minorities; and at least 12% of the total employee work hours in each trade shall be by women.

The Proponent also agrees to use good faith efforts to fill or make available to residents of the City of Boston certain employment opportunities at the Project, by notifying at least one of Boston's One-Stop Career Centers of any Proponent job openings at the Project, and encouraging tenants of the retail space and other employers occupying the development to do the same.

1

Project Change Description

In accordance with Article 80B of the Boston Zoning Code, this Notice of Project Change (NPC) is being submitted by Fenway Enterprises LLC, a Samuels & Associates entity, on behalf of Landmark Center Ventures LLC Entity (the "Proponent"), to describe the proposed changes to the Landmark Center Redevelopment project bounded by Park Drive, Brookline Avenue, Fullerton Street, and the MBTA right-of-way (the "Project Site") in Boston's Fenway neighborhood. The Landmark Center Redevelopment project was approved by the Boston Planning & Development Agency (BPDA) Board on January 16, 2014 (the "previously approved project"). This ch apter provides an overview of existing site conditions and describes the changes to the Project that will result from the implementation of Phase II, as described above. This chapter also discusses the Project's regulatory context and provides a description of ongoing agency coordination and public outreach activities.

1.1 Site Context and Existing Conditions

The Project Site is defined by its prominent location at the corner of Park Drive and Brookline Avenue, as well as its proximity to Fenway Park, the MassDOT/MBTA (Green Line) property, the Audubon Circle neighborhood, various institutions, such as Wheelock, Emmanuel and Simmons Colleges, the Longwood Medical and Academic Area (LMA), and portions of the Emerald Necklace recently restored by the Army Corps of Engineers (USACE) through the Muddy River Restoration Project.

The Project Site is bounded by MassDOT/MBTA's (Green Line) property; Fullerton Street to the northeast; Brookline Avenue to the southeast; and Park Drive to the southwest (Figure 1.0101). The approximately 9-acre site includes the historic Landmark Center building (Figure 1.02a). Constructed in 1928 as a distribution center and warehouse for Sears, Landmark Center was renovated into a retail and office complex in the late 1990s by the Abbey Group. The Project Site currently includes approximately 952,000 square feet of office and retail space (Figure 1.02b), an above-grade parking garage, surface parking, and loading/service areas.

The Project Site is currently well-served by infrastructure, some of which was recently upgraded, and is in close proximity to public transit including the MBTA Green Line, the Framingham/ Worcester Commuter Rail Line, and multiple bus routes.

1.2 Project Change Description

The following planning goals of the previously approved project have been preserved and, in some cases, enhanced in the revised configuration presented herein:

- Create active public open space to complement the Muddy River restoration;
- Activate streetscapes with engaging retail;
- Create connectivity and permeability through the building at the ground floor level;
- Enhance access to the Fenway MBTA station;
- Add uses and vitality to the building along Fullerton Street through vertical expansion; and
- Bring a destination food hall to the Project Site.

The Project is an integral part of the rejuvenation of the surrounding district. When it was approved by the BPDA Board on January 16, 2014, it was anticipated to include residential, retail/grocery, and offices uses. Due to changes in market conditions since its original approval the Proponent has reevaluated the Project, and is now proposing the following changes to the program:

- Maintain and reconfigure the existing parking structure to better serve the site. Build the Phase II expansion over and around the existing garage to conceal the existing structure.
- Eliminate the residential component;
- Reduce the retail/grocery components; and
- Expand the office component and add research/laboratory uses.

Minor modifications to the site plan have occurred to reflect the changes in the building uses (refer to Figure 1.03b).

Select components of the approved plan are currently being implemented as Phase I, including significant investments in public open space and other public realm improvements and brining engaging street level retail into the project. As part of Phase I, the Proponent is converting a 1.1-acre surface parking lot (former Best Buy lot) into open space, complementing the Muddy River Restoration along Park Drive. The proponent is rebuilding landscaping and streetscapes along Brookline Ave, and bringing a destination food hall into areas of the project formerly occupied by large format retail (Best Buy). Phase I includes reconfiguring the building's ground floor to create pedestrian permeability and connections through the building, improving pedestrian connections between the Fenway district and the MBTA station. Phase I also includes reconfiguring vehicle access along Park Drive and improving connections to the MBTA station.

As part of Phase II, the Project includes construction of a new class A office building with space for research and development laboratories geared toward occupants in high-tech, medical and academic fields. Ground-level retail will be located fronting both Brookline Avenue and Fullerton Street. Consistent with the previously approved project, this new building will be designed to be LEEDv3 Gold certified. The Project will result in the expansion and re-design of the pedestrian experience, adding a significant public plaza at the corner of Brookline Avenue and Fullerton Street, enlarging the pedestrian zone along Brookline Avenue, and providing streetscape amenities to both the Brookline Avenue and Fullerton Street frontages. The Project includes construction of the portion of the Fenway-Yawkey multi-use path adjacent to the Site, design of which will be coordinated with the City and the State.

The program proposed in Table 1.1, which is the subject of this NPC, will be implemented as Phase II.

TABLE 1.1 SUMMARY OF PROJECT CHANGES

Project Element	Previously Approved	Proposed	Change	%Change
Building Area	Up to 1,644,000 sf	1,484,200 sf (506,000 sf new)	-159,800 sf	-10%
Residential	Up to 464,000 sf	0	-464,000 sf	-100%
Retail[a]	Up to 400,000 sf	308,000 sf	-92,000 sf	-23%
Office/Laboratory[b]	Up to 705,000 sf	1,176,200 sf	+471,200 sf	+67%
FAR	Up to 5.0	4.95	Negligible	----
Number of New Buildings	4	1	-3	-75%
Building Height	197 ft (existing tower) 205 ft (new bldg.)	197 ft 208'6"	0 +3'6"	0% +2%
Parking	Up to 1,500 (no new)	Up to 1,500	0	0%
Off-Street Loading Bays	Min 8	Min 8	0	0%

aMay include grocery use, subject to market conditions. Accordingly, some or all of the proposed grocery use may occur in Phase I and/or be replaced with retail uses.

[b] Laboratory use is new to Phase II

Figures 1.04a-c depict various views of the previously approved and proposed Project.

1.3 Project Schedule

Work for Phase I began in June 2017. Site work is expected to be complete by summer 2018, and interior work is anticipated to be completed by spring 2019.

The Proponent has succeeded in bringing new types of office tenants to the office component of the Van Ness, located at 1325 Boylston Street, including technology companies, data analytics, and lab tenants. With the successful lease-up of the Van Ness, the Fenway has emerged as a business hub for tenants seeking knowledge workers. Based on this demand, the Proponent expects to start construction on Phase II in 2019. The actual commencement will be determined by leasing activity.

Project construction is expected to last approximately 18 months from start of demolition through completion of the core/shell building. Tenant interior fit out work will be leasing driven and extend roughly 12 additional months. Portions of existing retail and garage space will be demolished and reconfigured prior to construction of the vertical site elements. Reconfiguration work within interior spaces of the building and garage will be implemented in a manner to mitigate tenant disruption during construction.

1.4 Anticipated Permits and Approvals

Table 1.2 lists the anticipated permits and approvals from state and local governmental agencies, along with their status based on information currently available. It is possible that not all of these permits or actions will be required, or that additional permits or actions may be needed.

TABLE 1.2 ANTICIPATED PERMITS, APPROVALS AND ACTIONS

Agency/Department	Permit/Approval/Action	Status
Federal		
Environmental Protection Agency	NPDES General Construction Permit	Obtained 2014
Commonwealth of Massachusetts		
MA Department of Environmental Protection (DEP)	Temporary Construction Dewatering Permit	TBD
MA DEP, Division of Air Quality Control	Fossil Fuel Utilization Permit - Self Certification	Post Construction
	Notice of Asbestos Removal	Prior to Construction
	Notice of Commencement of Demolition and Construction	Prior to Demolition and Construction
MA Department of Transportation (MassDOT)	Approval for Construction on Former Right-of-Way Easement	ToTo be updated for proposed Project
Executive Office of Energy and Environmental Affairs	Notice of Project Change	TBD
	MEPA Certificate	TBD
Massachusetts Historical Commission	Project Notification Form	TBD
Massachusetts Bay Transportation Authority (MBTA)	Easement	TBD
City of Boston		
Boston Planning and Development Agency (BPDA)	Article 80B, Large Project Review	NPC submittedherein
	Amendment to Chapter 121A Approval	TBD
	121A Regulatory Agreement	TBD
	121A Agreement Not to Dispose of Interests	TBD
	121A Certificate of Approval Consistency	TBD
	Amendment to 6A Contract	TBD
	Various Article 80 agreements	TBD
	Certificate of Compliance	TBD

Agency/Department	Permit/Approval/Action	Status
Boston Civic Design Commission (BCDC)	Design Review	TBD
Boston Landmarks Commission (BLC)	Article 85 Demolition Delay (Determination of No Significance)	TBD
	Certificate of Design Approval	TBD
Boston Parks and Recreation Department	Approval of Demolition & Construction within 100 ft of Park or Parkway	In process
Boston Transportation Department (BPD)	Transportation Access Plan Agreement (TAPA)	Phase I TAPA executed
	Construction Management Plan	
	Signal Design Approval	
Boston Public Works Department (PWD)	Street Opening Permit; Street/Sidewalk	To be updated for proposed Project
	Occupancy Permit	Upon Construction Completion
Public Improvement Commission (PIC)	Review of Private Road Layout	To be updated for the proposed Project
	Specific Repair Approval for Sidewalk and Curb Improvements	
	Discontinuance of public right-of way	
	Monitoring Well Approval	
	Permit for Sign, Awning, Canopy	
	Approval for earth retention (if required)	
Boston Water and Sewer Commission (BWSC)	Site Plan and GCOD Approval	To be updated for the proposed Projec
Boston Conservation Commission	Request for Determination of Applicability regarding presence of floodplain on Site	Negative DOA issued 4-17-14
Boston Committee on Licensing	Flammable Storage Permit	Issued 12-3-14. Additional licenses to be updated per the proposed Project
Boston Inspectional Services Department (ISD)	Building Permits and other Construction-Related Permits	TBD
	Certificates of Occupancy	Post Construction

GCOD Groundwater Conservation Overlay District

1.5 Regulatory Context

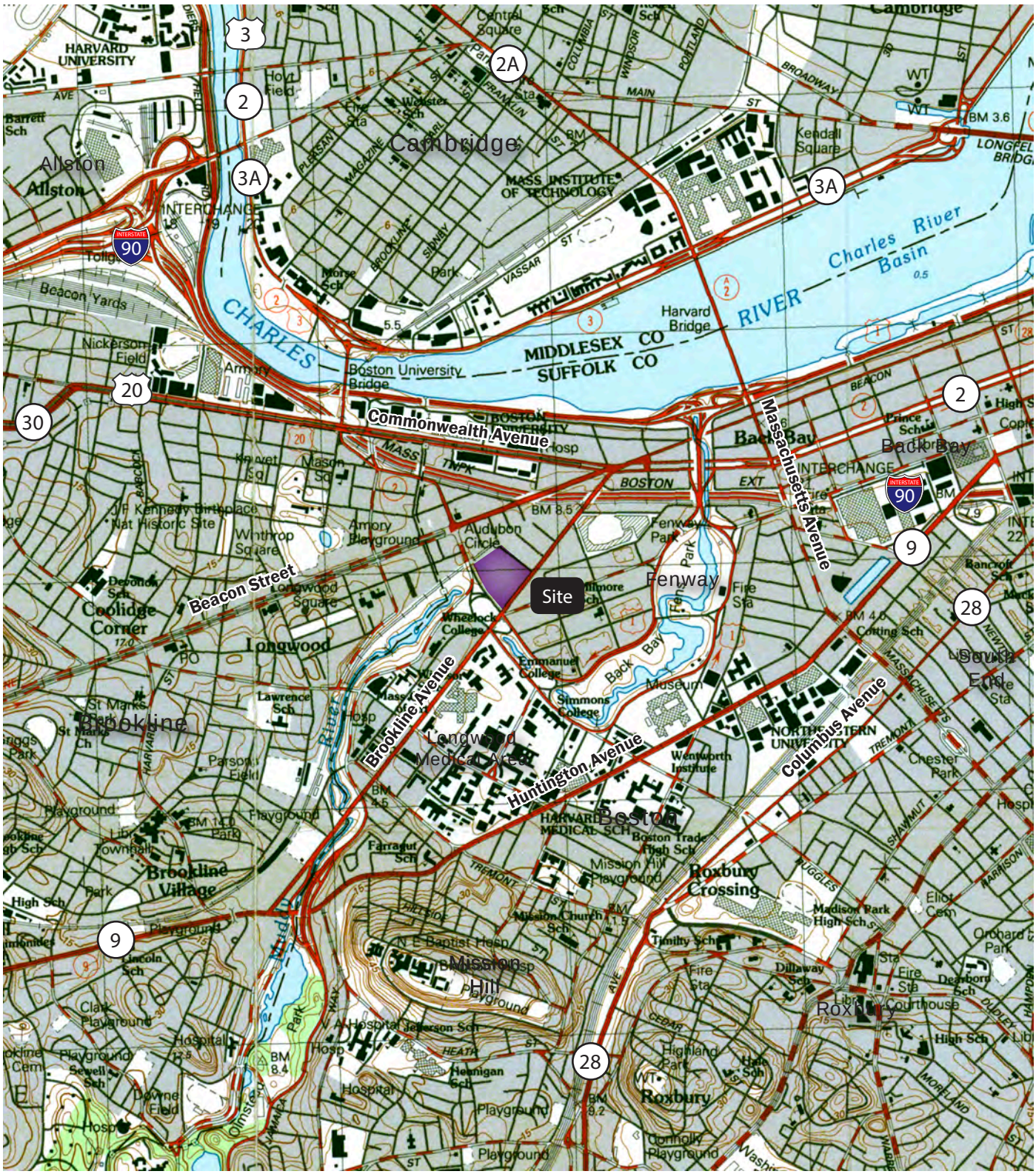
The Proponent is seeking a modification to the existing 121A Approval for the Project to update the previously granted zoning deviations to reflect the Project's current configuration and anticipated uses.

1.6 Agency Coordination and Public Outreach

The Proponent has worked in the Fenway neighborhood for nearly 20 years and has built a relationship with stakeholders that has resulted in an open and constructive discussion on the

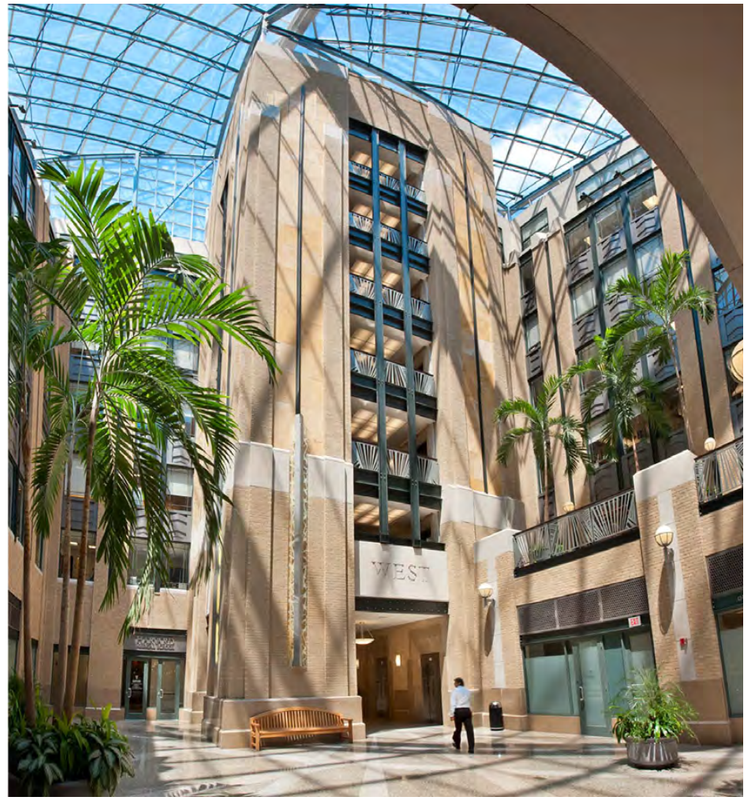
proposal for the Landmark Center Redevelopment. The Proponent met extensively with local residents, neighborhood groups, local business leaders and other local representatives for the purpose of getting feedback and building a broad-based consensus on the Project. Meetings with following entities have been held since the EPNF and Supplemental Information were filed:

- February 2017: Landmarks Commission, Phase I
- February 2017: Parks Department, Phase I
- March and May 2017: BPDA pre-filing consultation, Phase II
- April 27, 2017: Public Meeting, Phase I
- July 18, 2017: Fenway Civic Board Meeting, presentation of Phases I and II
- August 15, 2017: Audubon Circle Board Meeting, presentation of Phases I and II



\\vhb\proj\Boston\11615.00\graphics\FIGURES\NPC\Fig 1.1 Site Location.indd p1 06/19/17

Figure 1.1
Site Location Map



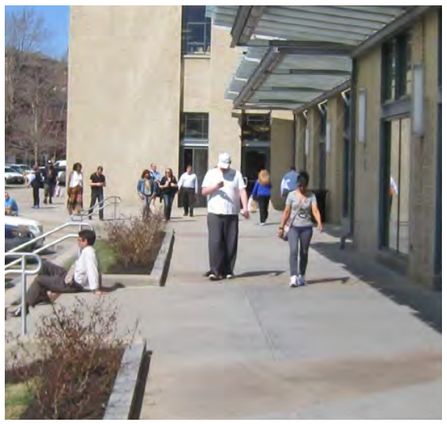


Figure 1.02a
Photographs of the Existing Landmark Center

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Figure 1.02b
Photographs of the Existing Miller Building

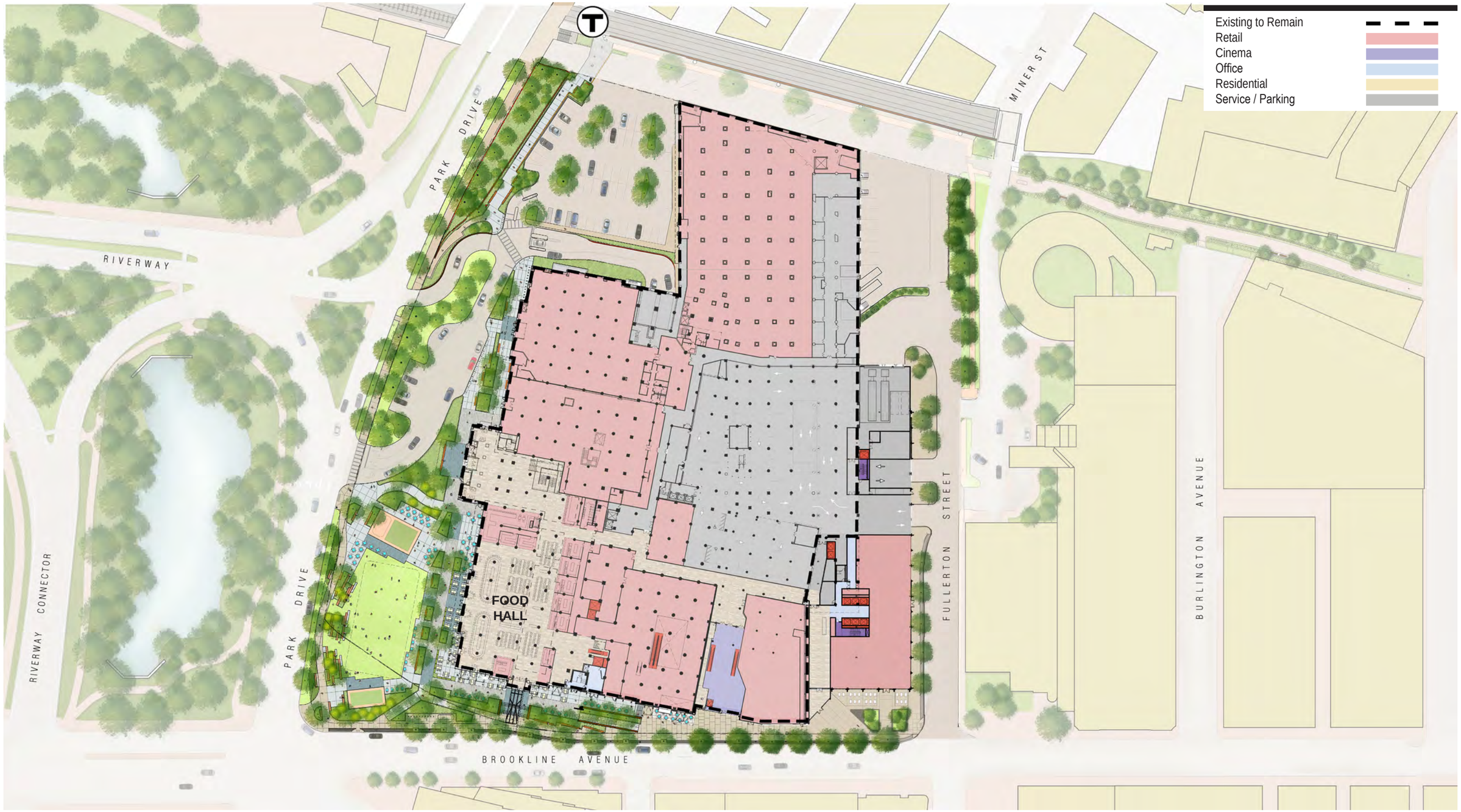

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Figure 1.03
Proposed Development Plan
(Ground Level)

Figure 1.04a
Proposed View of the Market Arcade and Office Lobby

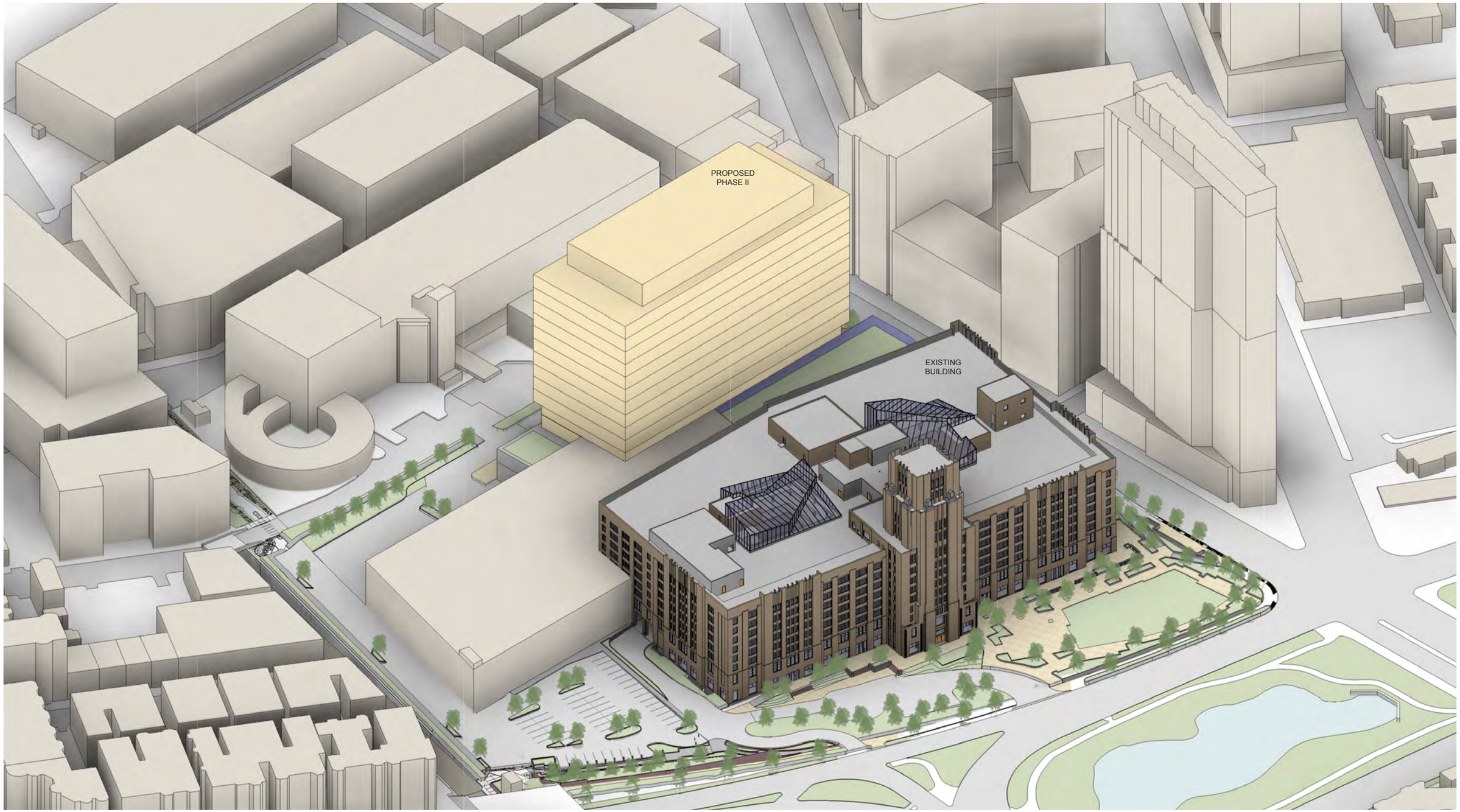

Figure 1.04b
Proposed Aerial View from Northwest

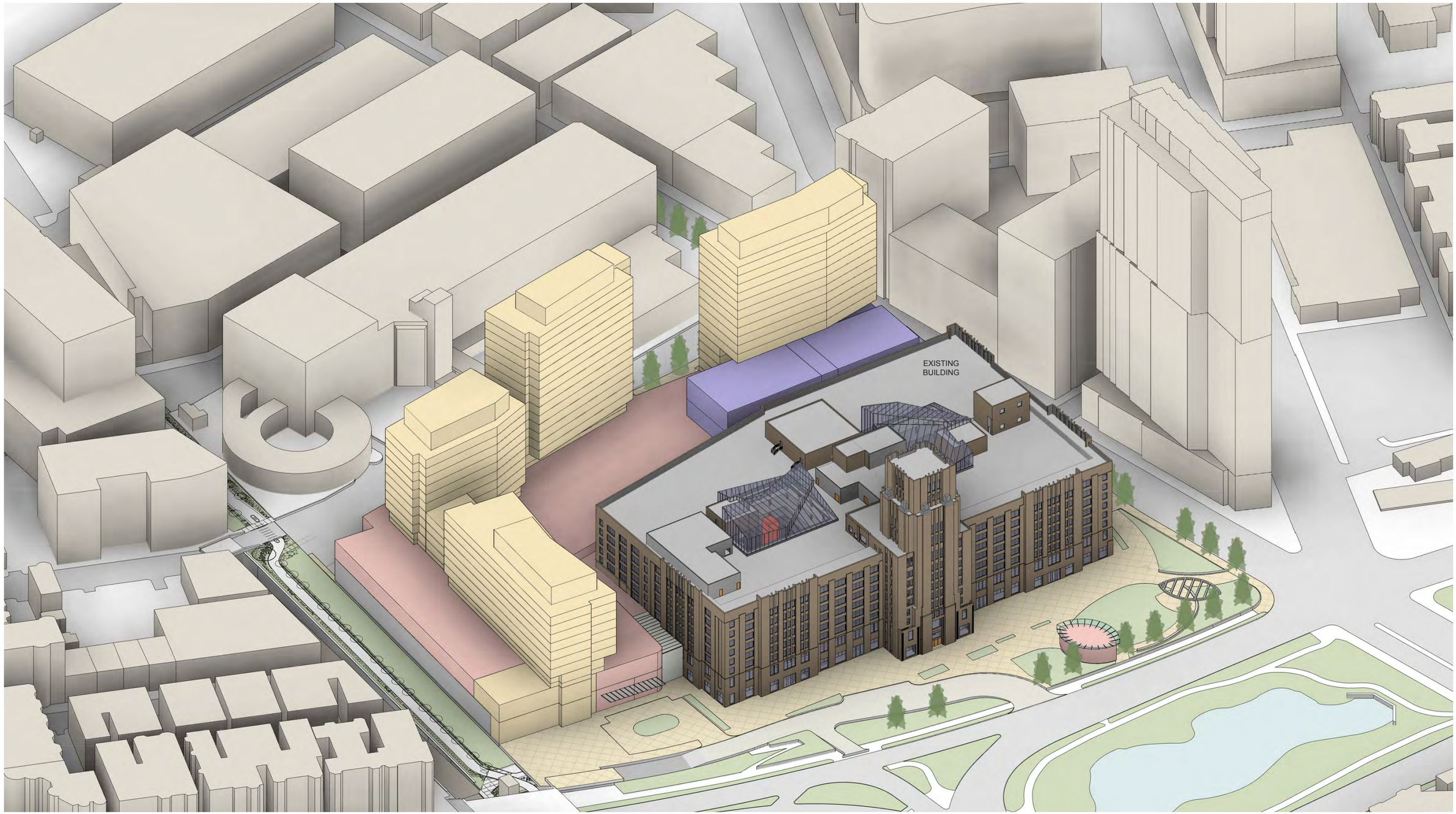

Figure 1.04c
Previously Approved Aerial View from Northwest

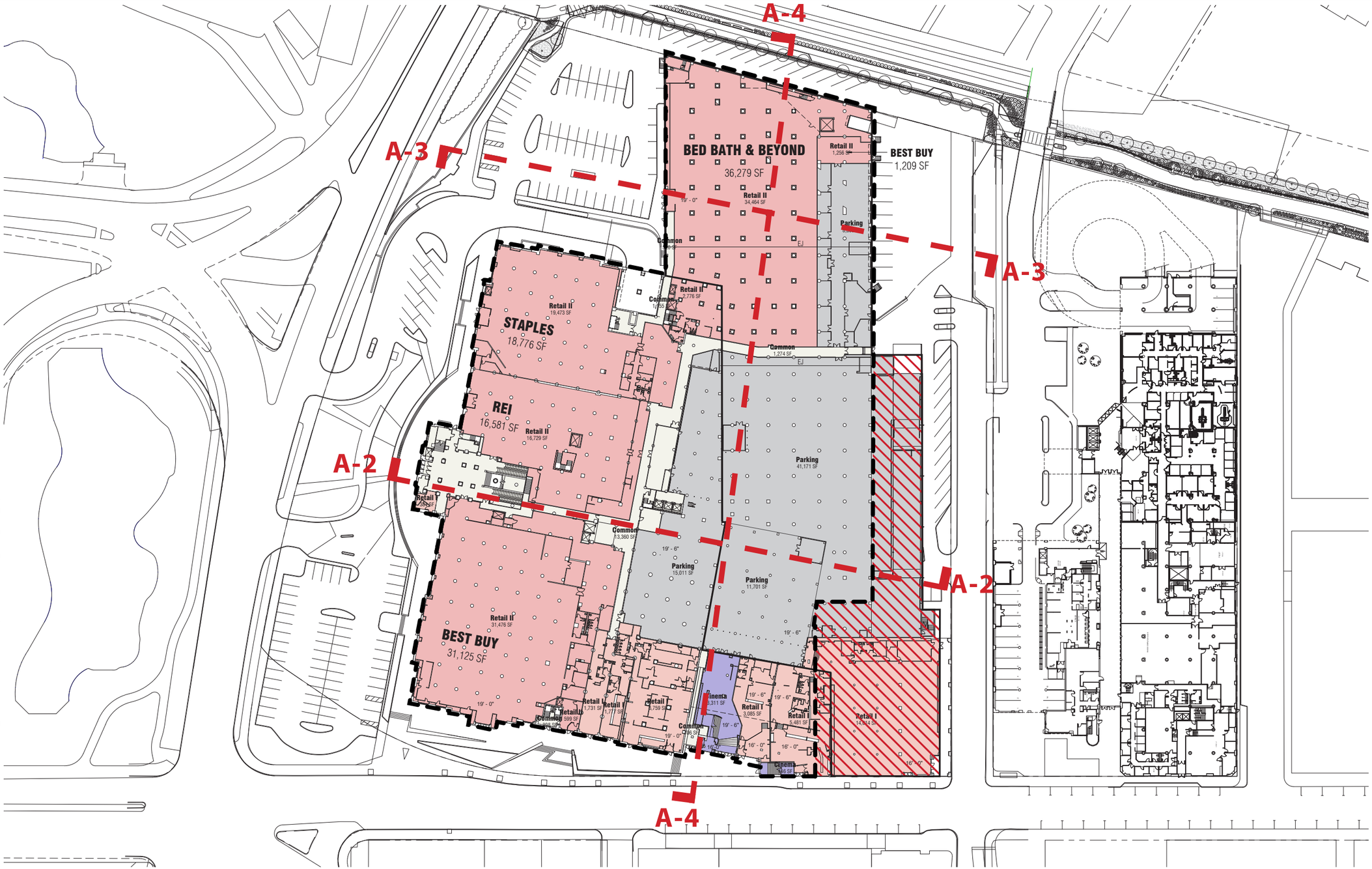

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Figure 1.05a
Phasing Plan - Existing Ground Floor Plan

DEMOLITION

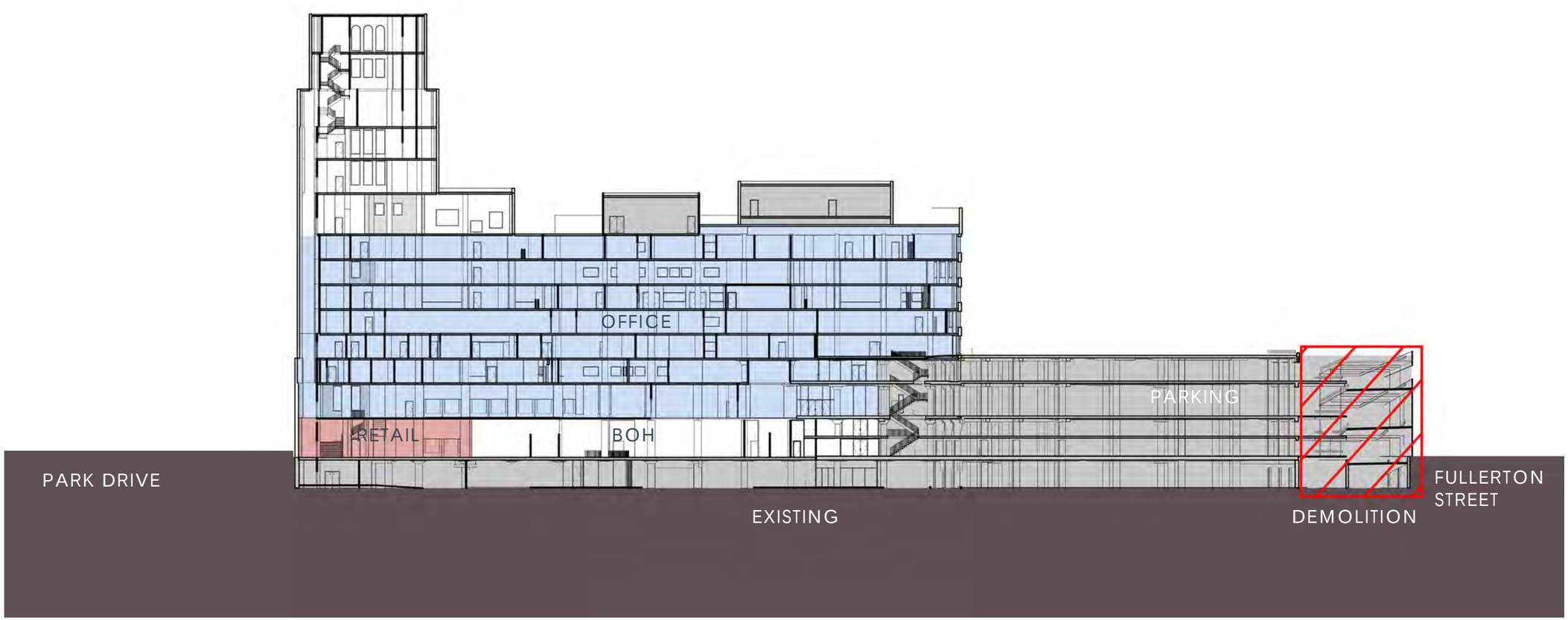

Figure 1.05b
Phasing Plan - A-2

DEMOLITION

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Figure 1.05c
Phasing Plan - A-3

DEMOLITION

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Figure 1.05d
Phasing Plan - A-4

Figure 1.05e
Phasing Plan - B-1

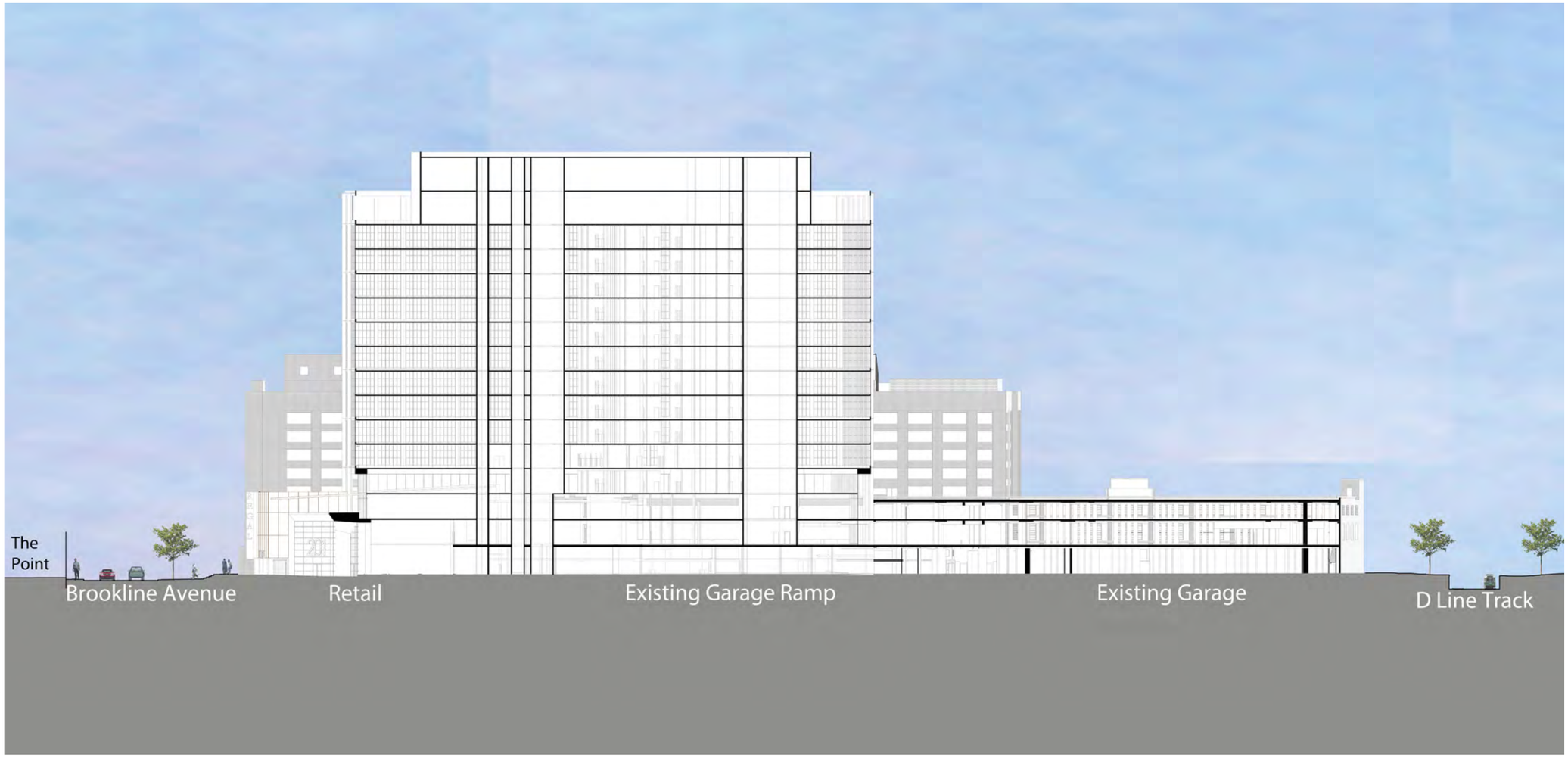
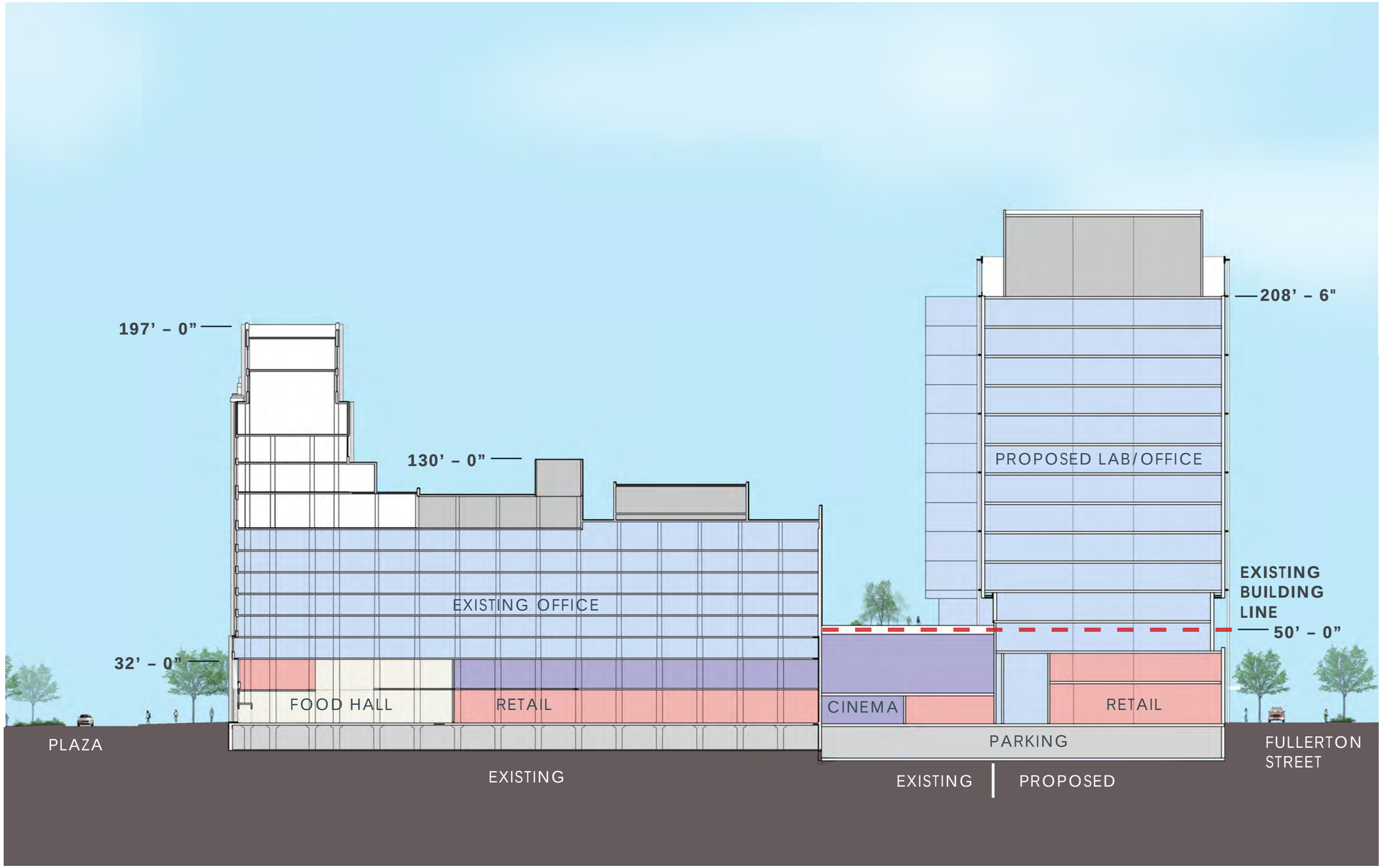
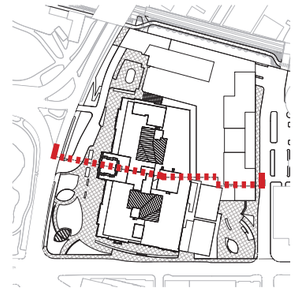


Figure 1.05f
Phasing Plan - B-2





EXISTING TO REMAIN
RETAIL
CINEMA
OFFICE
RESIDENTIAL
SERVICE/PARKING

Figure 1.05g
Phasing Plan - Proposed Section

2

Urban Design

This chapter presents the design concept for the Project and describes the visual aesthetics and architectural design, including height, massing, character and materials. It also describes how the ground level uses are integrated into the design, including pedestrian circulation and accessibility. Finally, public realm improvements are described, including open space, streetscapes, and the proposed multi-use path.

2.1 Key Findings

Key findings related to urban design include:

- The proposed massing and height for the Project Site are consistent with the adjacent existing and proposed development along Brookline Avenue.
- The new building's modern architectural style features an aesthetic reminiscent of old industrial buildings, with a combination of metal and glazing.
- The Project focuses on creating permeability and new connections between the Fenway MBTA stop and Brookline Avenue via the existing Landmark Center building. Improved accessibility is provided on-site with new accessible ramps and sloped sidewalks for improved pedestrian flow in and around the Site.
- At full build, the Site will include 2.2 acres of new open space, including 1.1-acre of public open space converted from a surface parking lot in Phase I and a 6,000 sf (0.14 acre) public plaza at the intersection of Brookline Avenue and Fullerton Street constructed in Phase II.
- The Project will create new vibrant streetscapes along Park Drive, Brookline Avenue and Fullerton Street by expanding the retail, reducing surface parking and expanding open space for public use. This streetscape will be enhanced by district-wide treatments, including signage, street furniture, lighting, and landscaping.
- The Project includes construction of the portion of the Fenway-Yawkey multi-use path adjacent to the Site, design of which will be coordinated with the City and the State.
- Interior bicycle parking will be provided from Fullerton Street, and the Proponent will continue to host the Hubway bike share station on Brookline Avenue.

2.2 Design Development and Concept

The Project's urban design strategies have largely grown out of and have been nurtured by the local Fenway community groups and the BPDA through new zoning of the Fenway. Through zoning changes following a neighborhood visioning process, the Fenway is being transformed with the development of new mixed-use projects, including Trilogy, 1330 Boylston Street, The Van Ness and Pierce, as well as redevelopment of existing buildings such as 120-126 Brookline Avenue and 1249-1255 Boylston Street. These catalytic developments have set the stage for the continued transformation of the underutilized parcels remaining along both Boylston Street and Brookline Avenue. The Project will continue this trend by reimagining the Landmark Center Site as a pedestrian-oriented destination that combines historic character with modern architecture and amenities. Figures 2.01a through 2.05b depict the previously approved and currently proposed elevations for each Project frontage. Figures 2.06a-2.07b show aerial views.

2.2.1 Height and Massing

The proposed massing and height for the Project Site are consistent with that of adjacent proposed development along Brookline Avenue and have been carefully crafted to fit within the context of the Audubon Circle neighborhood beyond the MBTA tracks to the north. In the current plan, which consists of one new office building as opposed to four residential buildings, massing is located only along Fullerton street and has been removed from the frontage along the MBTA line. The height of the new office building (208.5') is similar to that proposed in the previously approved residential building in this location (204').

Figure 2.08b shows the east-west cross section of the Project. Building massing has been shaped in response to the height and use of the surrounding area and the desire to preserve daylight and views both on- and off-site. The removal of the existing parking garage ramp on Fullerton Street allows the proposed building to screen a large portion of the existing parking garage. The retail base of the development is made up of a mix of small and intermediate-size retail spaces designed to draw pedestrians to and through the building with the reopening of the original Sears store entrance on Brookline Avenue. The Brookline Avenue entrance reopening provides a new pedestrian path connecting the MBTA's Fenway Stop, located in the westerly corner of the Site, to Brookline Avenue. Floor plans are shown in Figures 2.09 through 2.15.

The proposed building mass is oriented perpendicular to Brookline Avenue and parallel to Fullerton Street, and is set back from the street edge to allow for a pedestrian plaza to help anchor the corner. The Project Site is configured so that the massing is situated to minimize the new building's impact on the adjacent residential neighborhood. Materials and architectural expression carried down from the building mass to the street level accentuate the massing composition.

2.2.2 Character and Materials

A modern architectural expression that responds to the existing context and to the orientation of the new building is proposed, starting at the edges of Brookline Avenue and Fullerton Street with new paving, planting, seating and lighting. This will result in a lively and inviting streetscape along the storefronts.

The form and aesthetic of the new office/laboratory building takes cues from old industrial building proportions. The proposed building is differentiated from the existing art-deco masonry Landmark building by form and materials, becoming a backdrop to the Landmark building.

The new building incorporates a combination of metal and glazing that contrasts with the light beige historic masonry building, but relates to the black steel retail portal storefronts fitted into the façade's existing masonry openings. Glazing systems throughout the Project will use energy efficient low-e glass in aluminum frames. Figures 2.03b and 2.04b show the proposed elevations along Brookline Avenue and Fullerton Street.

Historically, the Sears Roebuck and Company Mail Order Store displayed the company name in 12-foot high letters on its tower and on corner-mounted marquee signage. Bunting, banners, and surface mounted signage were also used to commemorate special events. Consistent with previous filings, the Proponent proposes to continue this tradition of monumental celebration signage for Project tenants and events.

2.3 Pedestrian Circulation and Accessibility

Figure 2.17 shows the proposed pedestrian circulation plan. The Project continues to focus on creating permeability and new connections between the MBTA Fenway Station and Brookline Avenue via the existing Landmark Center building. A grand new two-story high market hall entry is proposed to connect the central tower entrance on Park Drive through the existing Landmark Center building to the existing Brookline Avenue entrance (Figure 2.16b). A secondary pedestrian access-way will also be available to connect the existing Landmark Center building to the new building and Brookline Avenue.

The existing parking garage will be renovated to enhance the patron experience, and will be accessed via ramps from Park Drive and a reconfigured entrance off Fullerton Street. Existing conflicts between cars and pedestrian flow from the MBTA Fenway stop will be eliminated by reconfiguring the site access and improving the existing pedestrian sidewalk with a widened walkway and new lighting.

Improved accessibility is provided on-site with new accessible ramps and sloped sidewalks for improved pedestrian flow in and around the site. Accessible parking spaces are provided within direct proximity to the Park Drive main tower entrance. Please see the Accessibility Checklist included in Appendix C for more details regarding accessibility.

2.4 Public Realm Improvements

As previously proposed, the main goal of the Project is to enhance existing, and create new, pedestrian experiences for the public. The new office/lab building establishes street walls and generous sidewalks to accommodate an activated pedestrian realm. The Project includes improvements to pedestrian circulation and accessibility, new open space, enhanced streetscapes, and improvements to the multi-use path connecting to the MBTA station, as described below.

2.4.1 Open Space

At full build, the Site will include 2.2 acres of new open space. An approximately 1.1-acre open space along Park Drive is currently under construction as part of Phase I, and is anticipated to be open in 2018. Phase I will include an additional 0.5 acres of open space along Park Drive and Brookline Avenue in areas reclaimed from currently inactive and unattractive service facades and entrance ramps. Phase II will include the creation of approximately 0.24 acres of new open space. This will include an approximately 6,000 sf public plaza at the intersection of Brookline Avenue and Fullerton Street, which will be accommodated by setting the proposed building back approximately 60 feet. Approximately 0.35 acres of open space will be created in future phases. Portions of the existing parking on the roof level of the garage between the new and existing buildings will be resurfaced with sedum and other green roof materials, and will be available for use by building tenants.

2.4.2 Streetscapes

The Project will continue to create a new vibrant streetscape along Park Drive, Brookline Avenue and Fullerton Street by expanding the retail, reducing surface parking and expanding open space for public use. This streetscape will be enhanced by district-wide treatments, including signage, street furniture, lighting, and landscaping. Pedestrian circulation will be improved with generous sidewalk dimensions and sloped sidewalks for accessibility eliminating visual clutter and the need for railings throughout the Project Site.

In Phase II, the streetscape along Brookline Avenue, from its intersection with Fullerton Street to the cinema, will be widened with the demolition of the existing 1990s retail building (the Miller building) and the removal of the lower level cinema egress stair and brick enclosure.

A Fullerton Street presence is also proposed in keeping with the Proponent's aspiration to make this a vibrant urban street by extending retail around and onto Fullerton Street. Rather than relocating the service and loading facilities, the Project will maintain and screen them at their current location at the western end of Fullerton Street, with access kept roughly in its present location at the termination of Fullerton Street. Demolition of the Miller building will allow for the widening of Fullerton Street to include dedicated turning and bicycle lanes.

2.4.3 Multi-Use Path and Bicycle Accommodations

The Project includes construction of the portion of the Fenway-Yawkey multi-use path adjacent to the Site, design of which will be coordinated with the City and the State. The path will ultimately allow walkers and bicyclists to travel from Riverway Park directly to Yawkey Way station. Figure 2.18 depicts the location of the multi-use path. The detailed characteristics of the path will be determined in conjunction with the City and State as design progresses.

The Proponent will continue to host the Hubway bike share station along Brookline Avenue. Secure, covered bike parking will be provided adjacent to the parking ramp on Fullerton Street, as shown in Figure 2.18.

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Figure 2.01a
Brookline Ave and Kilmarnock Street Perspective

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Figure 2.01b
Exterior Plaza Perspective

0 25 50 Feet

Figure 2.02
Proposed Park Drive Elevation

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Figure 2.03
Proposed Brookline Avenue Elevation

0 25 50 Feet

Figure 2.04
Proposed Fullerton Street Elevation

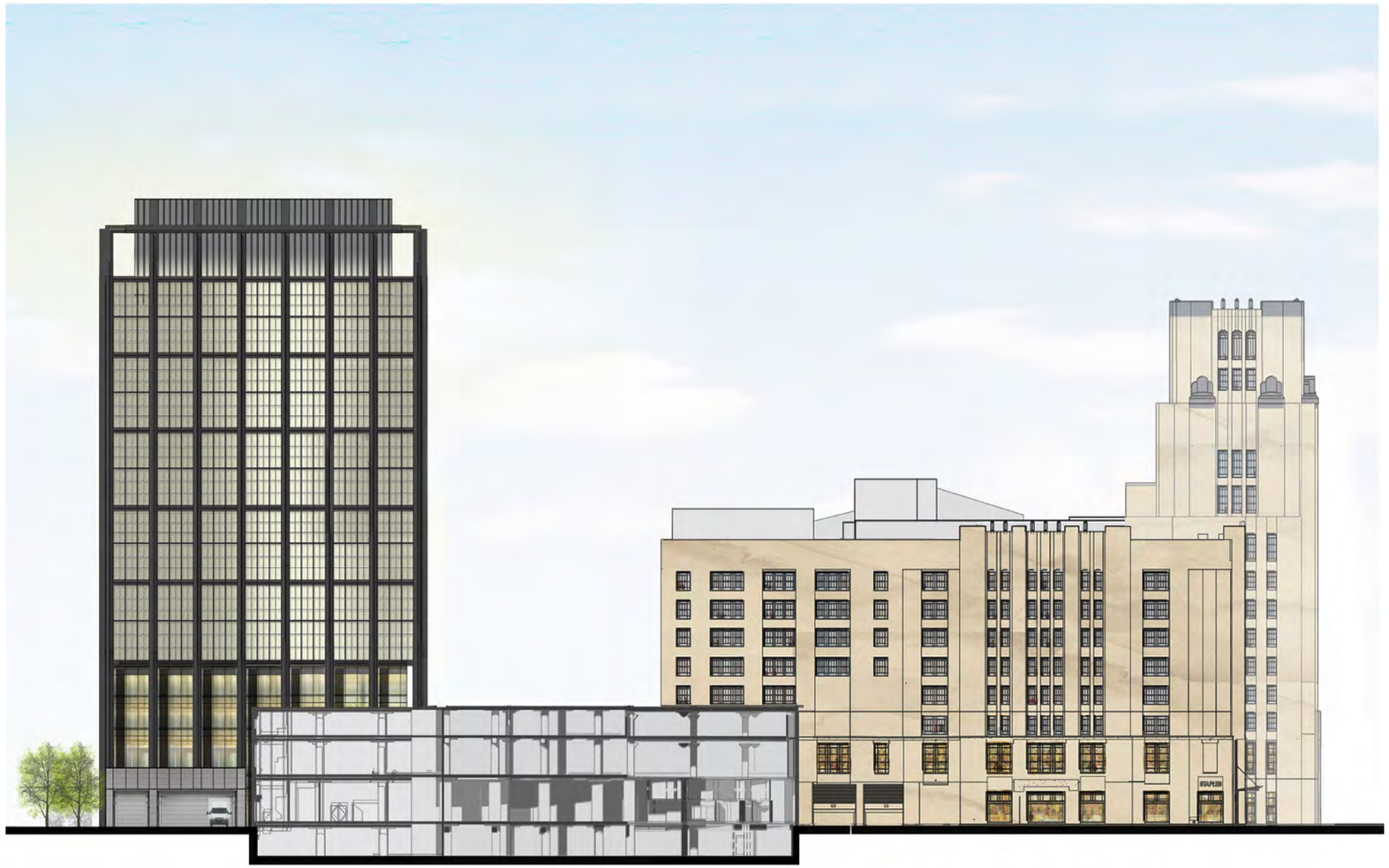

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Figure 2.05
Proposed MBTA Right-of-way Elevation

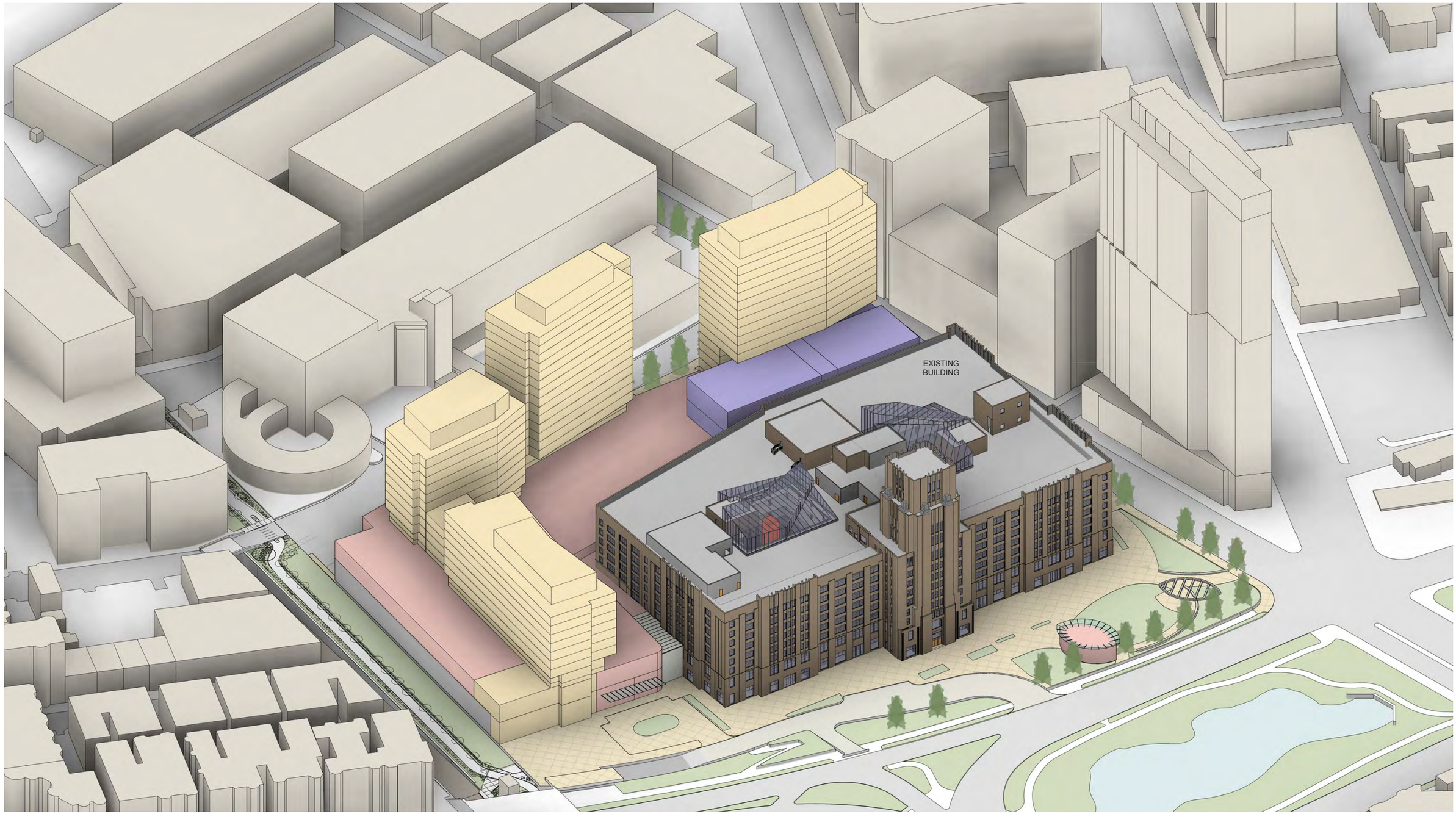

Figure 2.06a
Previously Approved Aerial View from Northwest

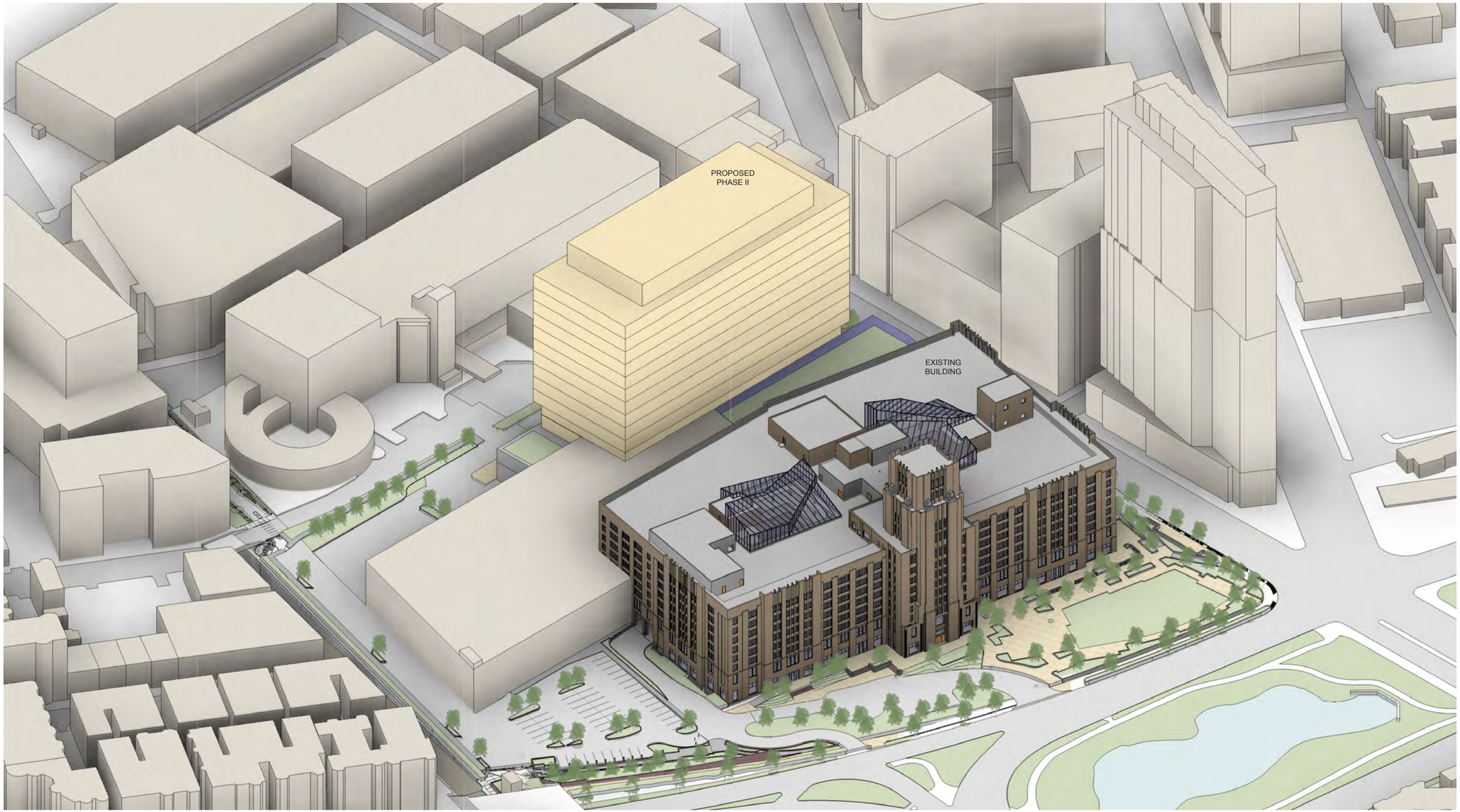

Figure 2.06b
Proposed Aerial View from Northwest

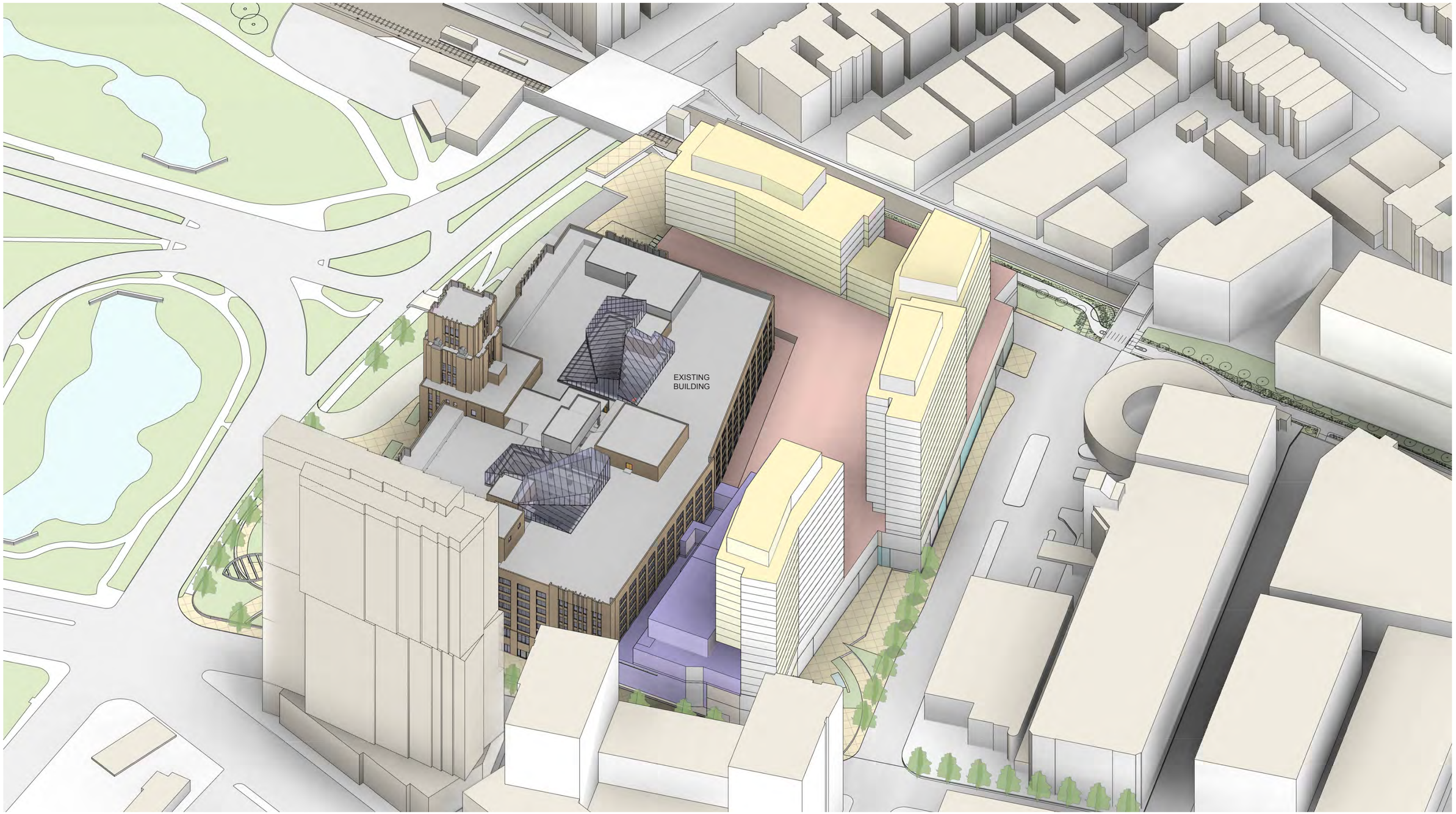

Figure 2.07a
Previously Approved Aerial View from Southeast

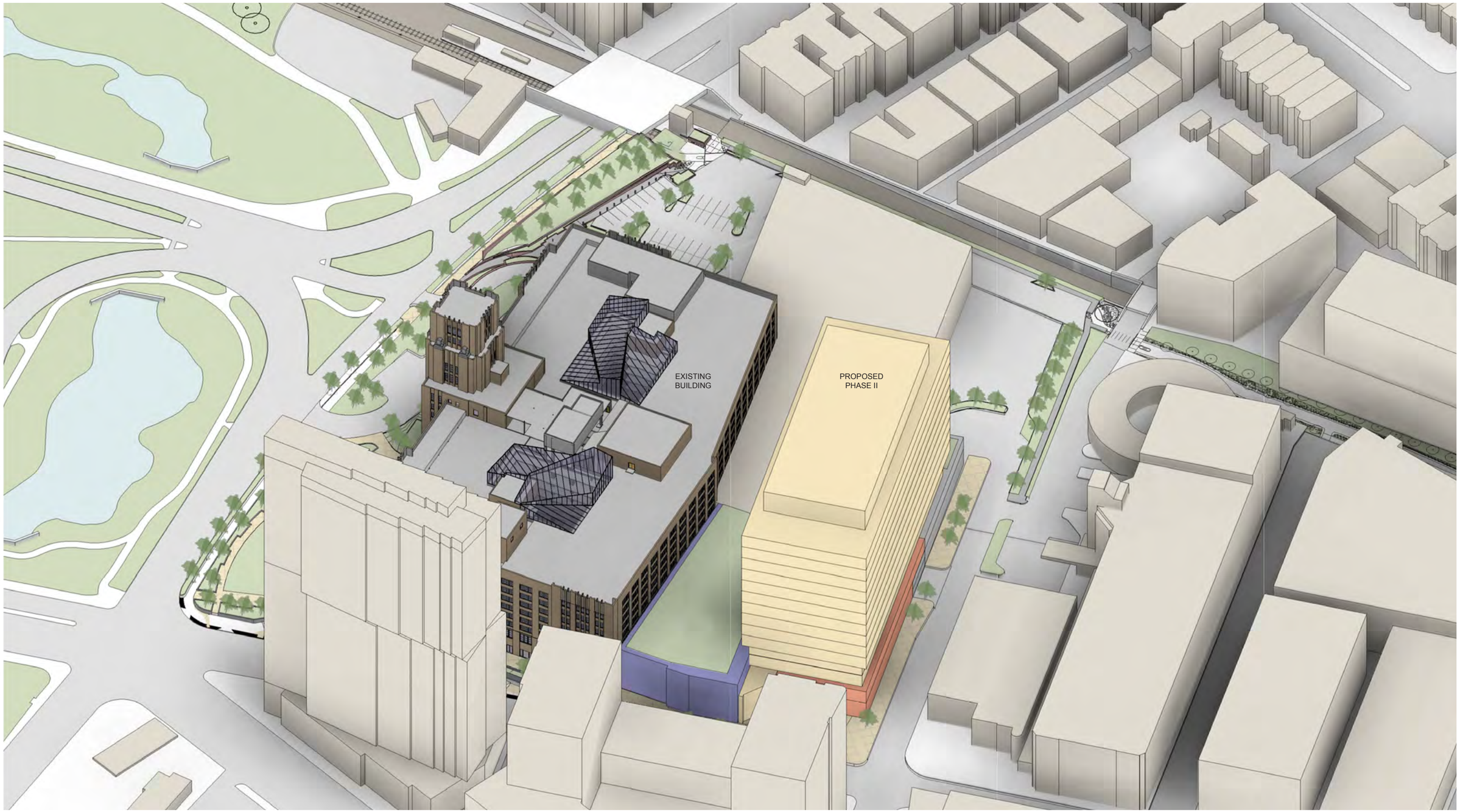

Figure 2.07b
Proposed Aerial View from Southeast

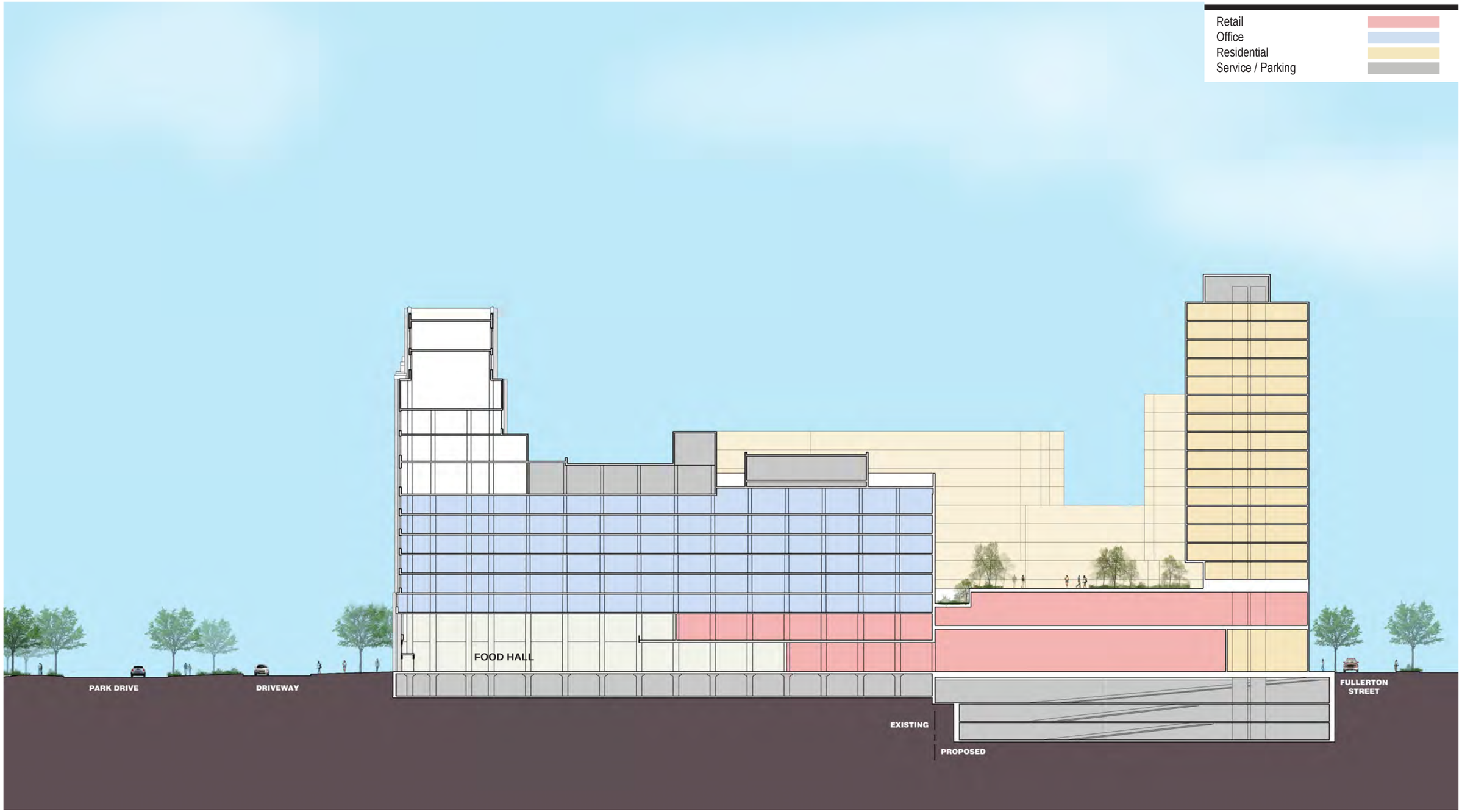

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Figure 2.08a
Previously Approved East-West Building Cross Section

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Figure 2.08b
Proposed East-West Building Cross Section

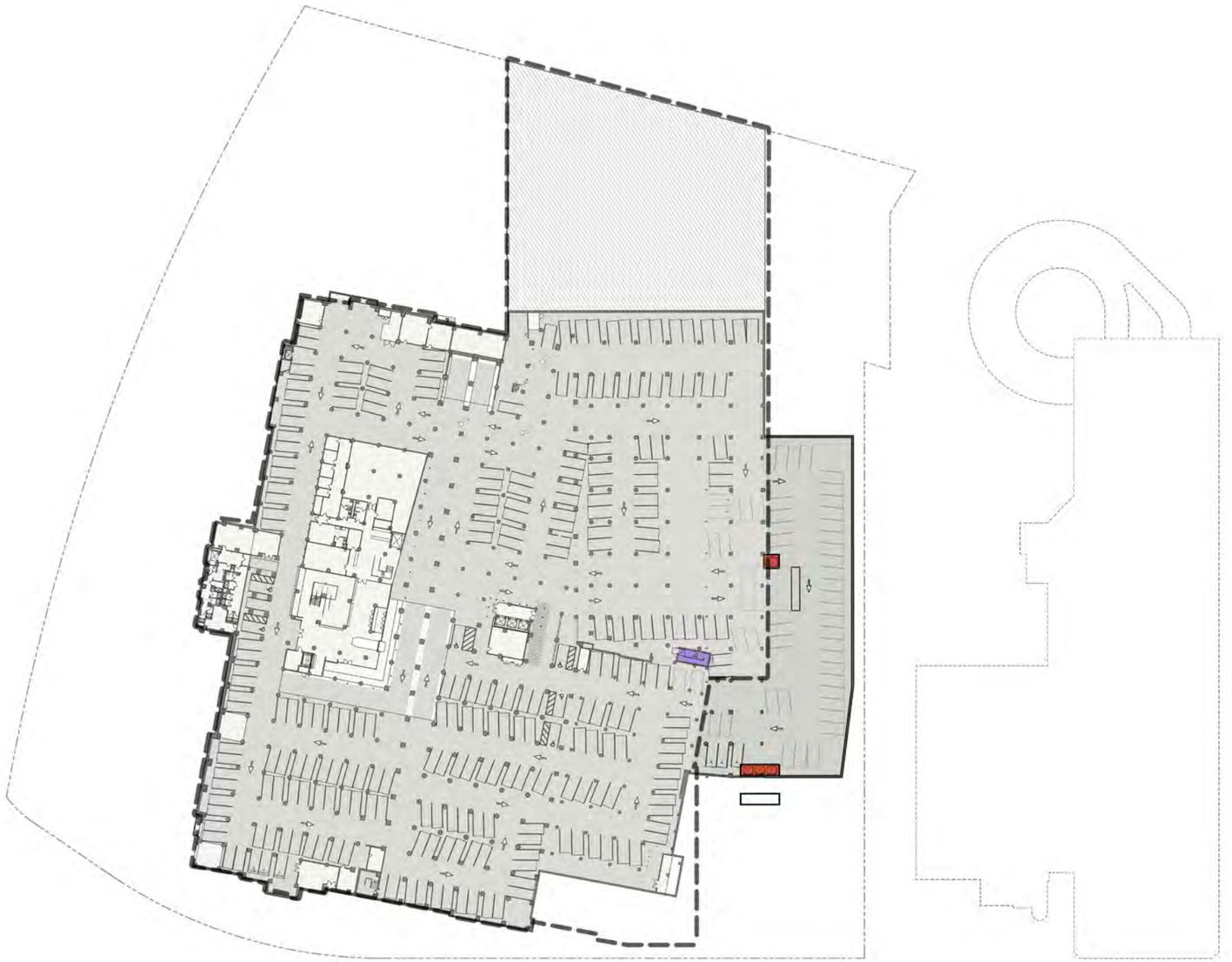

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Figure 2.09
Proposed Below Grade Parking Level P1

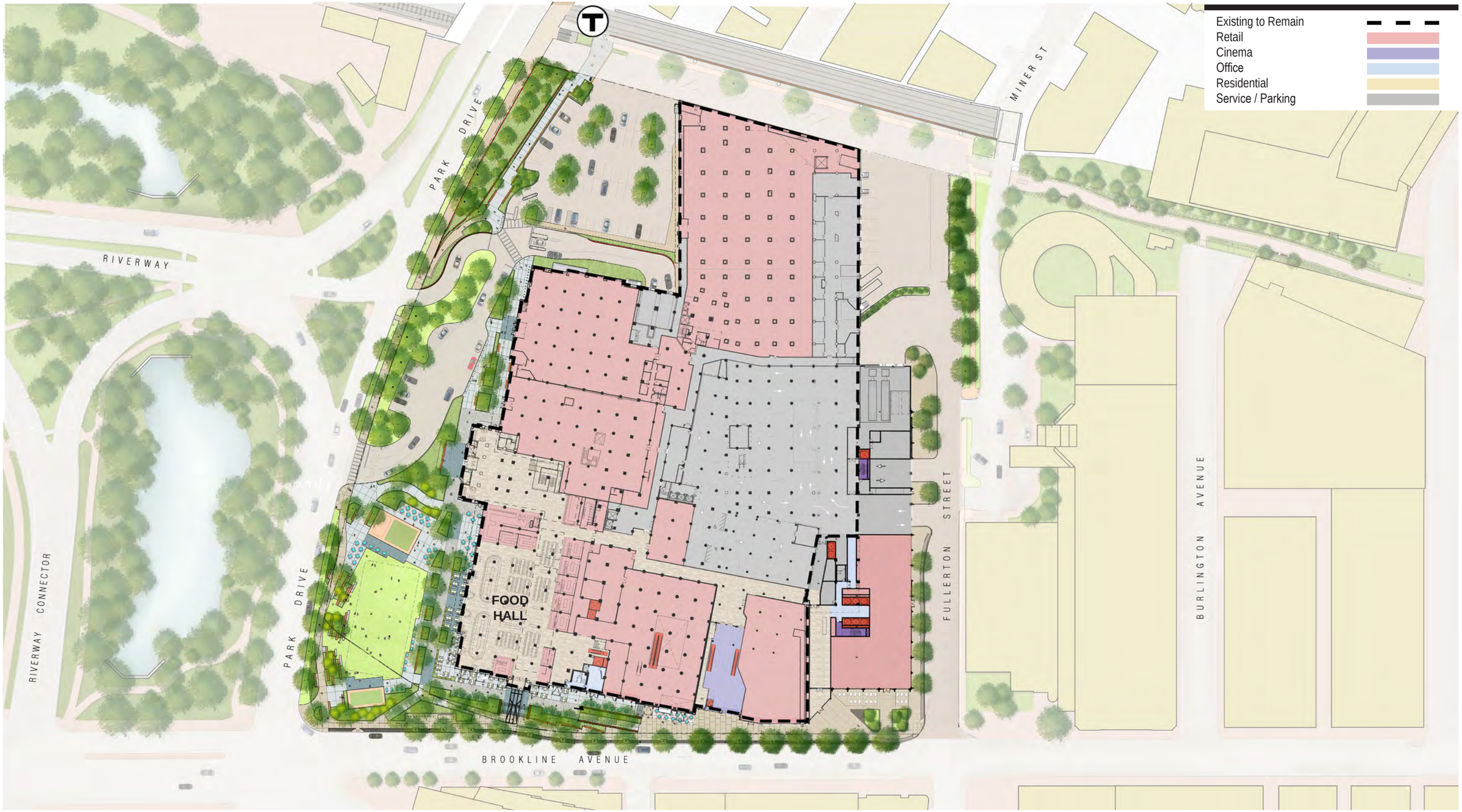

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Figure 2.10
Proposed Ground Floor Plan

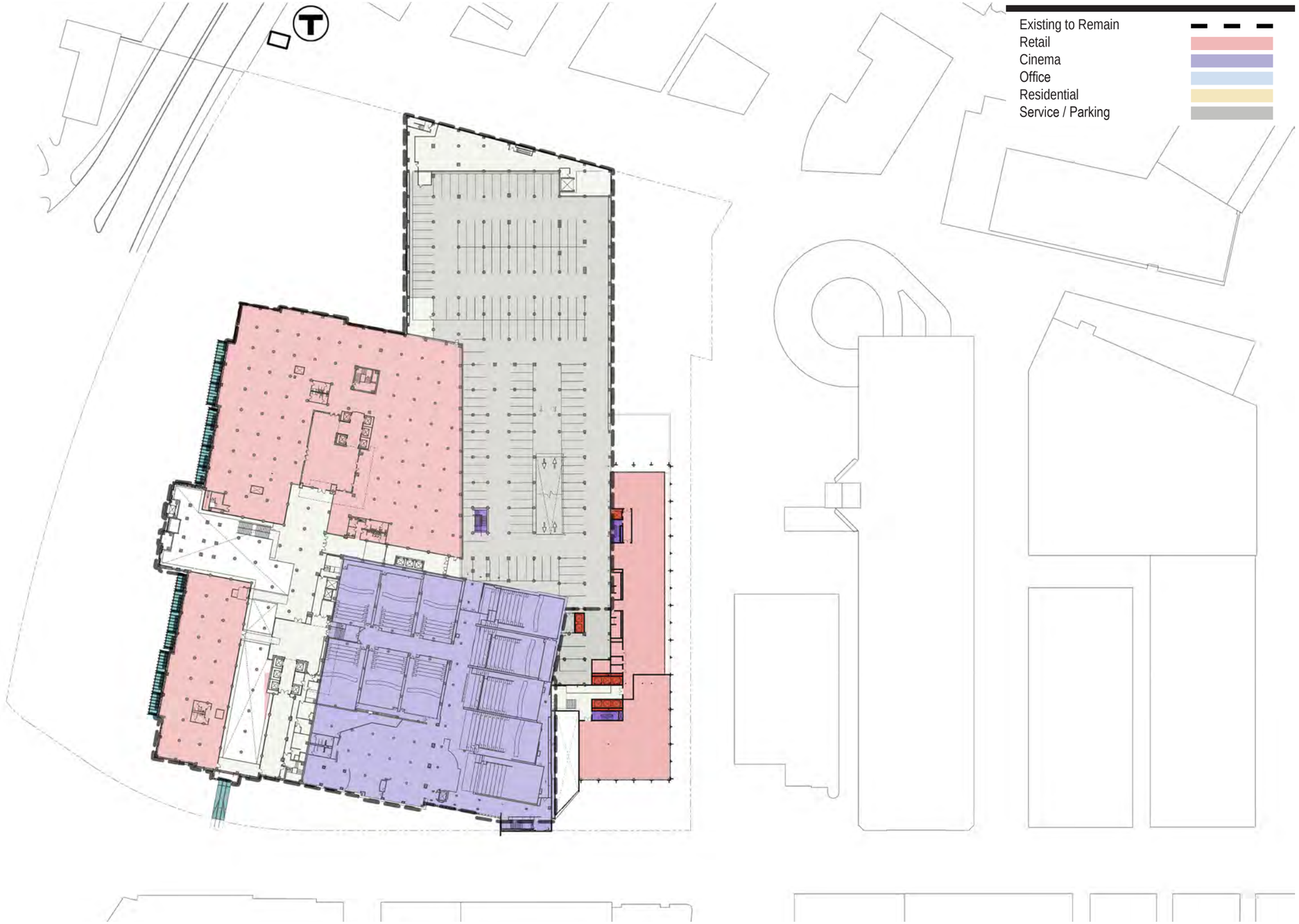

Figure 2.11
Proposed Level 2 Floor Plan

Figure 2.12
Proposed Level 4 Floor Plan

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Figure 2.13
Proposed Level 12 Floor Plan

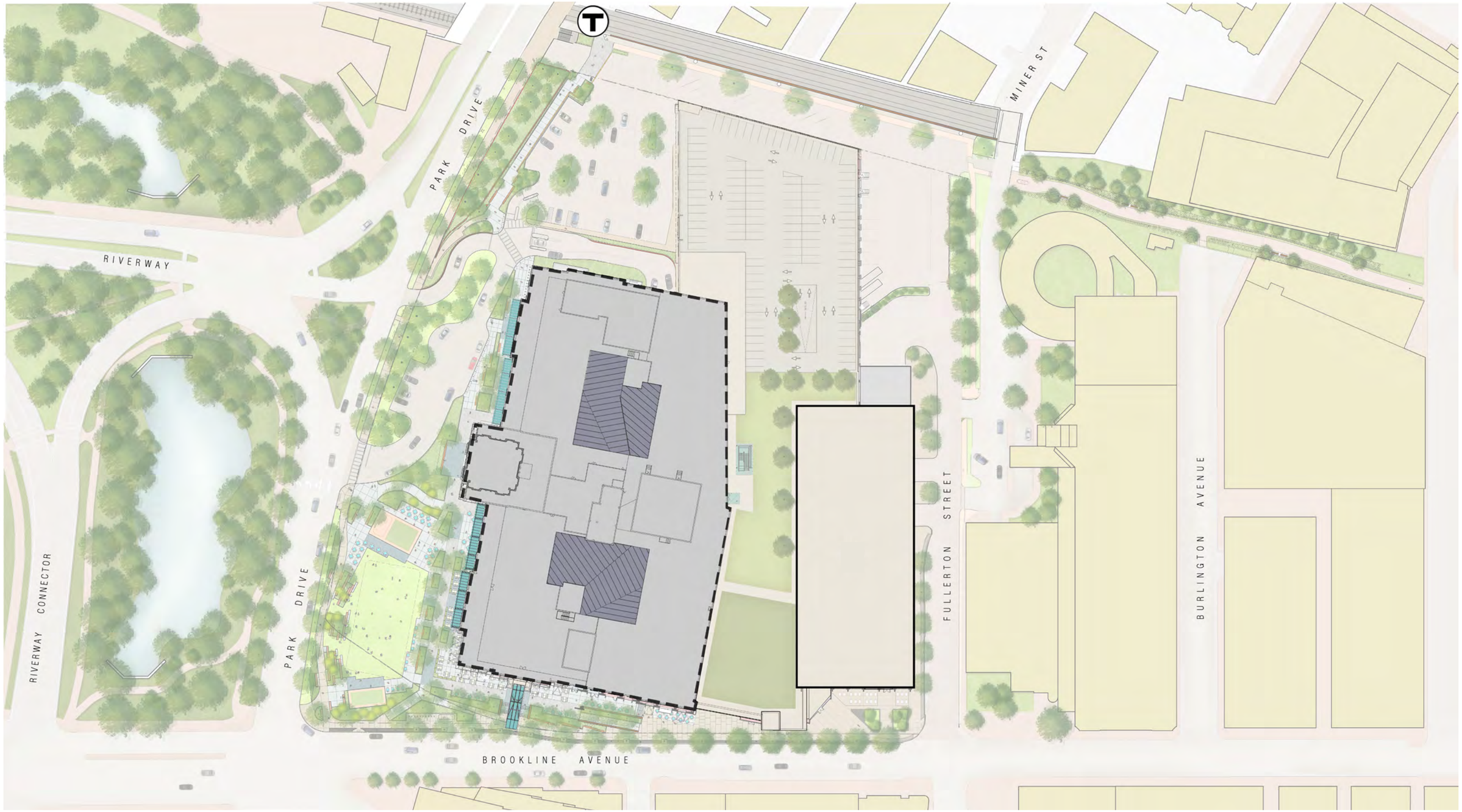

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Figure 2.14
Proposed Roof Plan

Figure 2.15a
Previously Approved Green Roof Plan (Level 3)

Figure 2.15b
Proposed Green Roof Plan (Level 3)

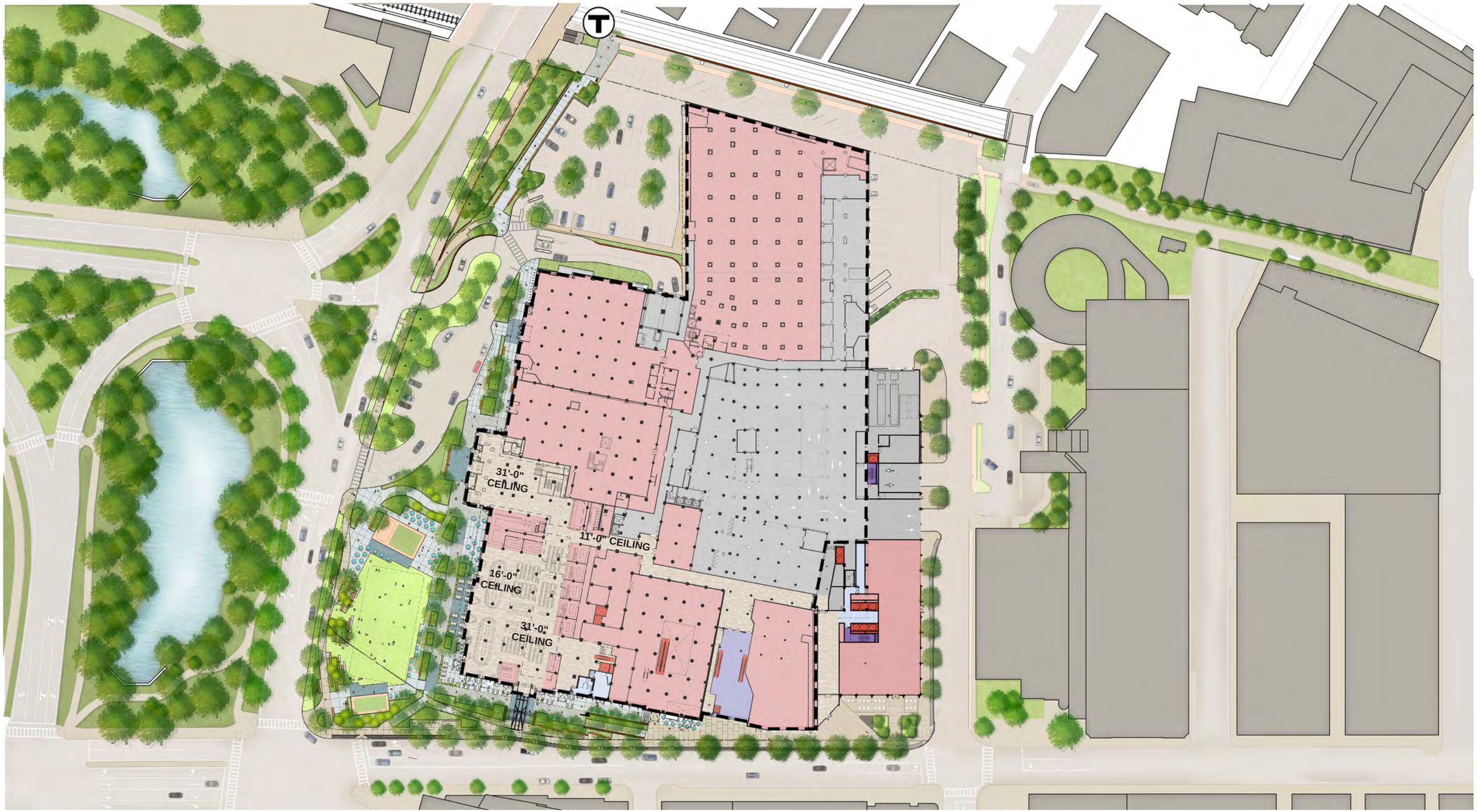

Figure 2.16
Proposed Level 1 – Concourse Ceiling Heights

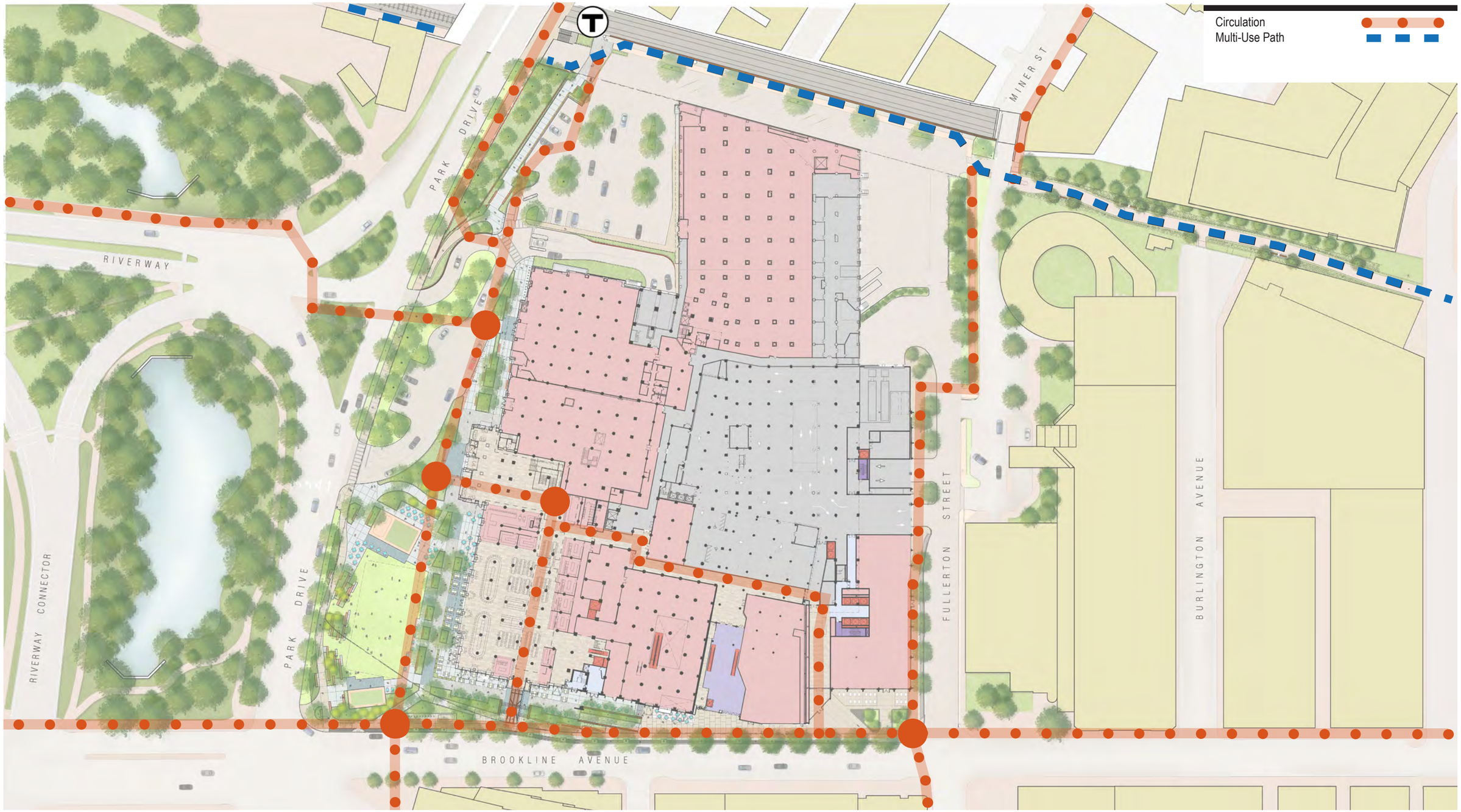

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Figure 2.17
Proposed Pedestrian Circulation Plan

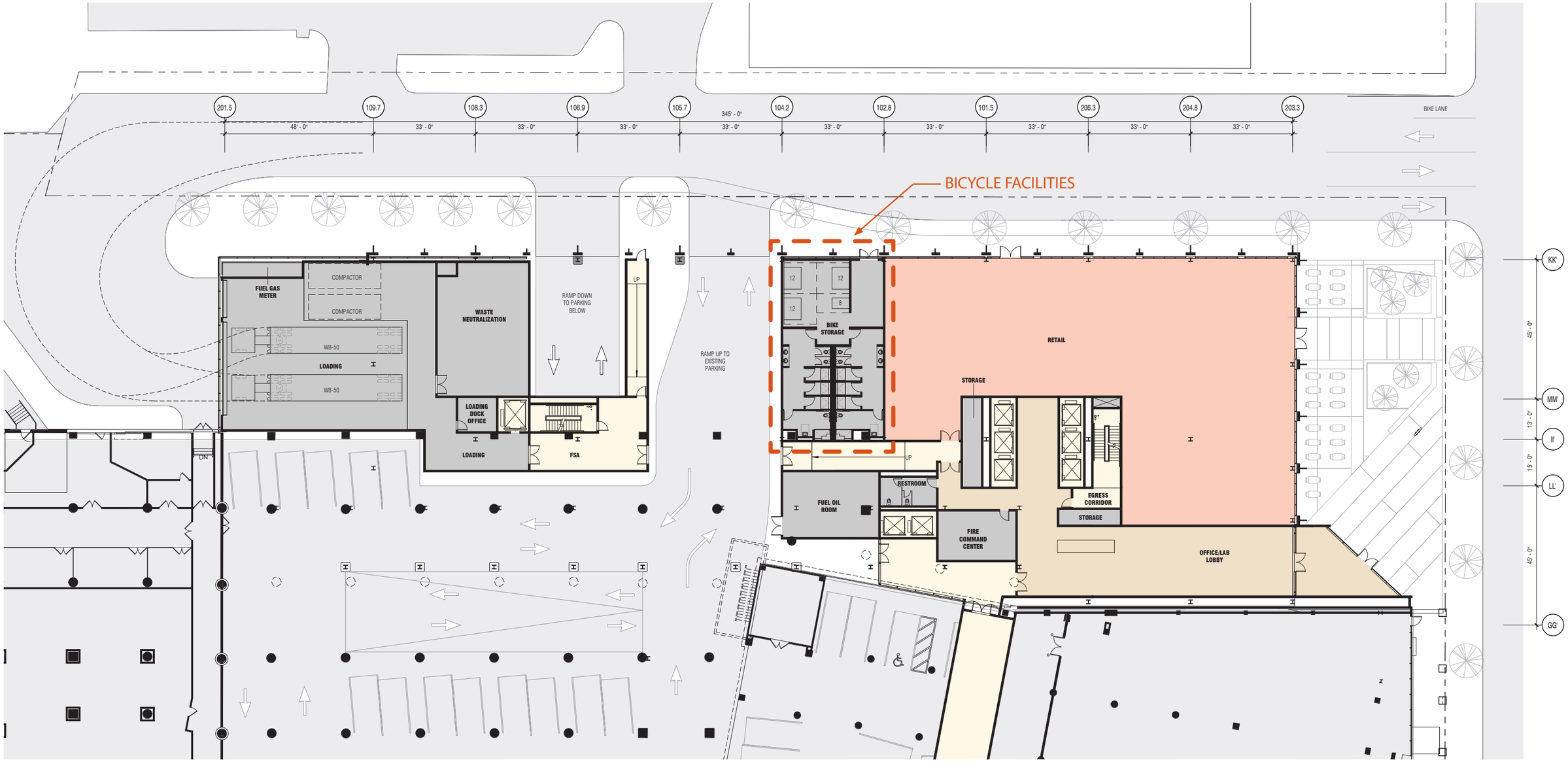

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Figure 2.18
Proposed Bicycle Facilities

3

Traffic and Transportation

This section provides an updated comparison of the forecast trip generation for the proposed redevelopment of the Landmark Center in Boston's Fenway neighborhood. The new trip generation estimates are based on the proposed Project program using the methodology established in the 2013 Expanded Project Notification Form (EPNF) filed with the Boston Redevelopment Authority (now the BPDA).

3.1 Key Findings

The key findings related to traffic and transportation include:

Impacts

- Due to the proposed changes, the Project is forecast to result in 1,747 fewer daily weekday trips than the previously approved project. It is forecast to result in a modest increase in morning peak hour trips (+73), and a small decrease in evening peak hour trips (-22).
- The significant overall reduction in trip generation by the Project leads to a high level of confidence that the findings of the previous transportation analyses are applicable to the proposed Project, and additional analysis is not necessary.

Mitigation

- The TAPA for Phase I outlines specific transportation commitments made by the Proponent to help improve conditions for pedestrians, bicyclists and motorists travelling to and around the Site, such as improving the site circulation by consolidating and simplifying the site driveways; providing major pedestrian improvements along the Site's Park Drive frontage; providing electrical vehicle charging stations and improved bicycle parking and storage; and implementing a Transportation Demand Management (TDM) plan to discourage single-occupancy vehicle trips.
- Phase I transportation mitigation actions will help mitigate the traffic impacts of Phase II.
- Phase II mitigation commitments include constructing roadway improvements at the intersection of Brookline Avenue with Fullerton and Kilmarnock streets that are aimed at reducing congestion, improving mobility and better accommodating pedestrians and cyclists

- The Proponent is committed to continuing its dialogue with the BTD to define and refine each of the specific actions that will be implemented as Part of Phase II, which will be included in an amended/updated TAPA with the BTD to codify the commitments.

3.2 Previously Approved Project

The previously approved project called for the addition of multiple building elements on the Project Site. The previously approved project would have maintained the existing original building and redeveloped the balance of the site with office, retail and residential uses. The program below was used for the trip generation analysis in the Landmark Center Redevelopment EPNF, and represented the future (2018) full build condition:

- Up to 600 residential units
- 75,000 square feet (sf) grocery use
- 386,200 sf retail use
- 617,340 sf office use
- Elimination of 500 off-site commuter parkers
- No new parking construction

This section of the NPC compares the trip generation forecasts of the previously approved project with those of the proposed Project to determine the effect the program change will have on daily and peak hour traffic generation.

3.3 Study Methodology

To assess the impact of the previously approved project, the 2013 trip generation estimates were forecast based on standard Institute of Transportation Engineers (ITE) rates shown in Table 3.1 below. These rates were then adjusted to account for the nearby availability of public transportation and bicycle/walk trips.

TABLE 3.1 TRIP GENERATION LAND USE CODES

Land Use	ITE Land Use Code (LUC)	Independent Variable
Residential	220 - Apartments	Dwelling Units
Retail	820 - Shopping Center	Square Feet
Grocery	850 - Supermarket	Square Feet
Office	710 - Office	Square Feet

Source: Institute of Transportation Engineers (ITE) Trip Generation, 9th Edition, Washington D.C. 2012

To account for alternative modes of transportation, mode shares for the Project area (based on BTD guidelines), were applied to the unadjusted ITE trip results. The Project falls within BTD

Area 4 (an area that includes the Fenway and Back Bay neighborhoods). Mode shares for Area 4, by land use are shown in Table 3.2 below.

TABLE 3.2 MODE SHARE – PEAK HOURS

Mode	Residential	Retail/Grocery	Office
Auto	21%	33%	37%
Transit	15%	31%	38%
Walk/Bike/Other	64%	36%	25%

Source: BTD Area 4 Trip Distribution

The vehicle occupancy rate (VOR) is the average number of people in a vehicle. For this analysis, the VOR for each land use was taken from the 2009 National Household Travel Survey. The vehicle occupancy rates were used to convert the unadjusted ITE vehicle trips into person trips, and then the local VOR was used in conjunction with the auto mode share to determine the project-generated, adjusted vehicle trips. For this analysis, it was assumed that the national VOR and local VOR were the same. The rates are shown in Table 3.3.

TABLE 3.3 2009 NATIONAL HOUSEHOLD TRAVEL SURVEY VEHICLE OCCUPANCY RATES

Land Use	Vehicle Occupancy Rate
Residential	1.2
Retail	1.8
Grocery	1.8
Office	1.2

Source: 2009 National Household Travel Survey

3.4 Proposed Project

Changes to the Project program described in this NPC result in the following:

- Residential units have been eliminated
- Reduction in grocery use to 45,000 sf from 75,000 sf[1]
- Reduction in retail use to 263,000 sf from 386,200 sf
- Increase in office use to 1,176,200 sf of office use (including 507,660 sf of new construction) from 705,000 sf
- Elimination of 500 off-site commuter parkers
- No new parking will be provided

[1] Grocery square footage may be repurposed to retail if necessary

3.4.1 Trip Generation

Using the same methodology as that used in the EPNF, a revised weekday trip generation analysis was conducted. To accurately show the number of new vehicles entering and exiting the Site, the EPNF analysis took credit for the existing land uses as well as the parking spaces that were leased to off-site users (i.e. commuters who do not work at the Landmark Center), and this step was repeated in the current analysis. Table 3.4 compares the impacts on trip generation of the previously approved project with those of the proposed Project.

TABLE 3.4 PROGRAM CHANGE TRIP GENERATION COMPARISON[1]

Time Period/ Direction	EPNF Forecast	Less Existing Landmark Trips	Less Existing Off-Site Parkers	EPNF Net New Forecast	Proposed Project Forecast	Less Existing Landmark Trips	Less Existing Off-Site Parkers	Proposed Project Net New Forecast	Net New Forecast Change
Daily (Total)									
Entering	4,990	-2,639	-500	1,851	4,116	-2,639	-500	977	-874
Exiting	4,990	-2,639	-500	1,851	4,116	-2,639	-500	977	-874
Total	9,980	-5,278	-1,000	3,702	8,232	-5,278	-1,000	1,954	-1,747
AM Peak Hour									
Entering	384	-299	-150	-65	509	-299	-150	60	125
Exiting	157	-62	-10	85	105	-62	-10	33	-52
Total	540	-360	-160	20	614	-360	-160	93	+73
PM Peak Hour									
Entering	353	-173	-11	168	254	-173	-11	70	-99
Exiting	521	-361	-137	23	598	-361	-137	100	77
Total	874	-535	-148	191	852	-535	-148	170	-22

[1] Numbers may not add up due to rounding

As Table 3.4 shows, the proposed Project results in 1,747 fewer daily weekday trips (874 entering, 874 exiting) than the previously approved project. During the morning peak hour, a modest increase of 73 trips is predicted, while during the evening peak hour, a small decrease of 22 trips is predicted.

3.5 Mitigation

In May, 2017 the Proponent completed negotiations with the Boston Transportation on the Project's Transportation Access Plan Agreement (TAPA) for Phase I of the Landmark Center Redevelopment. The TAPA outlines many specific transportation commitments made by the Proponent to help improve conditions for pedestrians, bicyclists and motorists travelling to and around the site. The commitments ranged from improving the site circulation by consolidating and simplifying the site driveways, and providing major pedestrian improvements along the Site's Park Drive frontage.

The Proponent has also committed to a set of mobility actions aimed at the tenants and users of the Site. These include a series to actions that include as providing electrical vehicle charging stations, providing improved bicycle parking and storage, and the implementation of a Transportation Demand Management (TDM) plan to discourage single-occupancy vehicle trips.

In the TAPA, the Proponent has also identified another broad set of important mitigation actions that will be implemented in the future, beyond Phase I. The specific actions involve additional improvements that will be constructed as Part of Phase II and future phases. They include the following:

- Widen Kilmarnock Street to help alleviate congestion on the northbound approach to Brookline Avenue.
- Widen Fullerton Street to improve vehicle turning movements at the intersection of Brookline Avenue/Kilmarnock Street/Fullerton Street.
- Provide on-street bicycle accommodations on Fullerton Street adjacent to the Site.
- Sponsor a second Hubway Station at the Landmark Center.
- Design and construct a portion of the City's planned multi-use path adjacent to the Site.
- Install a new traffic signal and pan-tilt-zoom (PTZ) camera at the intersection of Park Drive with Brookline Avenue and Boylston Street.
- Provide new sidewalks, streetlighting and street trees on Fullerton Street adjacent to the Site.

Many of these future transportation improvement actions listed above are considered to be a part of the current Phase II project. The Proponent will work closely with the BTD to update/amend the TAPA to define which actions shall be included as part of this phase. Both intersection improvements listed above will be a part of the Phase II and in particular, the Proponent will work closely with the BTD on developing the most appropriate final design for improving the intersection of Brookline Avenue at Fullerton and Kilmarnock streets.

3.6 Conclusion

The forecast daily trips resulting from the proposed Project will be substantially lower than those estimated to result from the previously approved program. The peak hour evaluation shows a modest increase in trip making over the previously approved program during the morning peak period, while a decrease is predicted for the evening peak hour. These changes are likely to have only a limited effect on the results of the traffic analysis included in the EPNF. Since the daily trip forecast based on the proposed Project is so much lower than what was estimated for the previously approved program, and because only the morning peak hour forecast is higher under the proposed Project, additional peak hour traffic analyses for the morning condition are unlikely to significantly change the findings of the previous analyses.

The many transportation mitigation actions already committed by the Proponent that are defined above will help mitigate the traffic impacts of Phase II. The Proponent is committed to continuing the dialogue with the BTD to define and refine the specific actions that will be implemented as Part of Phase II. Each of these additional commitments will be included in an amended/updated TAPA with the BTD to codify the commitments.

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Environmental Protection

This chapter presents information on the potential impacts to environmental conditions that may occur as a result of the proposed Project, as compared to those studied for the previously approved project. This chapter examines the impacts to the pedestrian wind environment, shadows, daylight, solar glare, green building commitments, water use, and wastewater generation. The proposed Project will have a substantially equivalent impact on air quality, water quality, flood hazard, groundwater/geotechnical conditions, solid and hazardous waste, noise, and drainage/stormwater management as the previously approved project, and therefore no additional analyses were conducted related to these topics.

4.1 Key Findings

Table 4.1 below highlights the key findings of the environmental impact analyses:

TABLE 4.1 IMPACT COMPARISON

	Previously Approved Impact	**Proposed Impact**
Pedestrian Wind	No Negative Impacts	No Change from Previously Approved
Shadow	No new shadow on Muddy River Restoration	Generally consistent with or better than Previously Approved
Daylight	Daylight obstruction most significant from Fullerton Street at 70.3%	Slightly increased from Approved at Fullerton Street to 73.1%
Solar Glare	No significant impact over existing conditions	No Change from Previously Approved
Air Quality	Complies with city, state, and federal air quality requirements.	No Change from Previously Approved
Water Quality	Complies with DEP Stormwater Management Policy and Standards, including phosphorous treatment	No Change from Previously Approved
Flood Hazard	Located in FEMA flood zone, but does not contain bordering land subject to flooding	No Change from Previously Approved

	Previously Approved Impact	Proposed Impact
Groundwater/ Geotech	Complies with GCOD/No significant impacts	No Change from Previously Approved
Solid & Hazardous Waste	Complies with MPC	No Change from Previously Approved
Noise	Imperceptible increase	No Change from Previously Approved
Green Building/ Sustainability	Retail: LEEDv3 Silver certified/Residential: LEEDv3 Gold certified	LEEDv3 Gold certified
	Meets the MA Stretch Code	Achieves a 10.4% site energy reduction in compliance with the MA Stretch Code.
Drainage/Stormwater Management	Reduced impervious surface, increased infiltration	No Change from Previously Approved
Water Use	241,867 gpd[a]	168,799 gpd (-30% gpd)
Wastewater Generation	219,879 gpd[a]	153,454 gpd (-30% gpd)

[a] Based on program as approved by BPDA Board
GCOD: Groundwater Conservation Overlay District
MCP: Massachusetts Contingency Plan
LEED: Leadership in Energy and Environmental Design
gpd: gallons per day

4.2 Wind

A pedestrian wind comfort study was conducted for the proposed new office/lab building to assess its effect on local conditions in pedestrian areas around the study site and provide recommendations for minimizing adverse effects. The methodology and No Build scenario used in the present study were identical to those used in the EPNF.

The study involved wind simulations on a 1:300 scale model of the proposed building and surroundings. These simulations were then conducted in RWDI's boundary-layer wind tunnel at Guelph, Ontario, for the purpose of quantifying local wind speed conditions and comparing to appropriate criteria for gauging wind comfort in pedestrian areas. The criteria recommended by the BPDA were used in this study. Appendix A describes the methods and presents the detailed results of the wind tunnel simulations. The following summary of pedestrian wind comfort is based on the annual winds for the Build Condition, which includes the existing site surroundings, proposed Project design, and planned buildings within the study locus.

4.2.1 Impacts and Mitigation

Despite the urban conditions and scale of the proposed Project, the overwhelming majority of studied locations experienced conditions that are generally comfortable for walking or standing, consistent with vision for the Project Site of creating a comfortable public realm.

With the addition of the proposed building and landscaping, along Brookline Avenue and Fullerton Street, winds at most off-site locations are expected to improve upon or remain similar to the No Build conditions on an annual basis. Wind speeds comfortable for sitting are predicted at the major entrances to the new building on Brookline Avenue. Wind speeds at other locations around the perimeter of the new building (at the sidewalk) are expected to be comfortable for walking or better on an annual basis. These conditions are considered appropriate for the intended use.

Winds at the northwest corner of the proposed building (at Fullerton Street) are predicted to be uncomfortable on an annual basis, similar to predicted conditions under the previously approved project. High wind activity at this corner is primarily due to the westerly winds that are accelerated at this corner. Reduced wind speeds can be achieved by including coniferous trees at the northwest corner of the proposed development, along Fullerton Street. Alternatively, vertical wind screens at least 6 ft. tall and 20 – 30% porous could be added in staggered arrangement at this corner to reduce the energy of the westerly winds.

The addition of the proposed building is expected to result in uncomfortable wind conditions at two new locations along Fullerton Street and Brookline Avenue (near the entrance to the cinema on Brookline Avenue), compared to the No Build configuration.

Many of the uncomfortable conditions predicted for the No Build configuration along Brookline Avenue and Boylston Street are improved under the Build condition; however, as under the previously approved project, the uncomfortable wind conditions at two locations along Brookline Avenue remain unchanged (the southwest corner of Brookline Avenue and Fullerton Street, and at the vehicular entrance to the service drive at the rear of the new Pierce building).

As with the previously approved project, the proposed Project creates a new public open space at the intersection of Fullerton Street and Brookline Avenue. The proposed wind conditions in this area range from sitting to standing, which supports the active pedestrian space planned here.

No dangerous wind conditions are predicted in the Build condition at any location.

With the addition of the proposed development, the effective gust exceedance at one location along Brookline Avenue remains similar to the No Build condition (the southwest corner of Brookline Avenue and Fullerton Street,). The exceedance of the effective gust criterion at three locations along Boylston Street are eliminated. Wind speeds at the northwest corner of the proposed building are also predicted to exceed the effective gust criterion during the winter.

4.3 Shadow

As to be expected when replacing a low-density, suburban-style development pattern with urban buildings of varying heights, the Project will result in new shadows on roads and sidewalks during various times of the year. The majority of new shadows are along the portions of the railroad right-of-way north of the Project Site and across Fullerton Street to the Harvard Vanguard service drive and parking entrance. There is no new shadow impact on the restored section of the Muddy River at the Sears Rotary or the Riverway section of the Emerald Necklace Park west of the Project Site.

The presence of these new shadows is consistent with the urban environment and planning objectives of the neighborhood, and when combined with the Proponent's proposed enhancements to the public realm in the area, are not likely to discourage the use of sidewalks or public areas in the vicinity of the Project Site. The shadow impacts are generally consistent with or better than previously approved.

4.3.1 Potential Effects

The following section describes the estimated shadows under the Approved and Proposed Conditions.

4.3.1.1 March 21

March 21 is the spring equinox on which Boston experiences roughly equal length day and night. The approved and proposed condition shadows for this condition are depicted on Figure 4.01a and 4.01b.

Approved

Under the approved condition, at 9:00 AM new shadows are cast northwest across Park Drive, the Fenway T-stop and onto the southernmost buildings of the Audubon neighborhood. By 12:00 PM, these new shadows withdraw from the neighborhood and begin to shade the Miner Street overpass and the Harvard Vanguard service drive and parking entrance. The Fullerton Street intersection at Brookline Avenue receives net new sunlight as a result of demolition to create the new plaza. At 3:00 PM, the shadows along the railroad right-of-way have mostly cleared off. New shadows are cast on the Harvard Vanguard main entrance and southeast façade. New sunlight continues to fall on Fullerton Street. At 6:00 PM, the Project continues to cast new shadows on Harvard Vanguard and on rooftops beyond to the east. There is new shadow on Van Ness street at the southeast corner of Fenway Park that would be overshadowed by any form of low-rise future development on the west side of Yawkey Way.

Proposed

Under the proposed condition, shadows are cast in a substantially similar manner to those cast under the approved condition as described above.

4.3.1.2 June 21

June 21 is the summer solstice with the longest day of the year and the smallest shadows expected. Figure 4.02a and 4.02b depicts the anticipated shadows cast by the approved and proposed conditions on June 21.

Approved

Under the approved condition, at 9:00 AM, the project casts minor new shadows on the Fenway T-stop, Park Drive overpass and railroad right-of-way. At 12:00 PM, the neighborhood is in sunlight, as the sun is very high in the sky and, therefore, very limited amounts of net new shadows fall on the railroad right-of-way and the Project side of Fullerton Street. At 3:00 PM, new shadow falls on the Harvard Vanguard service drive and a portion of the annex building. The Fullerton Street intersection at Brookline Avenue receives net new sunlight as a result of demolition to create the new plaza. By 6:00 PM, the sun is north of west and new shadows fall on the annex, Brookline Avenue, 132 Brookline and a portion of Van Ness Street at The Van Ness beyond.

Proposed

Under the proposed condition, at 9:00 AM, the approved project no new shadows are on the Fenway T-stop, Park Drive overpass or railroad right-of-way. For the remainder of the day, shadows are cast in a substantially similar manner to those cast under the approved condition as described above.

4.3.1.3 September 21

September 21 is the fall equinox where Boston experiences roughly equal length days and nights. The approved and proposed condition shadows are depicted on Figure 4.03a and 4.03b for this condition. In comparison to the spring equinox, the fall equinox shadows are somewhat shorter in the morning and somewhat longer in the afternoon at comparable times of the day.

Approved

Under the approved condition, at 9:00 AM new shadows are cast northwest across Park Drive, the Fenway T-stop and onto the roofs of southernmost buildings of the Audubon neighborhood. By 12:00 PM, these new shadows withdraw from the neighborhood and begin to shade the Miner Street overpass and the Harvard Vanguard service drive and parking entrance. New sunlight falls on Fullerton Street adjacent to the new plaza. At 3:00 PM, the

shadows along the railroad right-of-way have mostly cleared off. New shadows are cast on the Harvard Vanguard main entrance and southeast façade. New sunlight continues to fall on Fullerton Street. At 6:00PM the Project continues to cast new shadows on Harvard Vanguard and on rooftops beyond to the east. There is new shadow on Van Ness Street at the southeast corner of Fenway Park that may be overshadowed by even low-rise future development on the west side of Yawkey Way.

Proposed

Under the proposed condition, at 9:00 AM no new shadows are cast across Park Drive or the Fenway T-stopm and the shadows onto the roofs of southernmost buildings of the Audubon neighborhood are greatly diminished as compared to the approved condition. At 12:00 PM, the neighborhood and railroad right-of-way are in sunlight with shadows eliminated. Shadow impact on Fullerton Street is shifted primarily to the Harvard Vanguard parking garage and a portion of the annex building. New sunlight continues to fall on Fullerton Street adjacent to the new plaza. At 3:00 PM, shadows on Fullerton Street shift southeasterly with shadow predominately falling on the Harvard Vanguard entrance and a portion of the annex building. New sunlight falls adjacent to the new plaza on Brookline Avenue. At 6:00PM t shadows are diminished as compared to the approved condition, but new shadows continue to be cast on Harvard Vanguard and on rooftops beyond to the east. The new shadow continues on Van Ness Street at the southeast corner of Fenway Park, which may be overshadowed by even low-rise future development on the west side of Yawkey Way.

4.3.1.4 December 21

December 21 is the winter solstice and the shortest day of the year. Boston experiences long shadows throughout the day in most locations. The approved and proposed condition shadows for this condition are depicted on Figure 4.04a and 4.04b.

Approved

Under the approved condition, at 9:00 AM, new shadows are limited to rooftops and upper south facing façades of buildings in the Audubon Circle neighborhood north of the Landmark Center. By 12:00 PM, new shadows are cast north across the MBTA right-of-way down midblock alleys and streets in the neighborhood and across the bridge to Miner Street. The Harvard Vanguard service drive and parking ramp are also in shadow. At 3:00 PM, the sun is low in the sky and shadows cover most of the area north and east of the site. New shadows are cast on the railroad right-of-way, Harvard Vanguard and roof tops and sections of the proposed multi-use path beyond. The Brookline Avenue frontage comes out of shadow and the Park Drive frontage remains in full sunlight during this time.

Proposed

Under the proposed condition, at 9:00 AM, shadows are greatly reduced as compared to the approved condition, only affecting the block between Aberdeen Street and Minor Street rooftops and upper south facing façades of buildings in the Audubon Circle neighborhood north of the Landmark Center. At 12:00 PM, the neighborhood and railroad right-of-way are in sunlight with shadows eliminated. Shadow impact on Fullerton Street is shifted primarily to Harvard Vanguard service drive, entrance and a portion of the annex building. At 3:00 PM, the sun is low in the sky and shadows although diminished cover much of the area northeast of the site. The shadows cast on the railroad right-of-way under the approved condition are eliminated. Harvard Vanguard and roof tops continue to be affected, but additional shadows on sections of the proposed multi-use path beyond are eliminated. The Brookline Avenue frontage continues to come out of shadow and the Park Drive frontage remains in full sunlight during this time.

4.4 Daylight

This section describes the anticipated effect on daylight coverage at the Project Site as a result of the Project. An analysis of the obstruction of skyplane under the No-Build and Build Conditions is a requirement of the Article 80, Large Project Review (Section 80B-2(c) of the City of Boston Zoning Code). The daylight analysis was prepared using the BPDA's Daylight Analysis Program (BRADA) and has been completed in accordance with the requirements of Article 80. Figures 4.05a-c illustrate this analysis.

4.4.1 Methodology

The Project was analyzed using the BRADA and comparing the Existing/No-Build Condition and Build Condition using the same methodology as was used for the previously proposed project in earlier Article 80 filings. The following viewpoints were used for this daylight analysis:

- Park Drive – This viewpoint is located on the centerline of Park Drive, centered on the western façade of the existing Landmark Center.
- Brookline Avenue – This viewpoint is located on the centerline of Brookline Avenue, centered on the southern façade of the Project.
- Fullerton Street – This viewpoint is located on the centerline of Fullerton Street, centered on the eastern façade of the Project.

These points represent one viewpoint for each building façade when viewed from the adjacent pubic way, sidewalk or property line, as appropriate.

4.4.2 Daylight Existing/No-Build Conditions

The Existing/No-Build daylight conditions are identical to those presented in the previous Article 80 findings. Under the Existing/No-Build Condition, about one quarter, or 23 percent, of the Project Site's skyplane is obstructed along Park Drive due to the setback of the existing Landmark Center building (Figure 4.05a). Along Brookline Avenue, more of the skyplane is obstructed (40.4 percent) compared to Park Drive because the buildings are not set back along this site frontage (Figure 4.05b). Fullerton Street has just over one quarter, or 28.2 percent, of obstructed skyplane due to the existing garage structure and back-of-house service/loading areas currently fronting this street (Figure 4.05c).

4.4.3 Daylight Build Conditions

The changes to daylight conditions as a result of the Project are also presented in Figures 4.05a-c. Under the Build Condition, the amount of skyplane obstruction along Park Drive will remain essentially unchanged because the existing Landmark Center building, which is closest to the property limits, is not being changed and the new building is significantly set back from Park Drive. Along Brookline Avenue, the amount of skyplane obstruction decreases slightly (by 4.0 percent) because the proposed building is further away from the analysis point than the existing building. The highest amount of skyplane obstruction is projected along Fullerton Street (from 32.5 percent to 73.1 percent) due to the increased building height. This effect is to be expected and cannot be avoided when facing a low-rise building (the parking garage) with a much taller building (the proposed office/lab building). The Project is consistent with the planning goals for the Fenway neighborhood (e.g., mixed-use development of higher densities than what currently exists). The desired density and massing of the Project necessitates obstructing a portion of the skyplane views at the Project Site.

The proposed mixed-use nature of the Project will, by design, build on and increase the pedestrian activity generated by recent mixed-use projects along the adjacent sidewalks of Park Drive and Brookline Avenue, and will help transform Fullerton Street into a vibrant urban street by establishing street walls with new buildings and providing for generous sidewalks that will accommodate an activated pedestrian realm and streetscape. The net effect of the Project will be a substantial improvement of the public realm in this area.

4.4.4 Impact Summary

The Project will change the view of the skyplane from the adjacent streets and sidewalks. From two of the three studied viewpoints, the skyplane obstruction remains the same or is increased only slightly (Park Drive and Brookline Avenue, respectively). The skyplane obstruction will be greater along Fullerton Street, which is to be expected when shielding a low-level parking garage with a high-rise office building. The proposed mixed-use nature of the Project will, by design, increase the foot traffic along the adjacent sidewalks and through the Project Site substantially and improve the pedestrian enjoyment of the urban experience in this area.

Additionally, Fullerton Street will be transformed into a vibrant urban street by establishing street walls with new buildings and providing for generous sidewalks that accommodate an activated pedestrian realm and streetscape; thereby, mitigating impacts to daylight.

4.5 Solar Glare

A solar glare study was conducted using propriety software to assess the visual glare impacts of the Project on drivers, pedestrians, and facades, as well as the thermal impacts from glare. As with any modern building, the proposed office building will naturally create reflections within its surroundings. However, the design of the building, including the planar nature of the facades and the low visible reflectance of the glazing, will act to reduce the severity and frequency of the impacts in the surrounding area, as described in the subsections below. The solar glare study is included in its entirety in Appendix B.

4.5.1 Visual Glare Impacts for Drivers

Reflection impacts are generally predicted to be moderate to low for drivers in the area. Some high impact reflections are noted to occur, particularly along Miner and Fullerton Streets, however these impacts are expected to be generally short in duration, infrequent and/or occur early in the morning when road traffic levels are lower. This reduces the impact they will have on drivers.

4.5.2 Visual Glare Impacts for Pedestrians and Facades

Moderate levels of visual impact fall on all of the pedestrian and facade receptors in the surrounding neighborhood throughout the year. This is expected to occur most often on the skylights and northeast facade of the existing Landmark Center building. Visible reflections may also occur on adjacent buildings (e.g. 180 Brookline Avenue and the Harvard Vanguard Medical Associates Building). These reflections would likely be considered at worst a nuisance, which can be remedied with interior shading devices. Most impacts on the surrounding buildings occur only in the morning hours.

4.5.3 Thermal Impacts from Glare

The planar facades of the proposed development have been designed so that reflected sunlight will not focus (multiply) in any particular area. Therefore, no significant thermal impacts (i.e. risks to human safety or property damage) are expected to occur.

4.5.4 Mitigation

Based on the findings of the solar glare study, the reflections emanating from the proposed Project onto the surrounding neighborhood are comparable to reflections elsewhere in the city and are not likely to require mitigation.

4.6 Green Building/Sustainability

This section provides an overview of the sustainable design elements proposed as part of the Project and demonstrates how the new construction would meet the requirements of Article 37 of the Boston Zoning Code relative to the City's Green Building policies and procedures. It also demonstrates compliance with the Massachusetts Stretch Energy Code and addresses resiliency to climate change.

The Proponent continues to be deeply committed to building a livable, sustainable community in the Fenway. The proposed mixed-use, transit-oriented development aims to revitalize an underutilized urban site by using land efficiently, promoting the use of alternative modes of transportation, encouraging pedestrian activity, and improving air and water quality. The design team will continue to use the USGBC's LEED rating system as a model for incorporating sustainable design strategies into the Project with the goal of designing the new office/lab building to be LEEDv3 Gold certified.

4.6.1 Sustainable Design Features

As part of the work associated with the Project outlined in the 2013 EPNF the Project was registered with the USGBC in March 2014 under the LEED version 3/09 rating system (LEEDv3). This includes the Landmark Center campus Master Site (USGBC Project ID: 1000040632) and LEED-CS application (USGBC Project ID: 1000040807). The team intends to pursue formal LEED certification under the 2009 LEED for Core & Shell (CS) v09/3 rating system. Additionally, LEED-CSv09/3 will be used to demonstrate Article 37 compliance since the first substantive filing associated with the Project was submitted to the BPDA prior to November 1, 2016, after which date rating system requirements changed.

4.6.1.1 Overview of Potential Sustainable Design Features

The following is an outline of sustainable design features being evaluated for inclusion in the Project. This outline is organized based on the categories described by the LEED-CS v09/3 rating system. This outline is intended to demonstrate the Proponent's commitment to sustainability, rather than to precisely describe how the Project would score under the rating system, due to the fact that the level of design required to determine compliance with most of the LEED credits has not yet been achieved. The Project will comply with all LEED Prerequisites required to be eligible for LEED certification. The preliminary LEED-CS scorecard for the new construction is included as Figure 4.06 This scorecard considers those points marked as 'yes' and 'maybe' as points most likely to contribute to the goal of achieving a Gold rating level, based on the Proponent's past experience with designing and constructing LEED buildings.

LEED-CS Sustainable Sites (SS) Credits

Sustainability is a core element of the Project, and is grounded in both its mixed-use program and its location, which is in direct proximity to a major regional employment center and a variety of mass transit options. The majority of office and retail workers and customers are expected to use alternative means of transportation to reach the Site.

The Project design includes features that will complement the inherently sustainable location and development program. The Project includes structured parking, which conserves land area, protects stormwater, and enables development density to be clustered near transit.

The Project will incorporate stormwater management and treatment systems that will improve water quality, reduce runoff volume and control peak rates of runoff in comparison to existing conditions. The current design anticipates the inclusion of a stormwater infiltration system designed to accommodate a volume of one inch of stormwater over the Project Site impervious area.

The following is a list of anticipated Sustainable Sites LEED credits that may be achieved and the associated design features that could be implemented:

- SS Prerequisite 1 – Construction Activity Pollution Prevention. The Construction Manager will compile and submit an Erosion and Sedimentation Control (ESC) Plan for construction activities related to the demolition of existing and the construction of new buildings specific to this Project. The ESC Plan will conform to the erosion and sedimentation requirements of the EPA Construction General Permit.
- SS Credit 1 – Site Selection. The Project is on land that is currently developed.
- SS Credit 2 – Development Density and Community Connectivity. The Project is on a previously developed site in a dense urban residential neighborhood. The surrounding neighborhood includes an extensive array of attractions and services. The Project will qualify for Exemplary performance in this credit (IDc.1).
- SS Credit 3 – Brownfield Redevelopment. The Project Site will be remediated in an environmentally responsive manner. Environmental contaminants in buildings to be demolished (asbestos, mercury, etc.) will be abated in compliance with applicable regulations.
- SS Credit 4.1 – Alternative Transportation – Public Transportation Access. The Project is located adjacent to the Yawkey commuter rail station and within one-half mile of the Fenway and Kenmore MBTA light rail/subway stations and is The Project is also located within one-quarter mile of 8 MBTA bus lines. The Project is eligible for an Exemplary Performance Innovation in Design credit for providing more than 200 rides per day.
- SS Credit 4.2 – Alternative Transportation – Bicycle Storage and Changing Rooms. Appropriate Bicycle Storage facilities will be provided to encourage cycling as an alternate

form of transportation. The building will include showering facilities to meet the percentage required to satisfy the credit.

- SS Credit 4.3 – Alternative Transportation – Low-emission and Fuel Efficient Vehicles. The Project parking facility may include designated preferred parking for low-emitting and fuel efficient vehicles.
- SS Credit 4.4 – Alternative Transportation – Parking Capacity. The Project will not increase on-site parking.
- SS Credit 6.1 –Stormwater Design – Quantity Control. The Project will incorporate stormwater management and treatment systems that will improve water quality, reduce runoff volume and control peak rates of runoff in comparison to existing conditions
- SS Credit 6.2 –Stormwater Design – Quality Control. The Project's stormwater infiltration system is anticipated to capture and treat a significant amount of stormwater runoff (preliminary figures indicate 90% of the average annual rainfall).
- SS Credit 7.1 – Heat Island Effect – Non Roof. All proposed parking (100 percent) will be located under cover, in structured parking garages, which has several environmental benefits, including reducing heat island effects.
- SS Credit 7.2 – Heat Island Effect – Non Roof. A significant portion of the new Project roof area that is non-vegetated is anticipated to have an SRI greater than 78 (highly reflective roof), further reducing heat island effects.
- SS Credit 9 – Tenant Design & Construction Guidelines. The Proponent will include the development of guidelines to educate the tenants about implementing sustainable design and construction features in their tenant improvement build outs.

LEED-CS Water Efficiency (WE) Credits

The Project will incorporate measures to conserve water use both by building occupants and landscape features. The landscape design will include the appropriate use of indigenous plants and a high-efficiency irrigation system will reduce water use for irrigation (WE Credit 1). Low-flow plumbing fixtures will be selected for the Project to reduce the overall domestic water use by an anticipated 30% when compared with a baseline (WE Credit 3).

LEED-CS Energy and Atmosphere (EA) Credits

The Project will be designed to optimize building energy performance (EA Credit 1) by utilizing high efficiency building systems, where feasible and reasonable, and an enhanced independent building commissioning process (EA Credit 3). As described in Section 4.6.2 below, energy conservation is a local requirement and will be a critical focus of the design team. The building performance for the new portions of the Project will demonstrate, at a minimum, a 10% improvement in energy use when compared to a baseline building performance, as calculated using the rating method in Appendix G of ANSI/ASHREA/IESNA

Standard 90.1-2013. The design team will develop a whole-building energy model to demonstrate the expected performance rating of the designed building systems. Energy modeling results will be used in an iterative fashion to influence the design of the building façade and roof, and the selection of mechanical equipment and lighting. A state-of-the-art building management system, reflective roofs that reduce cooling loads of the building's HVAC system, and interior lighting control systems in all base building occupied areas are anticipated measures that will significantly reduce energy consumption. Additionally, through operations, Tenant Guidelines will be developed to encourage tenants to employ an interior lighting control system with occupancy sensors and that may use less power per square foot than a customary office environment. Tenants will also be encouraged to include provisions for turning off lighting in spaces when not occupied (at night).

In addition to achieving various points under EA Credit 1 – Optimize Energy Performance, the following is a list of anticipated Energy and Atmosphere LEED credits that may be achieved and the associated design features that could be implemented:

- EA Credit 2 - On-Site Renewable Energy. The Proponent will explore including renewable energy sources into the building, including solar photovoltaic panels. However, given the currently proposed design, which includes rooftop mechanical and electrical equipment, the amount of available roof space for a sufficient solar panel system will be limited.
- EA Credit 5.1 – Measurement & Verification – Base Building. The Project will be eligible for one point under this credit for creating an ENERGY STAR Portfolio Manager account to enable the USGBC to review whole building energy and water use for five years after occupancy, required as part of satisfying the LEED Minimum Program Requirement #6. The Proponent will evaluate developing a formal Measurement and Verification plan.
- EA Credit 5.2 – Measurement & Verification – Tenant Submetering. The Project will include a centrally monitored electronic metering network in the base building design that is capable of being expanded to accommodate the future tenant sub-metering, and an M&V plan will be developed by the Proponent outlining the metering arrangement.

LEED-CS Materials and Resources (MR) Credits

Building occupant waste recycling will be encouraged by implementing a building recycling program and facility. A demolition and construction waste management plan will be implemented during construction to divert at least 75% of waste material from landfills. Building materials will contain recycled content and materials from the local region will be used. The following is a list of anticipated Materials and Resources LEED credits that may be achieved and the associated design features that could be implemented:

- MR Credits 2.2- Construction Waste Management. It is anticipated that over 75% of the non-hazardous construction and demolition debris will be salvaged or recycled.

- Recycled Content (MR Credits 4.1, 4.2). The Project design is expected to include the use of materials with recycled content such that the sum of post-consumer plus one-half of the pre-consumer content constitutes at least 10% of the total value of materials used in the base building.
- Regional Materials (MR Credits 5.1, 5.2). The Project design will explore using regionally sourced and manufactured materials (i.e., within 500 miles of the Project Site) where appropriate.
- Certified Wood (MR Credit 6). Project Specifications will explore the cost and availability of using wood building components that are certified in accordance with the Forest Stewardship Council's principles and criteria.

LEED-CS Indoor Environmental Quality (IEQ) Credits

The comfort and well-being of the building occupants will be paramount in regard to air quality, access to daylight and outside views and an indoor air quality management plan will be implemented during construction to enhance the wellbeing of construction workers and building occupants. Low-emitting materials, finishes, adhesives and sealants, will be employed through-out the building to reduce the quantity of indoor air contaminants, and promote the comfort and well-being of installers and building occupants. The following is a list of anticipated Indoor Environmental Quality (IEQ) LEED credits that may be achieved and the associated design features that could be implemented:

- IEQ Credit 3 – Construction IAQ Management Plan, During Construction. Project specifications will include provisions for ensuring that procedures will be in place during the construction phase that will protect indoor air quality.
- IEQ Credits 4.1, 4.2, 4.3, 4.4 - Low-Emitting Materials. The Project specifications are expected to include low-emitting materials. The Construction Manager will be required to track products used to ensure compliance.
- IEQ Credit 7 – Thermal Comfort – Design. The Project design is expected to comply with ASHRAE Standard 55-2004.
- IEQ Credit 8.2 – Daylight and Views – Views for 90%. Portions of the office component of the Project will include sight lines to the outdoor environment. The retail component will be designed to enhance daylighting and views to the extent practicable.

LEED-CS Innovation in Design (ID) Credits

The following is a list of anticipated Innovation in Design (ID) LEED credits that may be achieved and the associated design features that could be implemented:

- ID Credit 1.1 – Exemplary Performance within Sustainable Sites – Public Transportation Access. The Project Site location can be accessed from an extensive number of shuttle,

bus, light rail, subway and commuter rail lines. The Project is eligible for an Exemplary Performance Innovation in Design credit for providing more than 200 rides per day.

- ID Credit 1.2 – Exemplary Performance within Sustainable Sites – Development Density. The Project Site is located in a dense and vibrant neighborhood that far exceeds the LEED requirements of SS Credit 2.
- ID Credit 1.3 – Exemplary Performance within Sustainable Sites – Heat Island Effect– Non Roof. The Project will include 100% structured parking and an enclosed loading dock area. By eliminating exterior site parking and loading, the Project eliminates a considerable source of heat island effect as well as stormwater runoff pollution.
- ID Credit 2 - LEED Accredited Professional. The Project team brings a wealth of experience with projects requiring a high level of sustainability and energy efficiency. The design team for the Project includes several LEED Accredited Professionals (AP), including the Sustainability Consultant, Erik Ruoff, Senior Project Manager with The Green Engineer.

LEED-CS Regional Priority Credits

The concept of Regional Priority Credits (RPCs) was introduced in the LEED 2009 rating systems to incentivize the achievement of credits that address geographically specific environmental priorities. RPCs are not new LEED credits, but are existing credits that USGBC chapters and regional councils have designated as being particularly important for their areas and are achieved in the form of a bonus point. The RPCs that may be achievable for the Project are as follows:

- SSc3: Brownfield Redevelopment
- SSc6.1: Stormwater Design Quantity Control
- SSc7.1: Heat Island Effect, Non-Roof
- SSc7.2: Heat Island Effect, Roof

LEED-Existing Building: Operations & Maintenance Certification

Since taking ownership of the property in 2011, the Proponent has endeavored to improve the existing Landmark Center building's performance and reduce its environmental footprint. Landmark Center earned LEED-EBOM Gold certification in August 2014. While not required as part of Article 80, the Proponent has invested heavily in maintaining and operating the existing Landmark Center as an energy efficient and sustainable building. The Proponent has also worked to educate new and existing tenants of the importance of conserving energy and water. The Proponent has installed metering systems and structured leases to provide tenants with an incentive to conserve utilities, and with support from building management, this has resulted in collaborative frameworks where landlord and tenant work together to make respective improvements. The Proponent is currently performing detailed engineering studies for energy efficiency projects and implementation of best green practices in the operation of the facility.

The key to the success of projects seeking LEED-EBOM certification is an integrative, iterative, multi-disciplinary approach. Sustainability has become a core value shared by the entire Project team and it informs work across all disciplines. Metrics, such as LEED and ENERGY STAR, are incorporated not as an end unto themselves, but as tools that can be implemented to achieve energy performance goals.

4.6.2 Massachusetts Stretch Energy Code

The Project includes new retail, office and lab space. To comply with the minimum energy requirements of the Massachusetts Stretch Energy code, the design must achieve at least 10% energy savings relative to ASHRAE 90.1-2013 Appendix G.[1] Energy modeling was performed for the Proposed Project using eQUEST v3.65 energy simulation software. The results are based on the most current available design documentation as of 6/15/2017. As the design is in progress, these results are subject to change until the final models are complete at the 100% construction design phase.

The design achieves a 10.4% site energy reduction relative to ASHRAE 90.1-2013 and meets the MA Stretch Code. The results are summarized in Table 4.2 below. The detailed results of the energy model can be found in Appendix C.

TABLE 4.2 IMPACT COMPARISON

Proposed Design	Annual Energy Use (MMBtu)	Annual Energy Cost ($)	EUI (kBtu/SF)	Site Energy Savings vs ASHRAE 90.1-2013
Baseline (ASHRAE 90.1-2013)	55,620	$1,651,938	114.9	--
Proposed Design	49,792	$1,541,989	102.9	10.4%

4.6.3 Climate Change Resiliency

The Project was designed with future climate conditions in mind, including more extreme weather events such as higher year-round average temperatures, higher peak temperatures, more periods of extended peak temperatures, more rainfall and higher intensity rain fall. A Climate Resiliency Checklist detailing these considerations is included in Appendix D.

4.7 Water Use

Domestic water demand is based on estimated sewage generation with an added factor of 10 percent for consumption, system losses, and other use. Based upon standard sewage generation rates outlined in the DEP System Sewage Flow Design Criteria, 310 CMR 15.203, the

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[1] The Previously Approved Project was designed to meet the requirements of the version of the Stretch Energy Code that was in effect at the time of design by reducing the use of energy in the building by a minimum of 20 percent above and beyond the requirements of ASHRAE 90.1-2007, Appendix G.

Project will require approximately 168,799 gallons of water per day, which is a 30% decrease from the previously approved Projects estimated water use of 241,867 gpd.

The Proponent will continue to consider and evaluate methods to conserve water as building design evolves. New water connections will be designed in accordance with BWSC design standards and requirements. Water services to the new building will be metered in accordance with BWSC's Site Plan Requirements and Site Review Process. The review includes, but is not limited to, sizing of domestic water and fire protection services, calculation of meter sizing, backflow prevention design, and location of hydrants and Siamese connections that will conform to BWSC and Boston Fire Department (BFD) requirements. The Proponent will connect the Site's meters to the BWSC's automatic meter reading system. Fire protection connections on the Project Site will also need approval of the BFD. The Proponent will request record hydrant flow test information from the BWSC to aid in the preliminary water design. In addition, the Proponent will request new hydrant flow tests on the main to which the Project will connect.

4.8 Wastewater Generation

Based on the revised development program, the Project is estimated to generate approximately 153,454 gallons per day of sanitary sewage. Table 4.2 below summarizes the proposed sewer generation rates based on Massachusetts State Environmental Code (Title 5) generation rates.

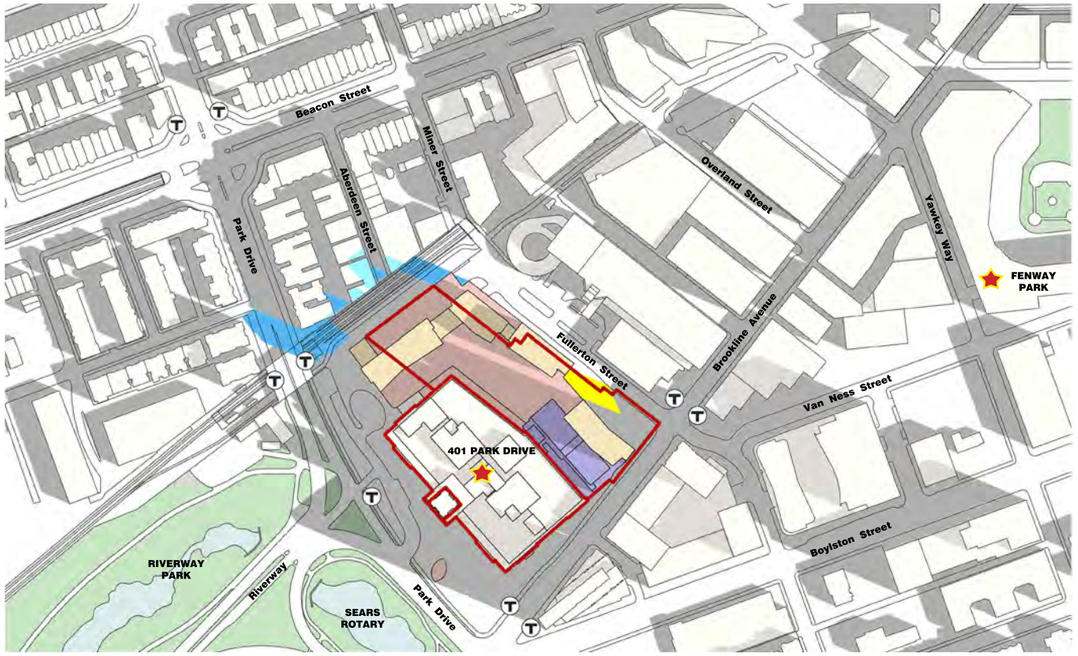
TABLE 4.2 WASTEWATER GENERATION

Program Type	Units	Generation Rate	Sewer Generation (gpd)
Previously Approved Program			
Residential	825 beds	110 gpd/bed	90,750
Retail	348,372 sf	50 gpd/ksf	17,419
Cinema	2,922 seats	5 gpd/seat	14,610
Daycare	195 people	10 gpd/person	1,950
Grocery	75,000 sf	97 gpd/ksf	7,275
Office	705,000 sf	75 gpd/ksf	52,875
Restaurant	1,000 seats	35 gpd/seat	35,000
Total			**219,879**
Proposed Development			
Residential	None	110 gpd/bed	0
Retail	256,372 sf	50 gpd/ksf	12,819
Cinema	821 seats	5 gpd/seat	4,105
Daycare	195 people	10 gpd/person	1,950
Grocery	45,000 sf	97 gpd/ksf	4,365

Program Type	Units	Generation Rate	Sewer Generation (gpd)
Office	1,176,200 sf	75 gpd/ksf	88,215
Restaurant	1,200 seats	35 gpd/seat	42,000
Total			**153,454**
Net Change			**-66,425**

Based on DEP Title 5 flow calculation factors.

Any future changes to the proposed building program may vary sanitary flow. Final flow estimates will be determined as the Project design moves forward. The Project will comply with the MA Department of Environmental Protection's (DEP) infiltration/inflow (I/I) policy, as applicable.



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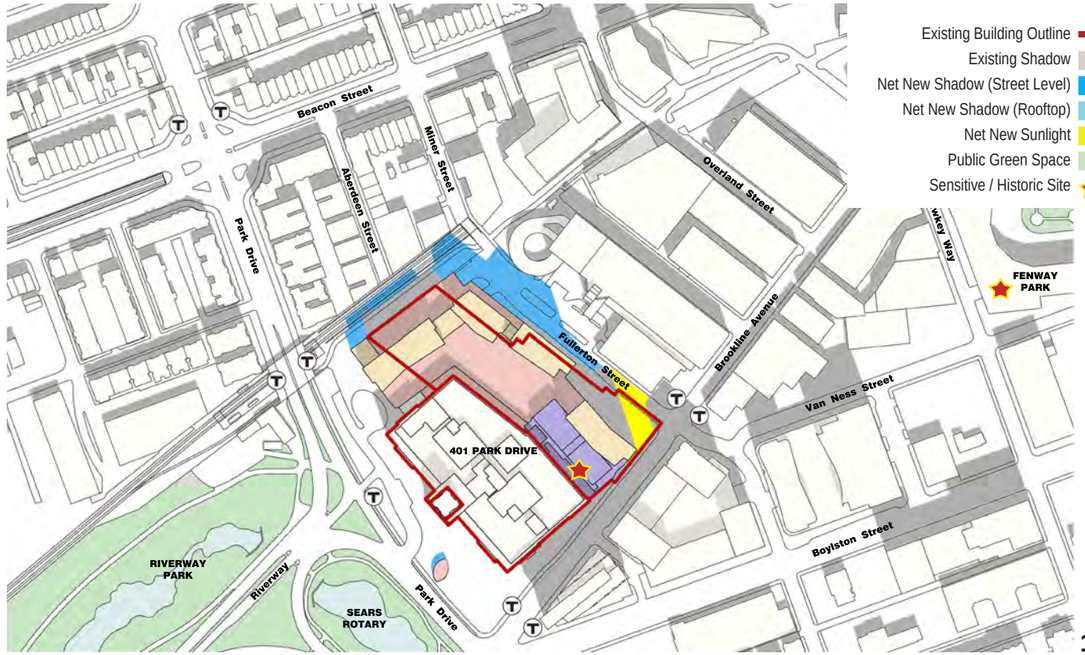

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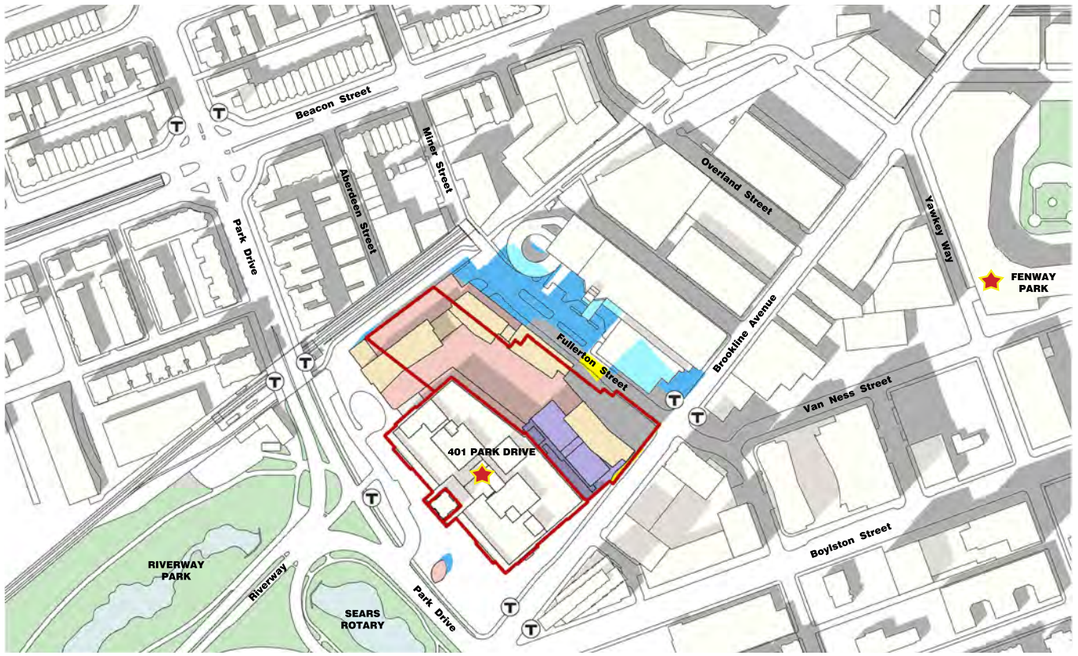

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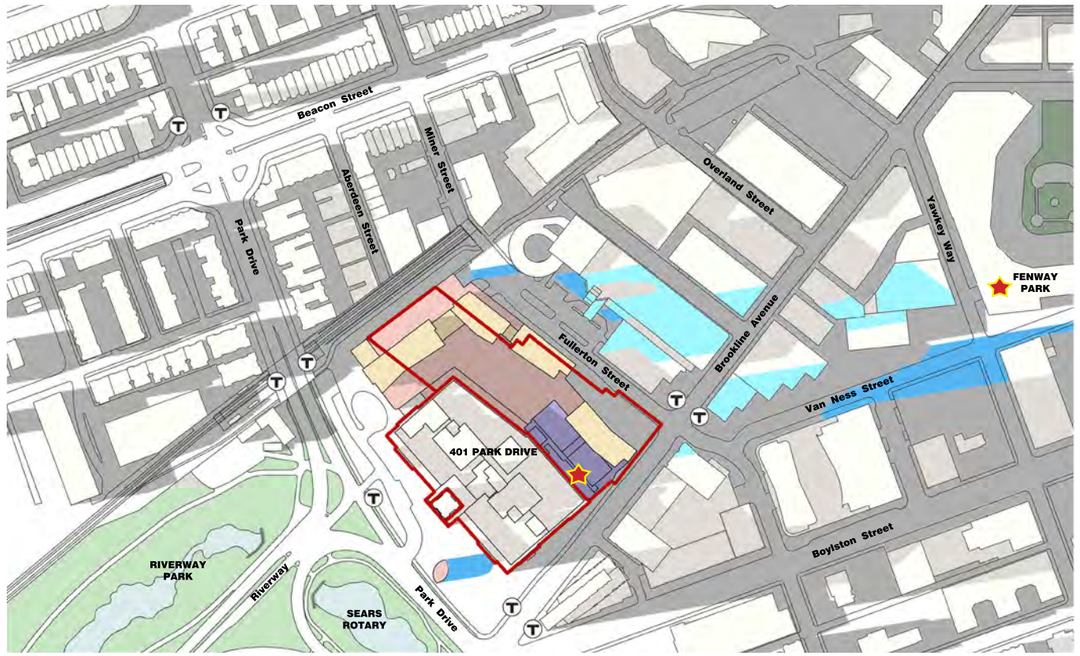

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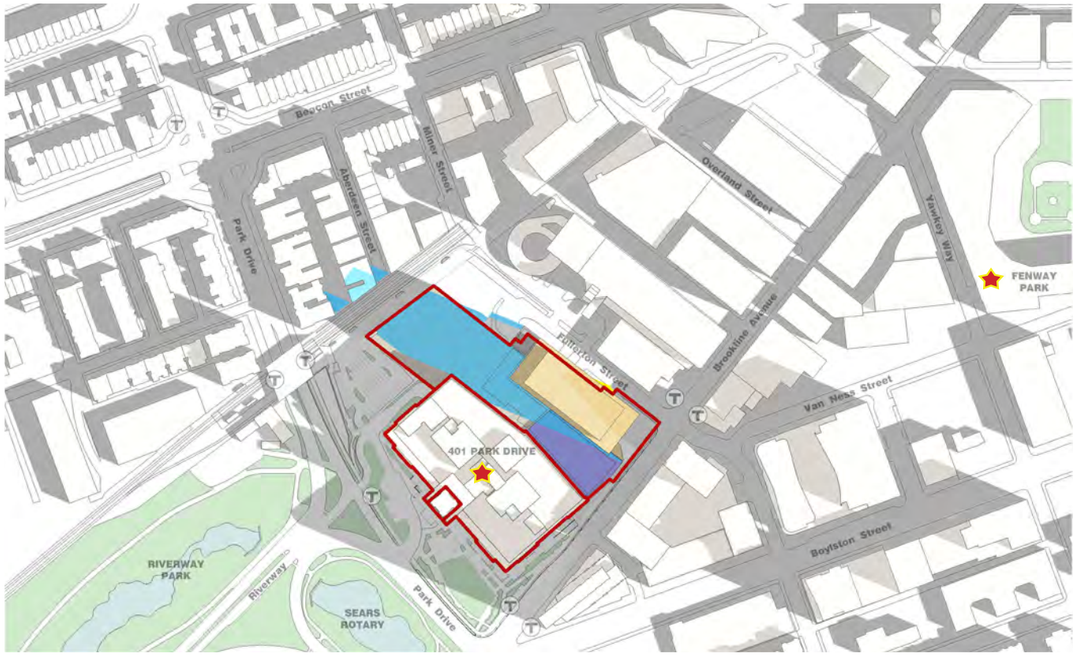
Figure 4.01a
Previously Approved Shadow Impacts - March 21



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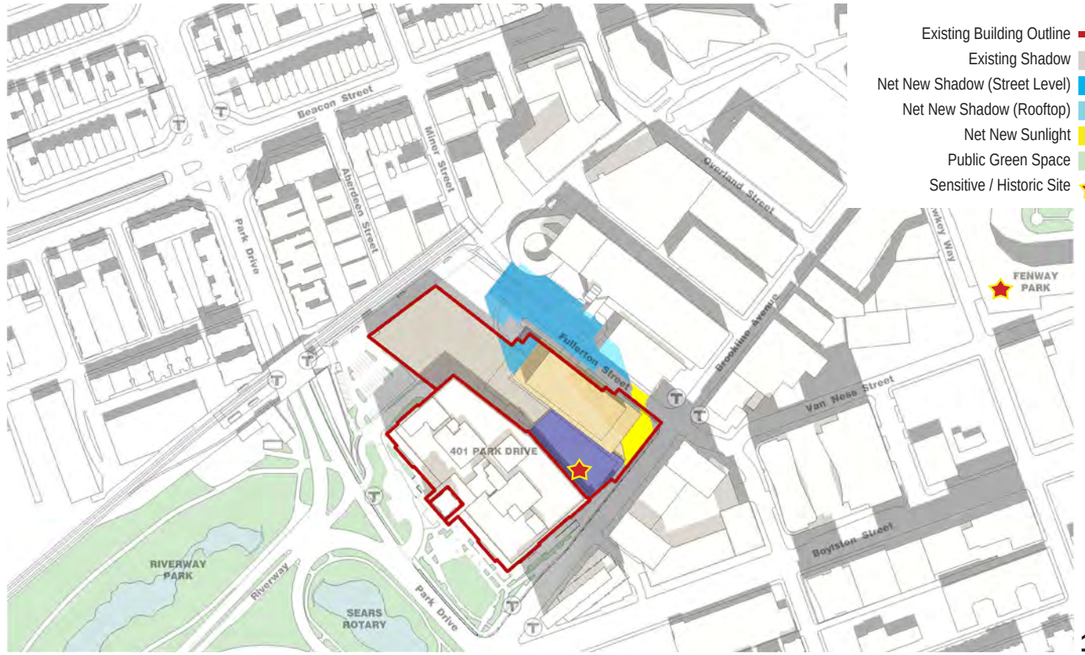

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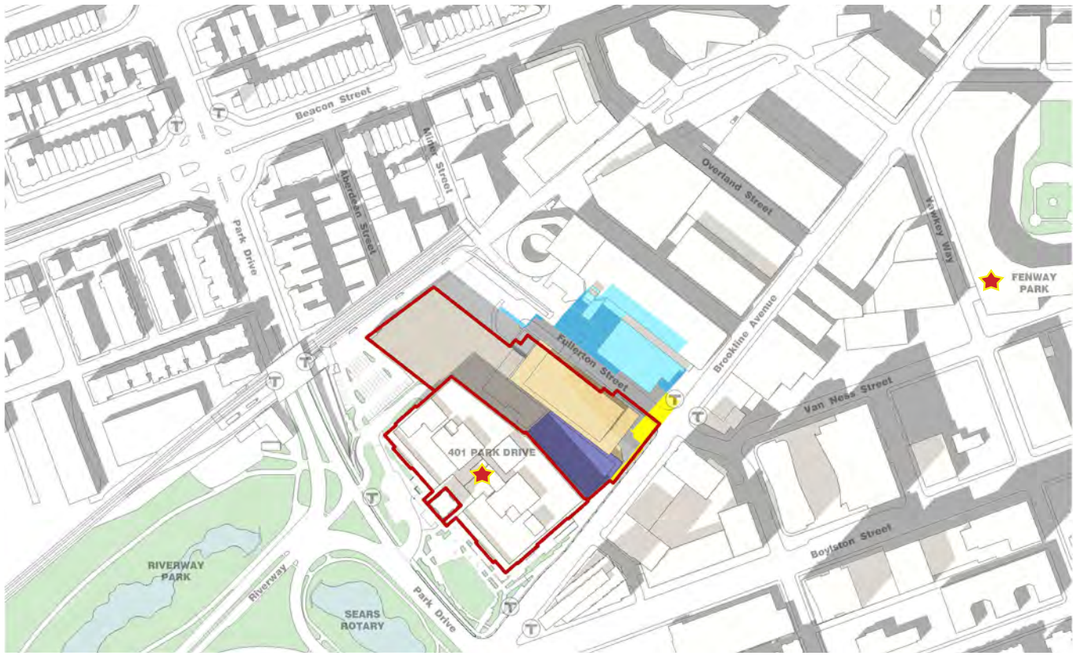

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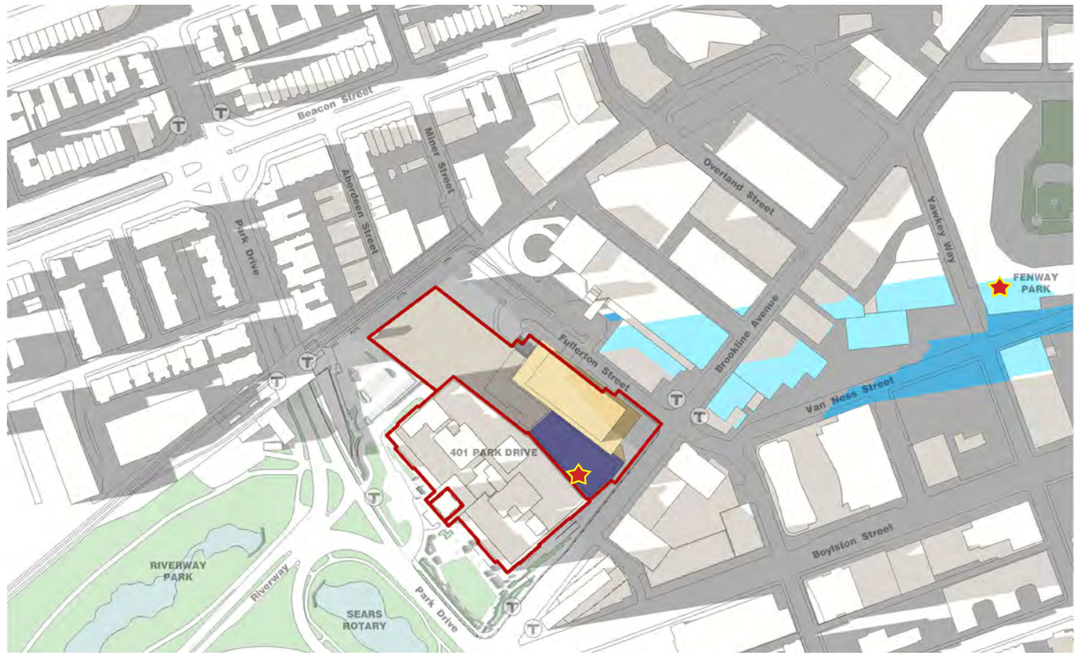

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Figure 4.01b
Proposed Shadow Impacts - March 21

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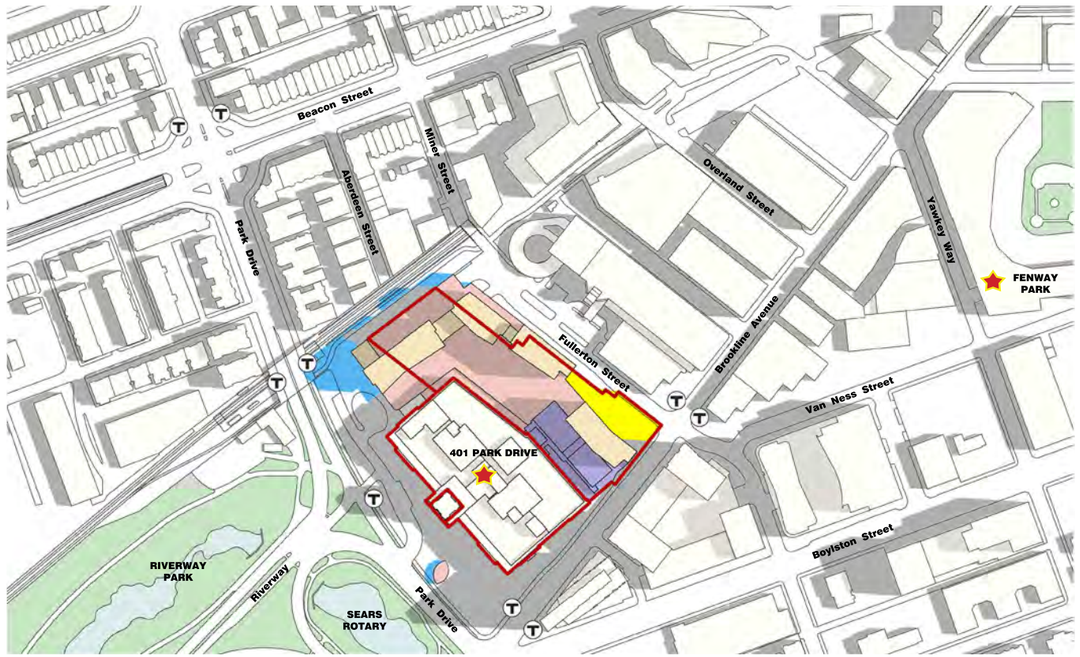

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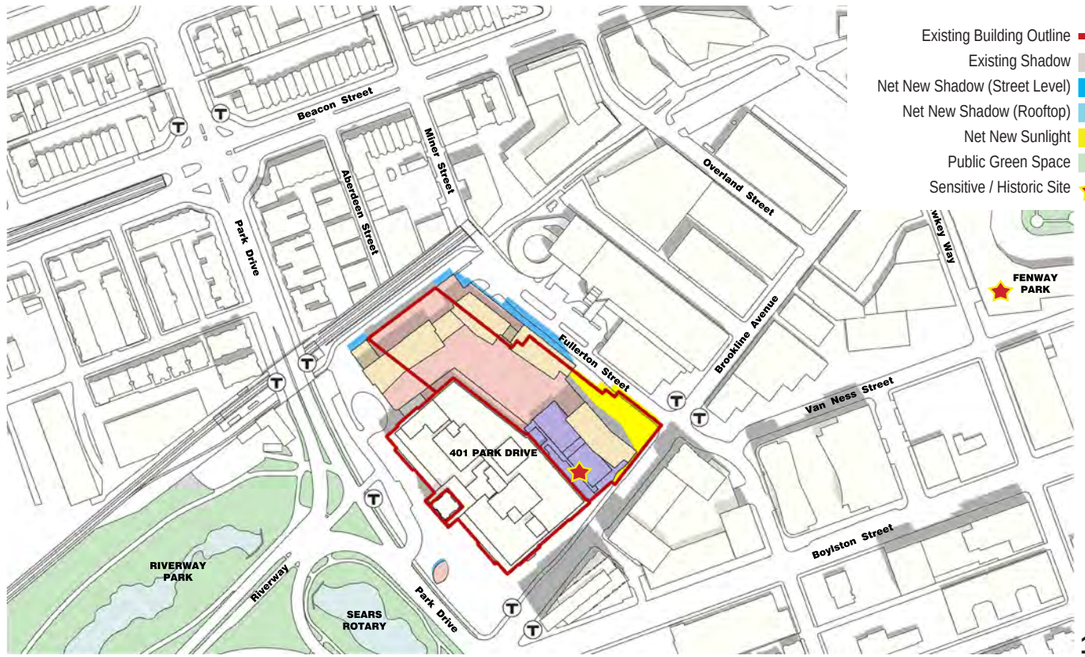

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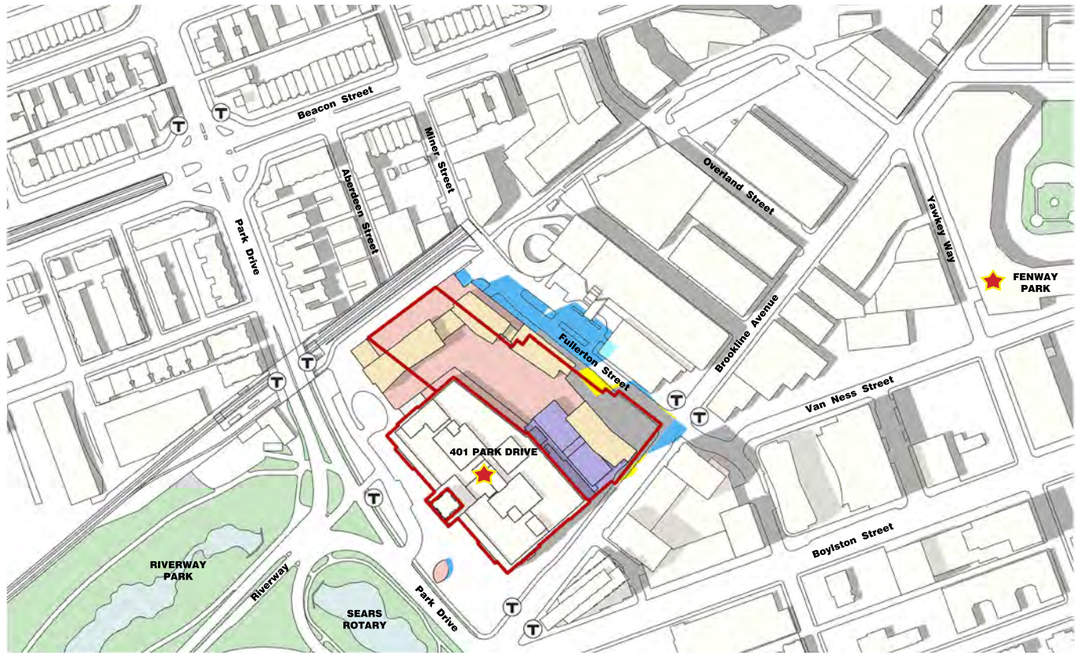

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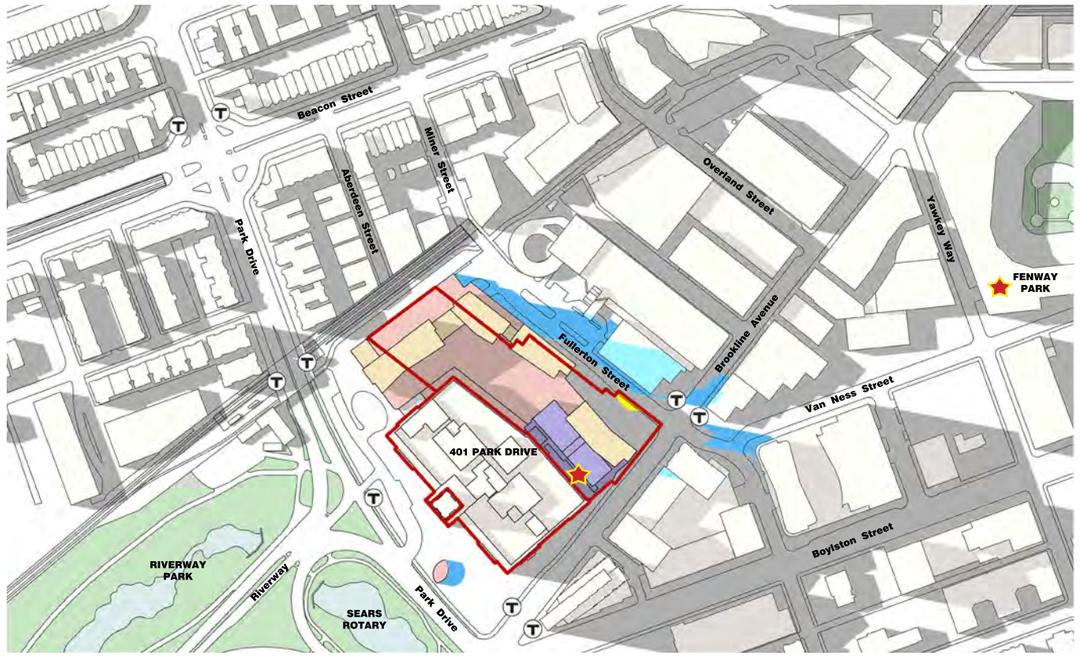

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Figure 4.02a
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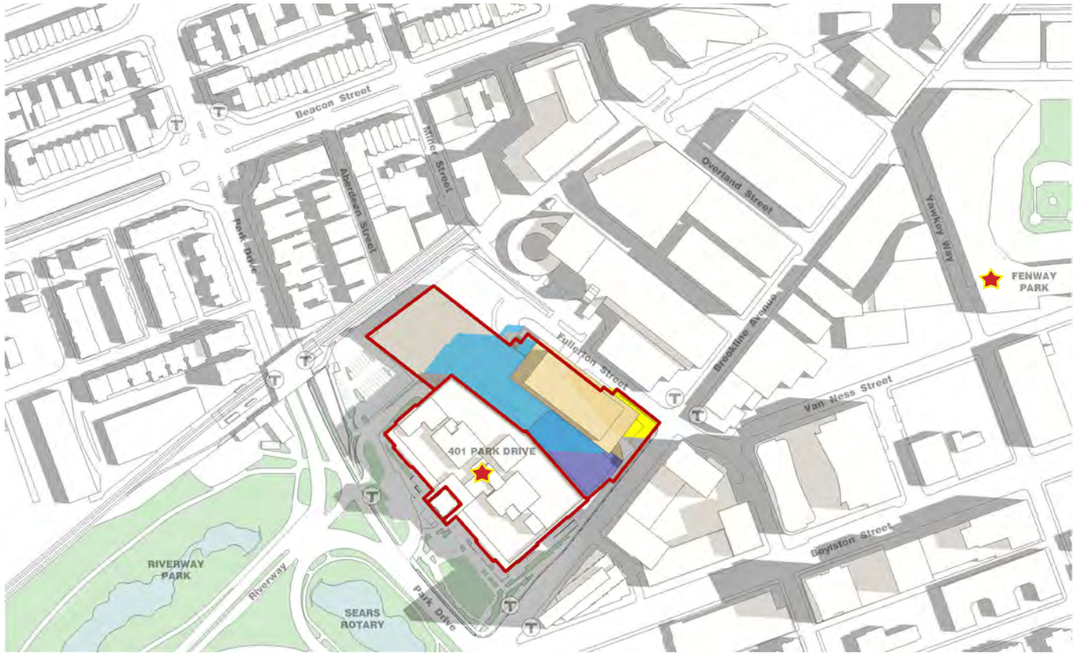

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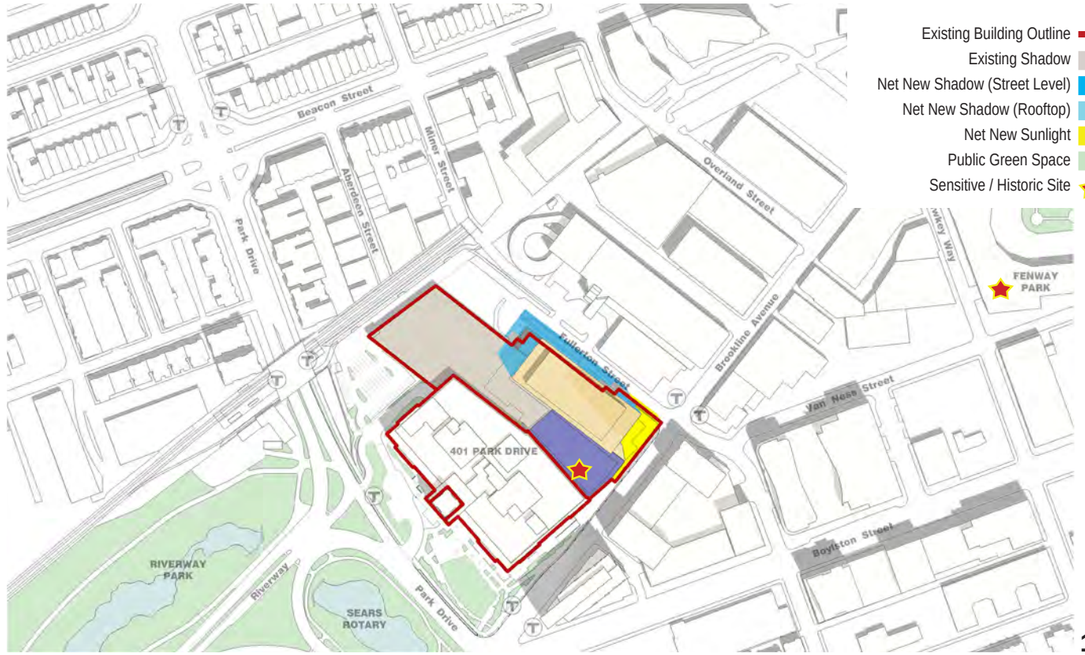

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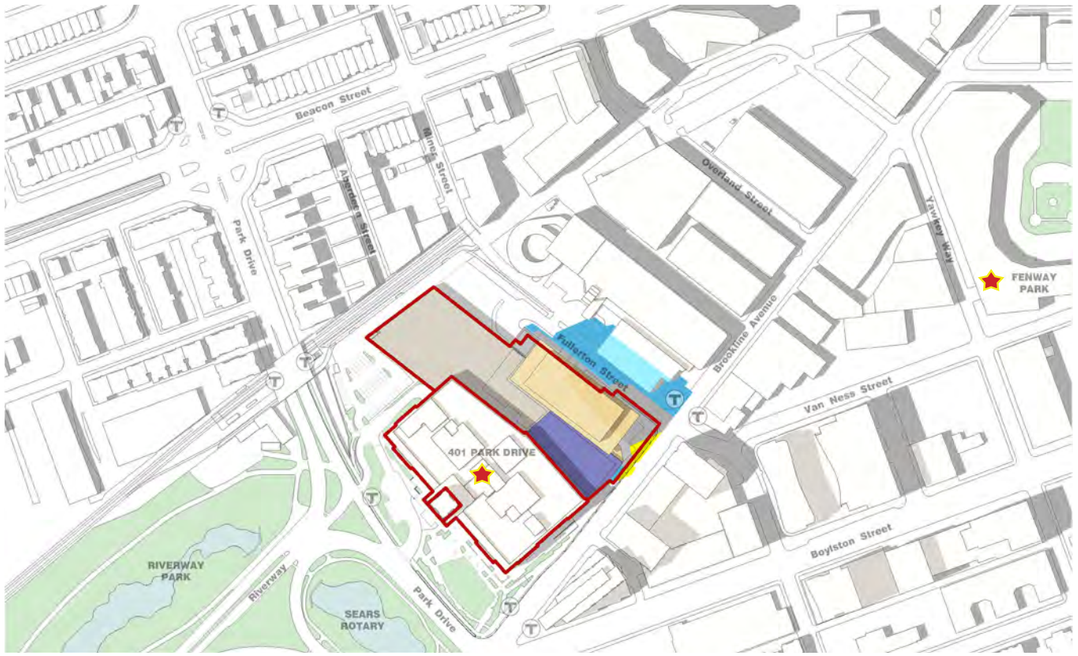

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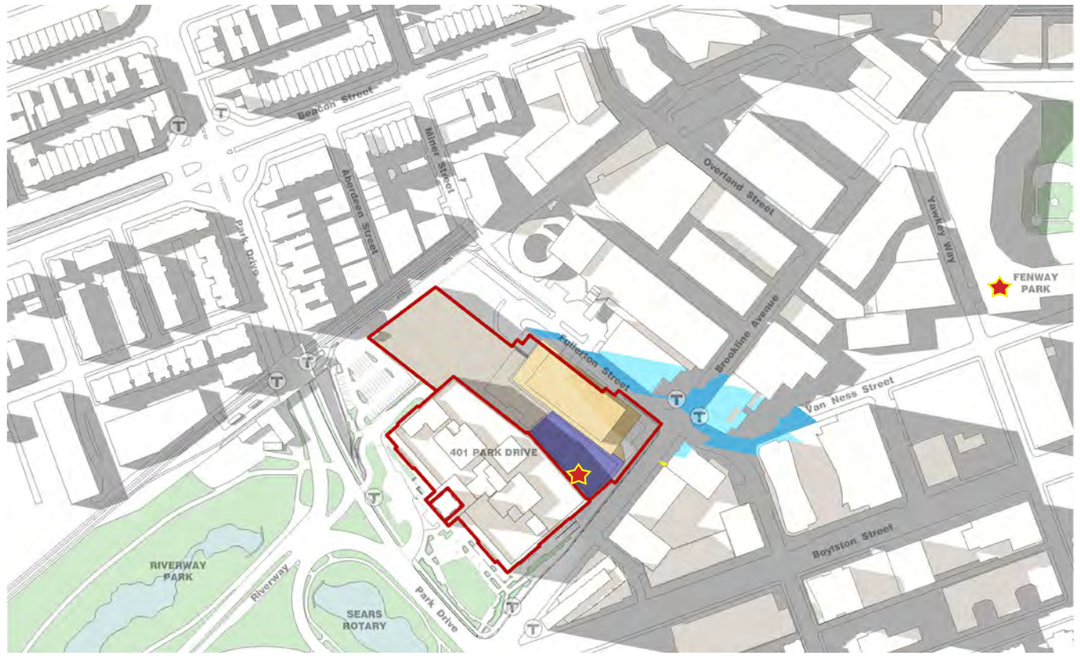

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Figure 4.02b
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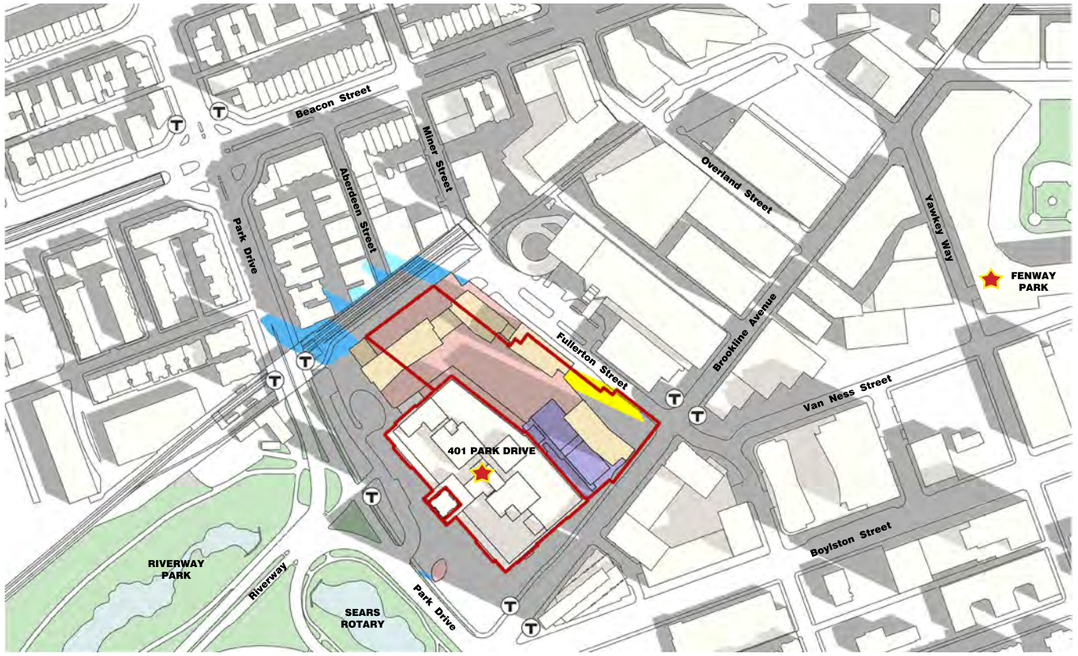

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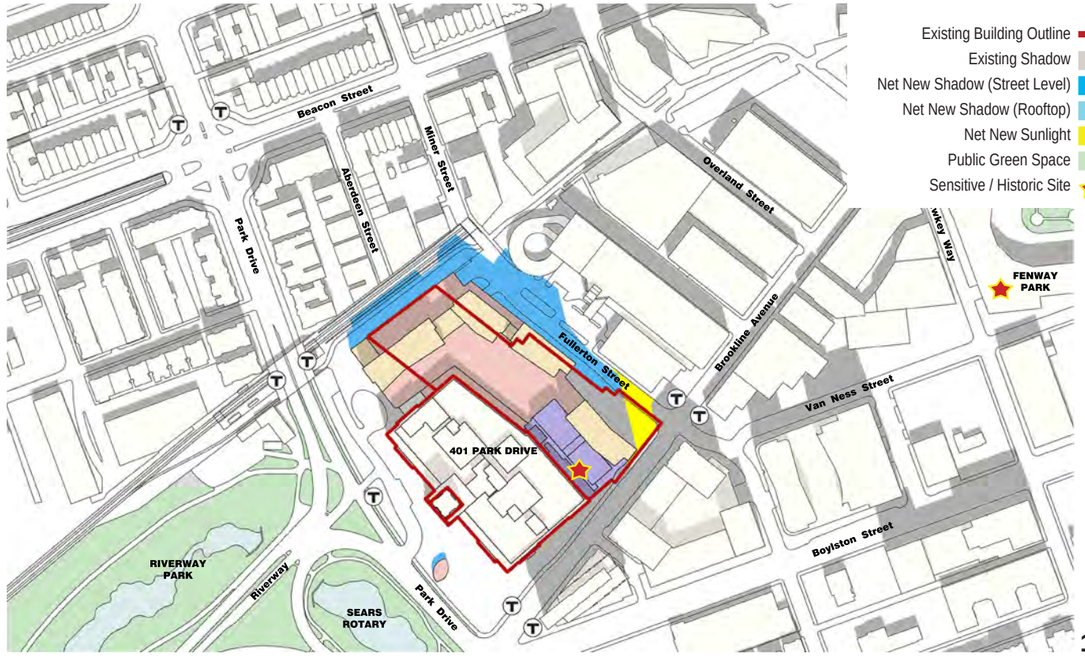

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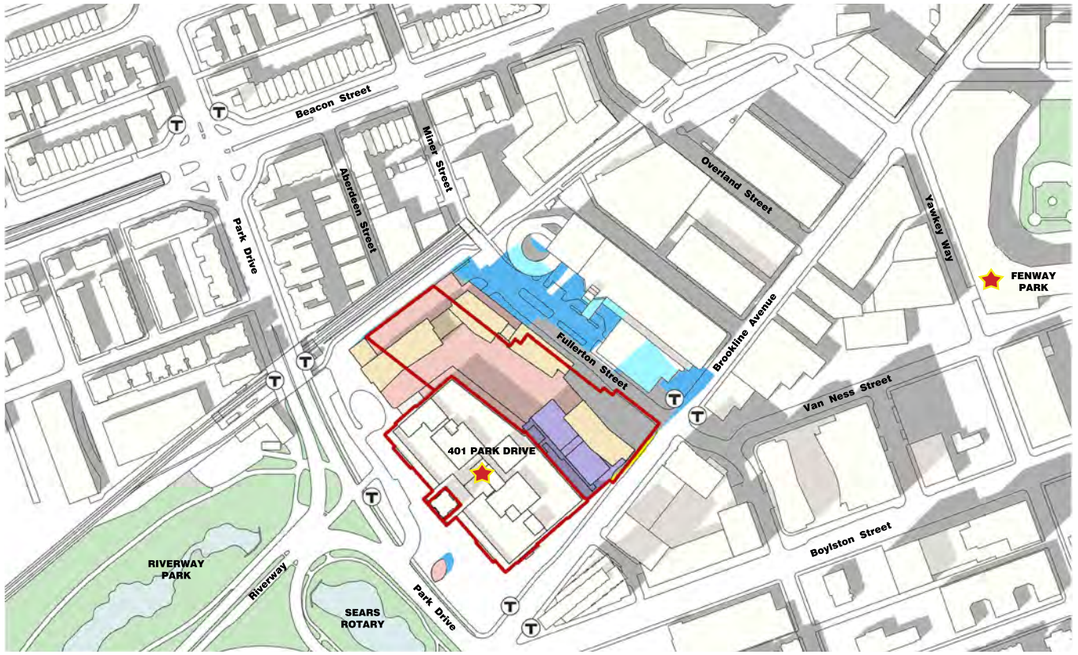

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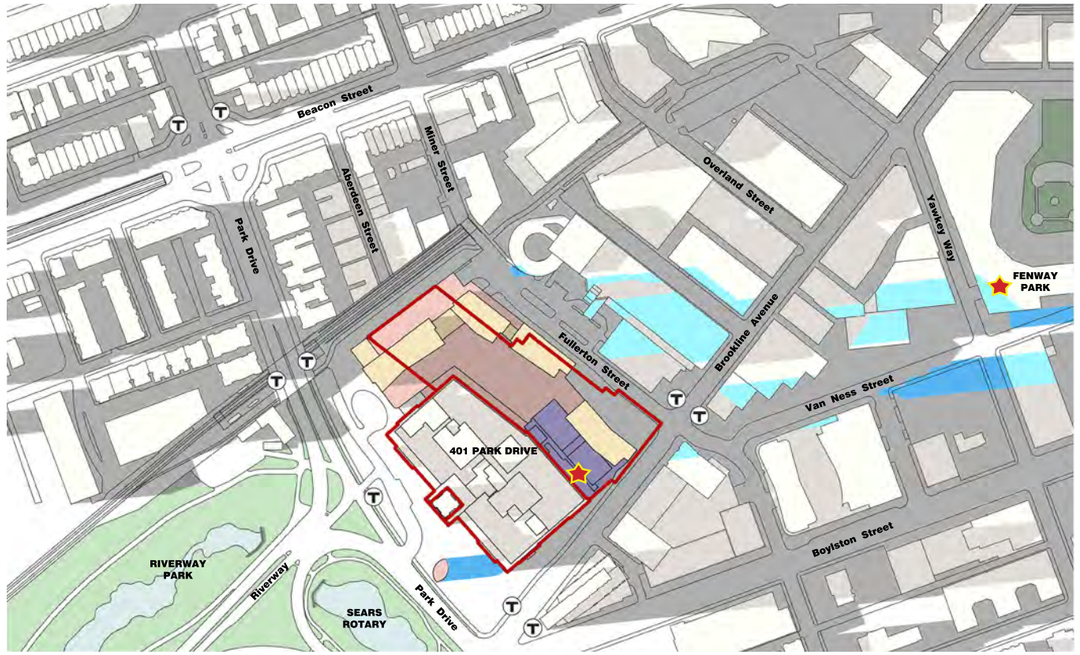

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Figure 4.03a
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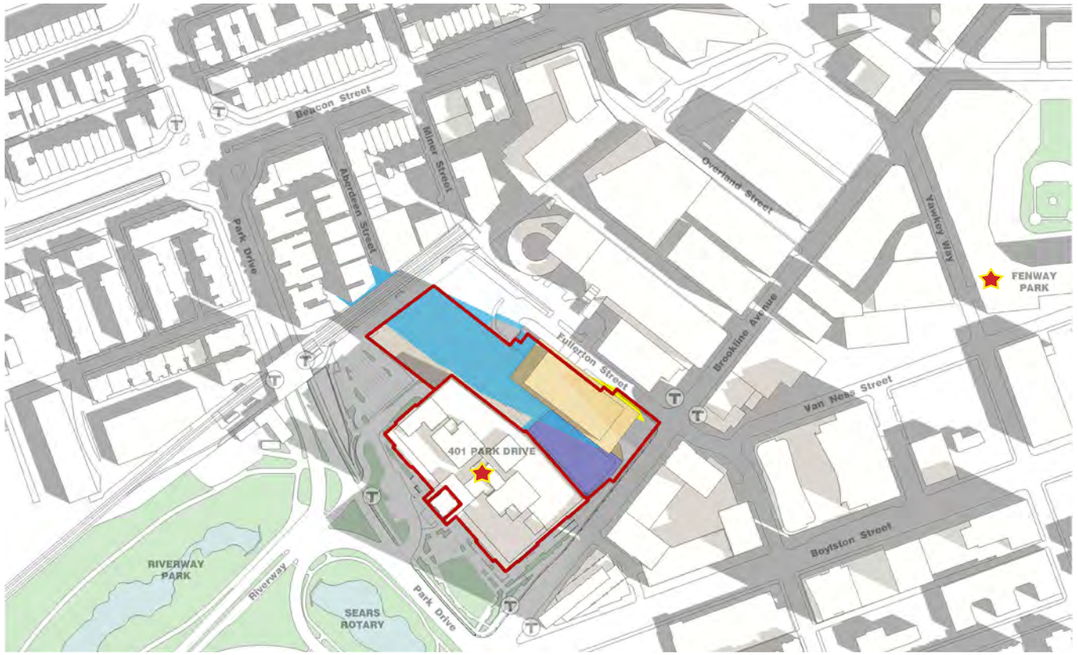

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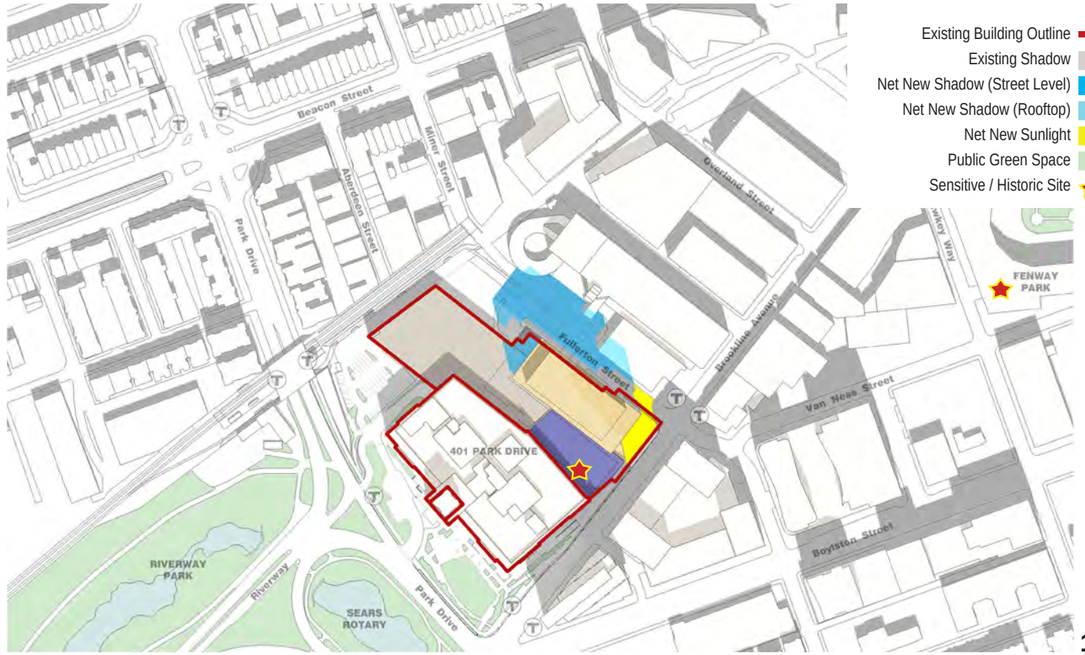

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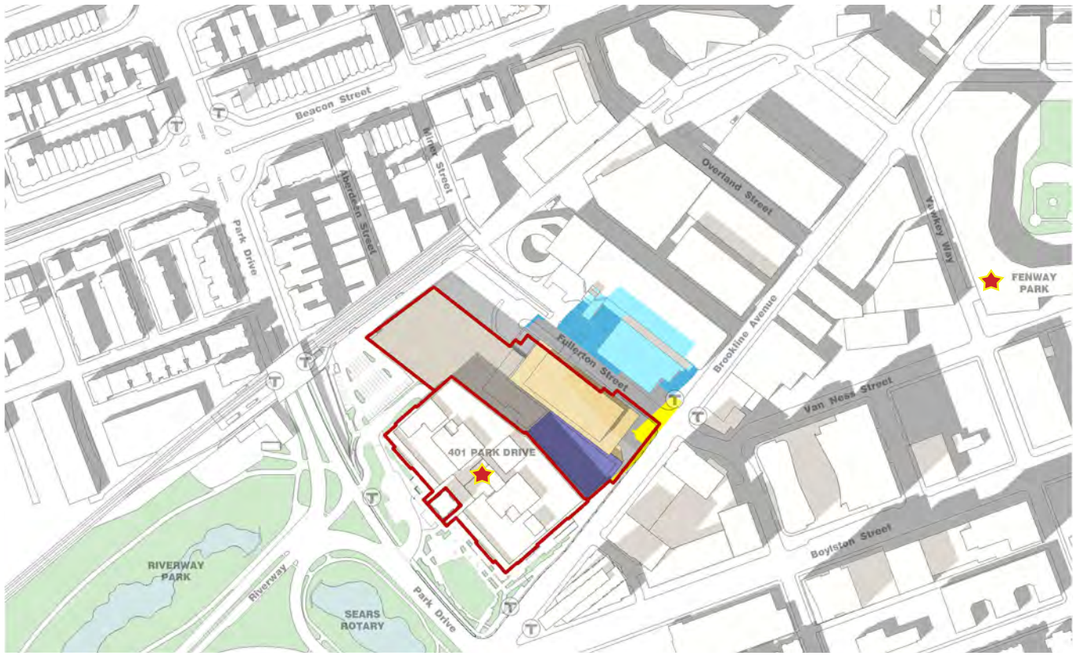

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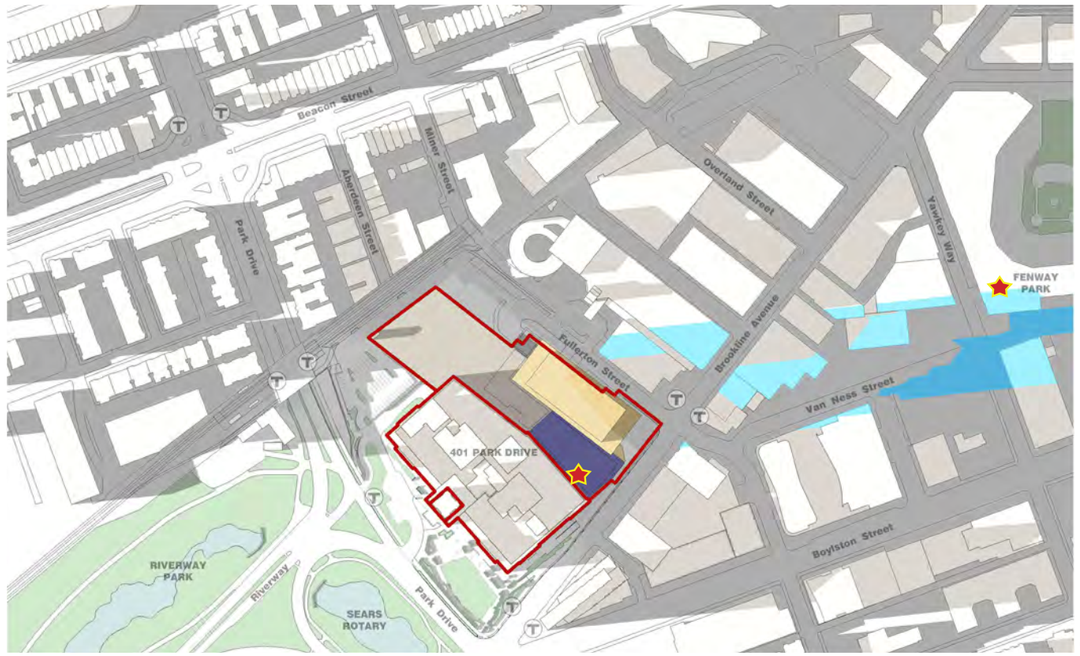

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Figure 4.03b
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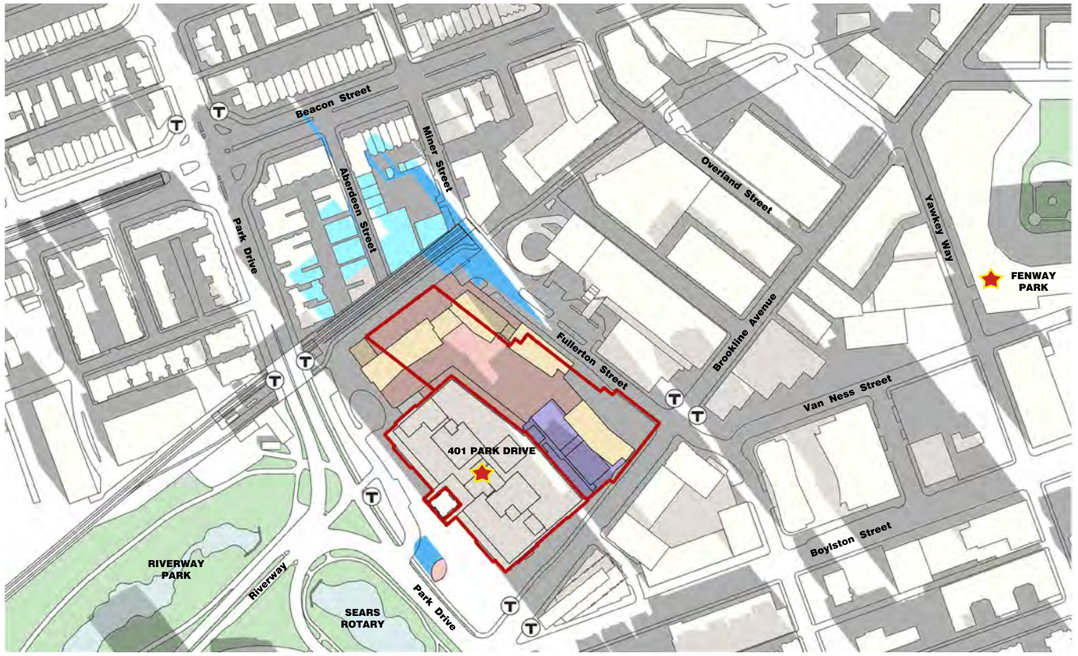

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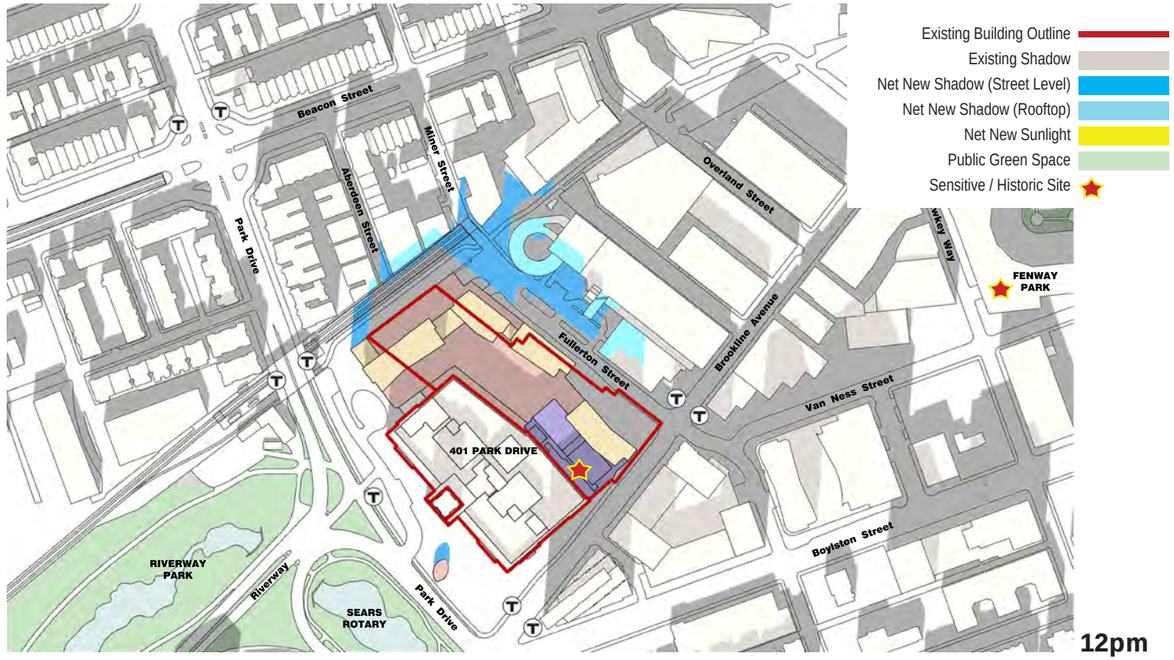

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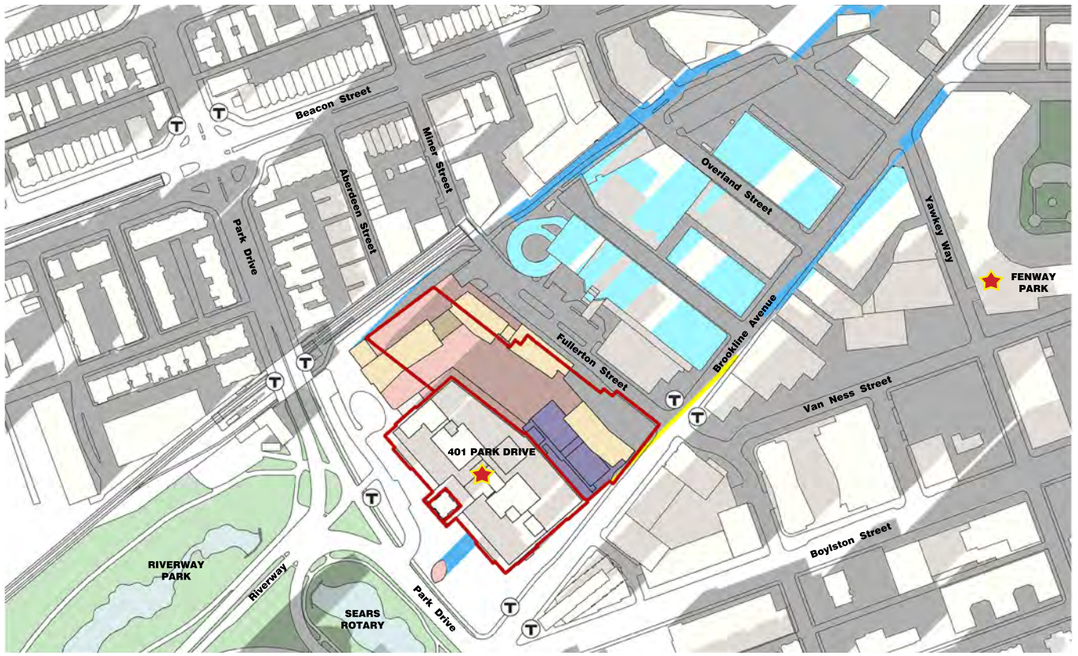

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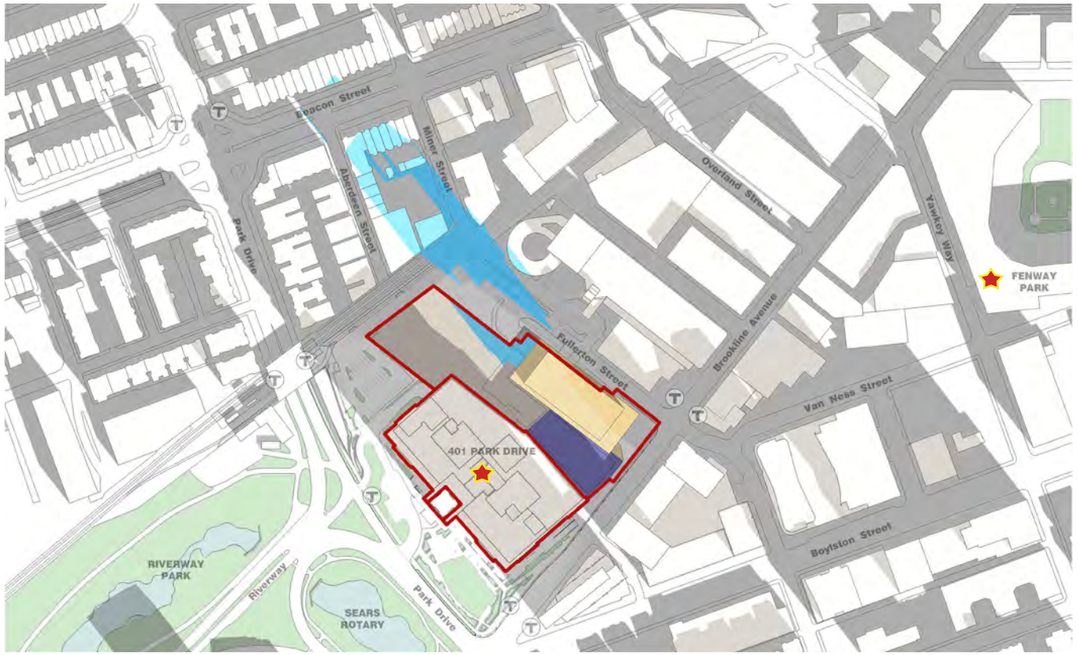
Figure 4.04a
Previously Approved Shadow Impacts - December 21



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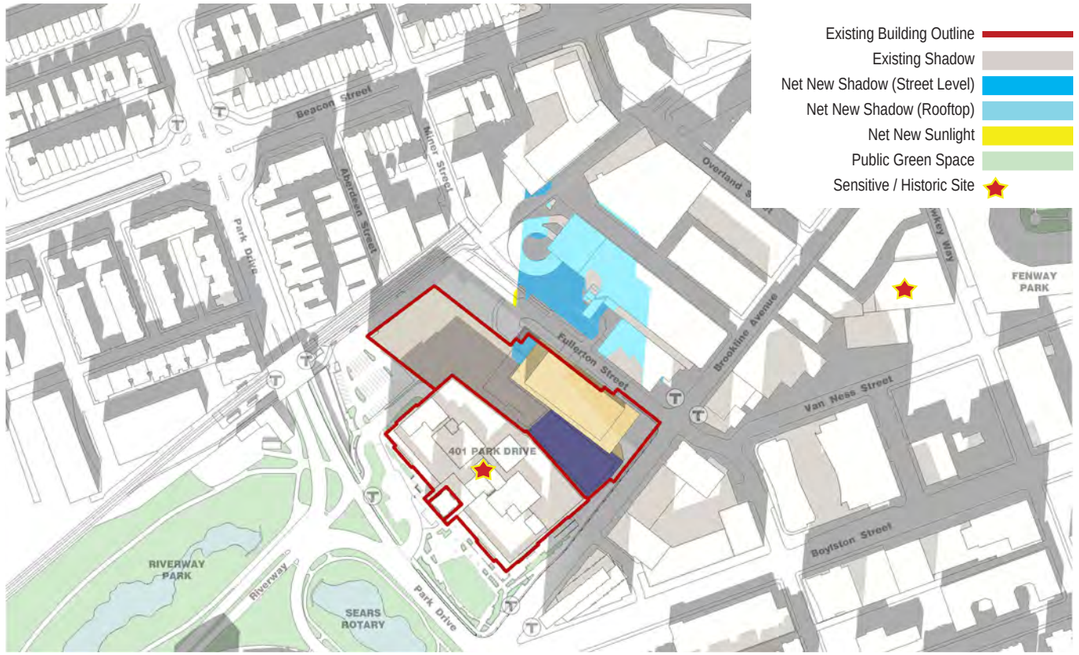

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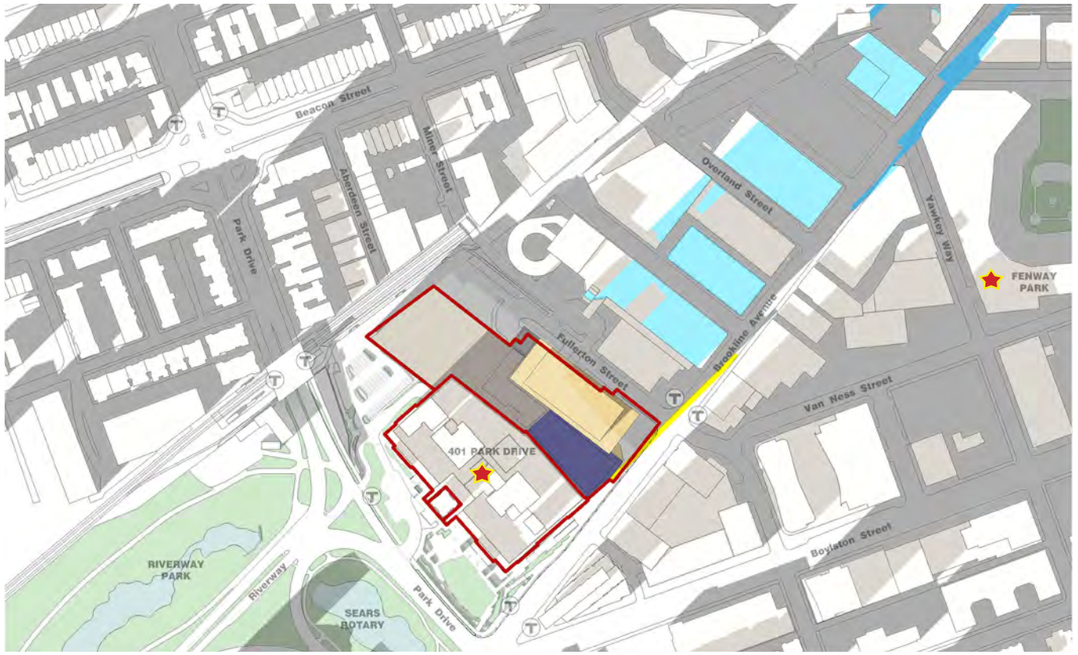

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Figure 4.04b
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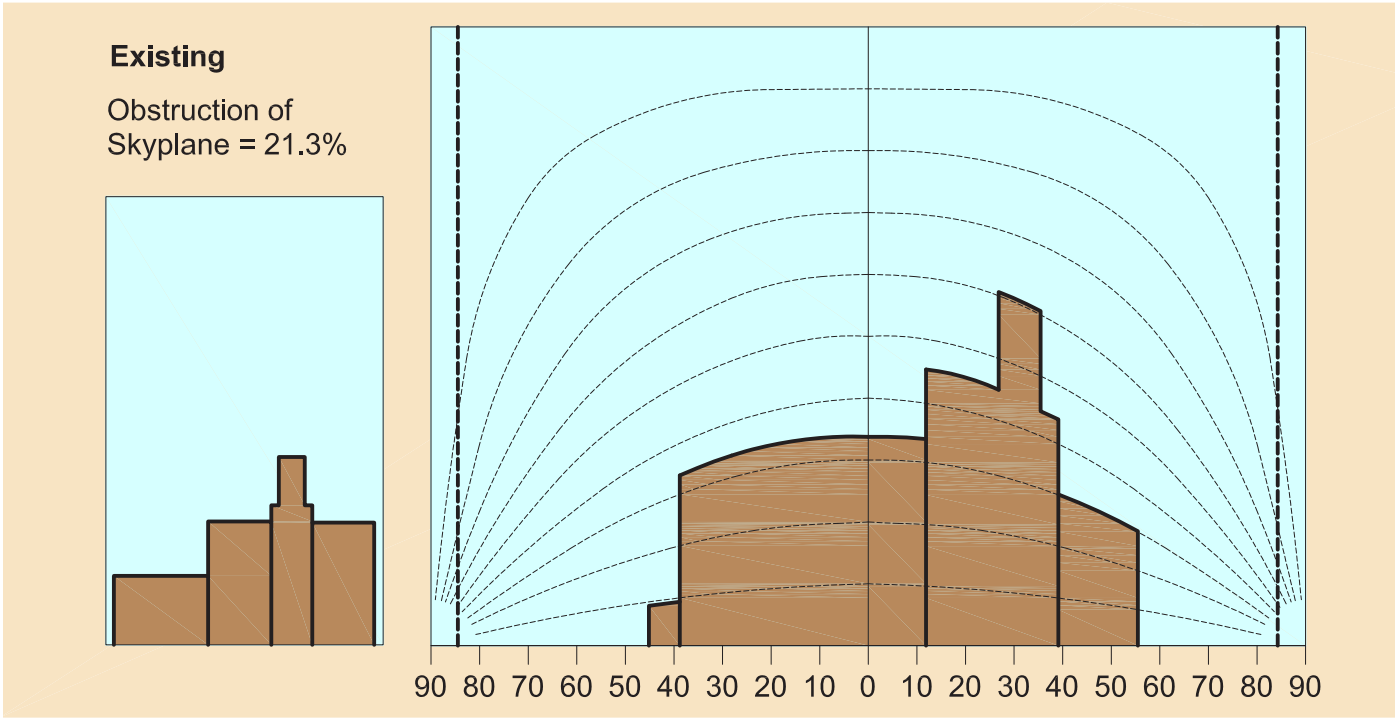

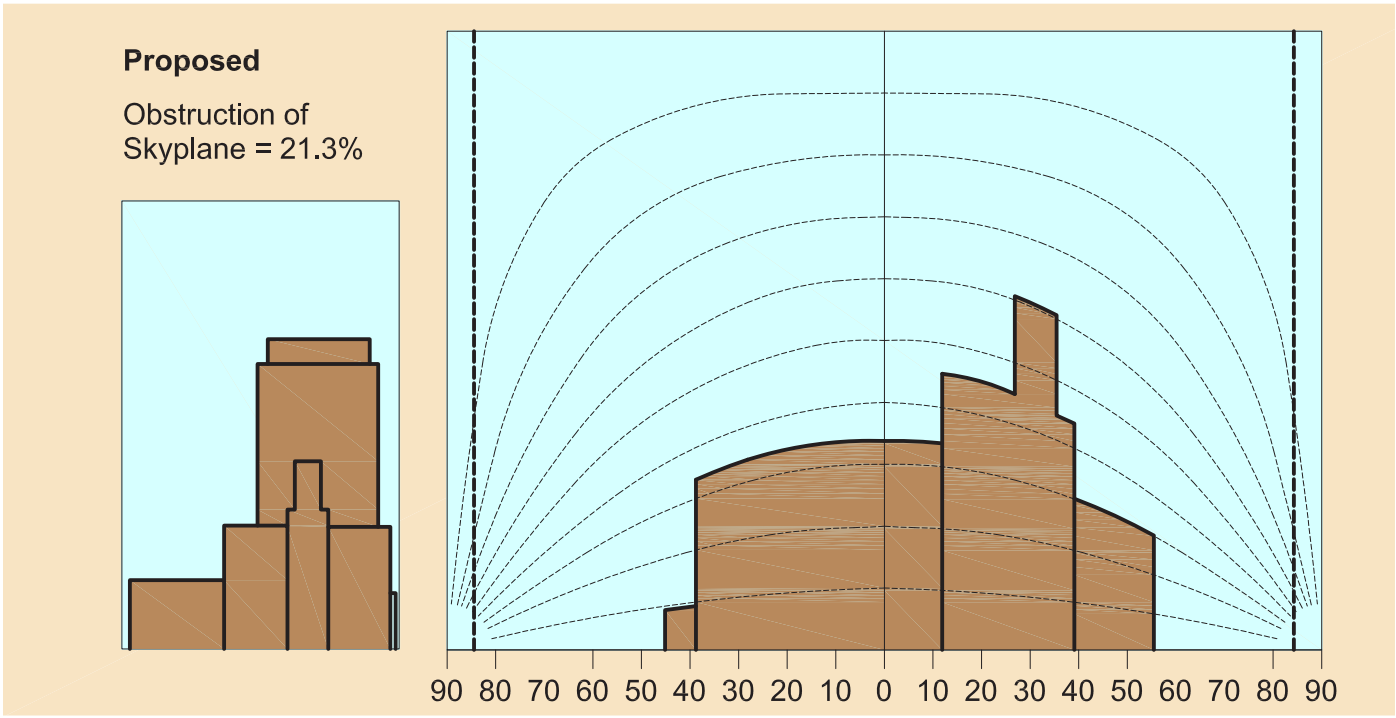

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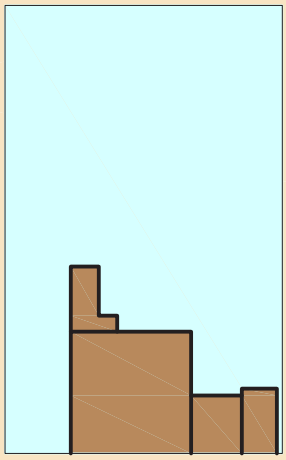
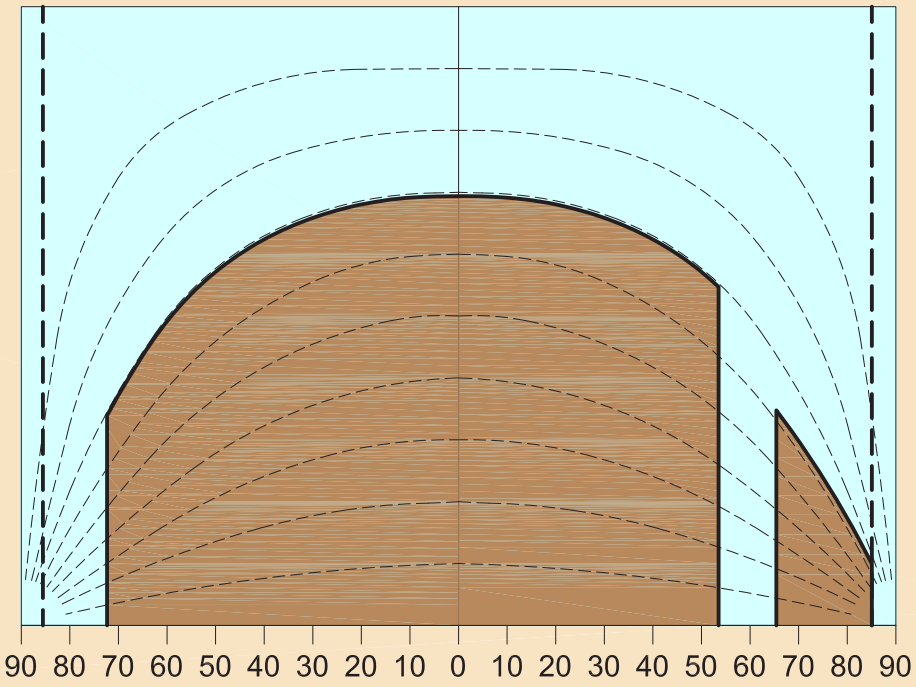
Figure 4.5a
Daylight Analysis
Center of Park Drive

Existing

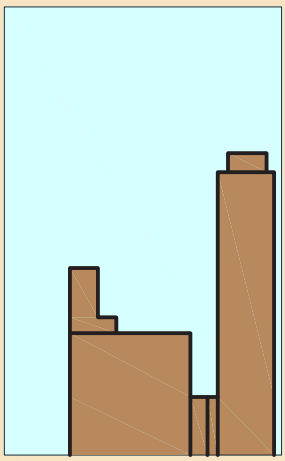
Obstruction of
Skyplane = 53.5%

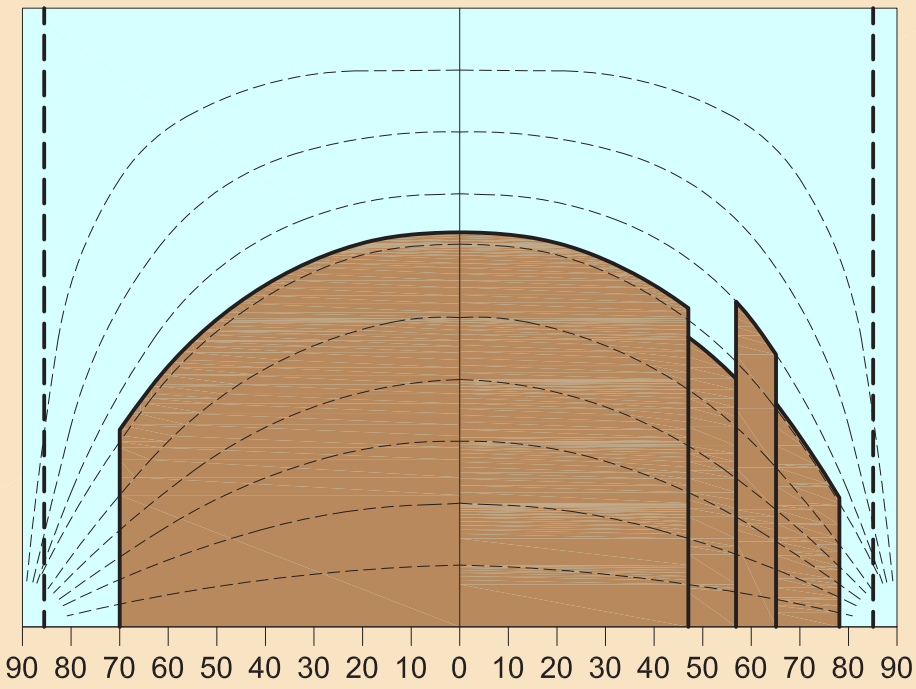


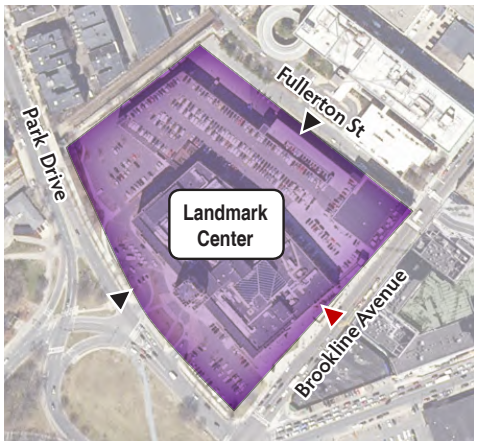


Proposed

Obstruction of
Skyplane = 49.5%





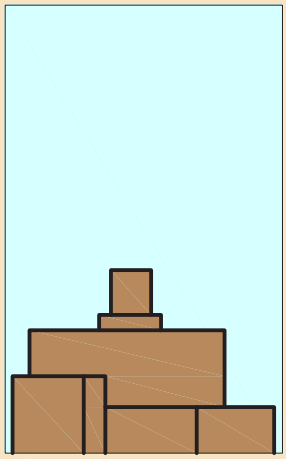


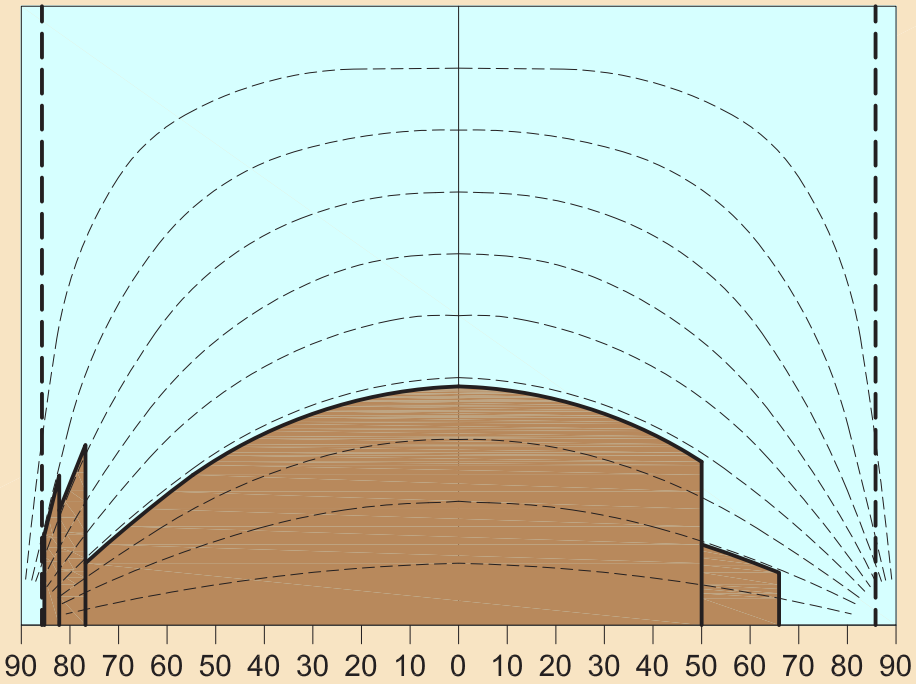
\\vhb\proj\Boston\11615.00\graphics\FIGURES\NPC\Daylighting.indd p2 07/05/17

Figure 4.5b
Daylight Analysis
Center of Brookline Avenue

Existing

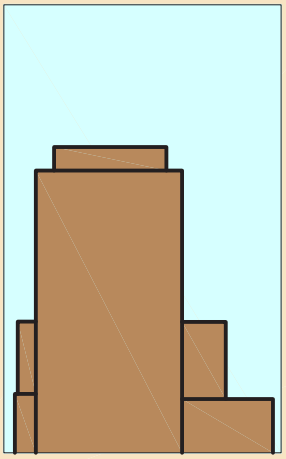
Obstruction of
Skyplane = 32.5%

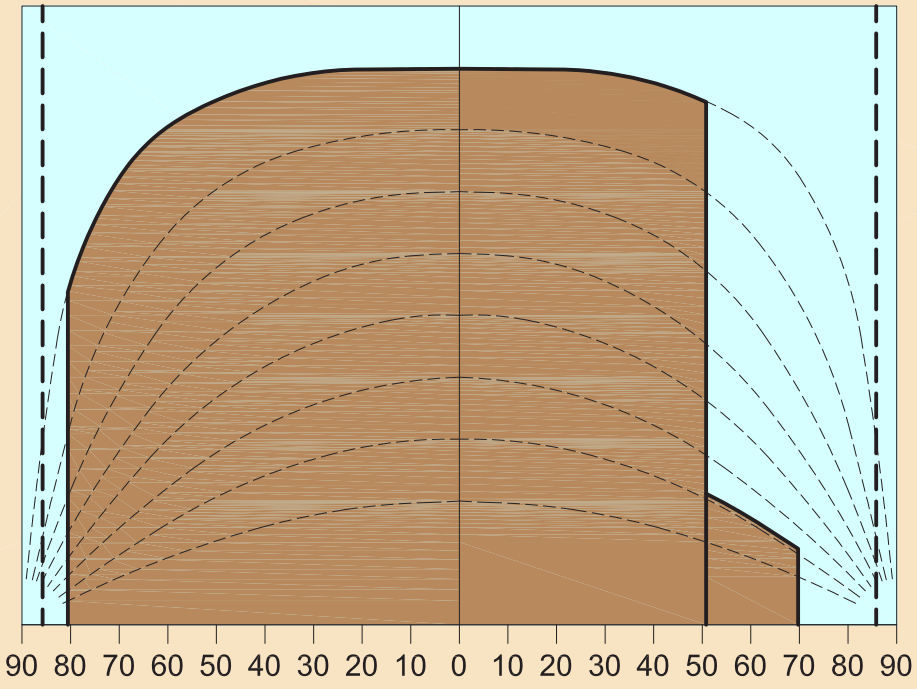




Proposed

Obstruction of
Skyplane = 73.1%





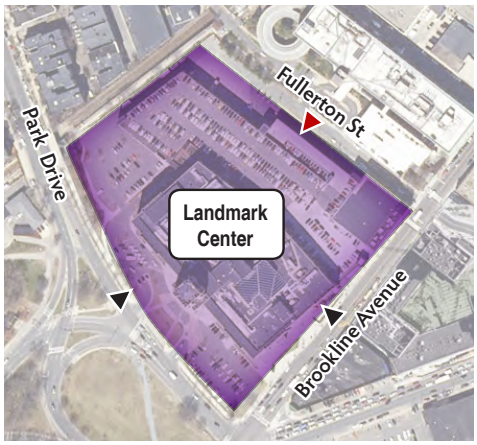


Figure 4.5c
Daylight Analysis
Center of Fullerton Street

LEED v3 for Core and Shell Development 2009
Project Scorecard

Figure 4.06
LEED Score Card

Project Name: Landmark Phase II
Project Address: Boston, MA

TOTALS

Yes	?	No
54	24	32

Yes	?	No			
22	4	2		**Sustainable Sites**	28
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
5			Credit 2	**Development Density & Community Connectivity**	5
1			Credit 3	**Brownfield Redevelopment**	1
6			Credit 4.1	**Alternative Transportation,** Public Transportation Access	6
2			Credit 4.2	**Alternative Transportation,** Bicycle Storage & Changing Rooms	2
	3		Credit 4.3	**Alternative Transportation,** Low-Emitting & Fuel-Efficient Vehicles	3
2			Credit 4.4	**Alternative Transportation,** Parking Capacity	2
		1	Credit 5.1	**Site Development,** Protect or Restore Habitat	1
	1		Credit 5.2	**Site Development,** Maximize Open Space	1
1			Credit 6.1	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	**Stormwater Design,** Quality Control	1
1			Credit 7.1	**Heat Island Effect,** Non-Roof	1
1			Credit 7.2	**Heat Island Effect,** Roof	1
		1	Credit 8	**Light Pollution Reduction**	1
1			Credit 9	**Tenant Design and Construction Guidelines**	1

Yes	?	No			
2	3	5		**Water Efficiency**	10
Y			Prereq 1	**Water Use Reduction, 20%** Reduction	Required
	2	2	Credit 1	**Water Efficient Landscaping**	2 to 4
		2	Credit 2	**Innovative Wastewater Technologies** *** RP	2
2	1	1	Credit 3	**Water Use Reduction**	2 to 4

Yes	?	No			
12	11	14		**Energy & Atmosphere**	37
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
6	4	11	Credit 1	**Optimize Energy Performance**	3 to 21
	1	3	Credit 2	**On-Site Renewable Energy** 1% Renewable Energy use	4
2			Credit 3	**Enhanced Commissioning**	2
	2		Credit 4	**Enhanced Refrigerant Management**	2
1	2		Credit 5.1	**Measurement & Verification:** Base Building	3
3			Credit 5.2	**Measurement & Verification:** Tenant Submetering	3
	2		Credit 6	**Green Power**	2

Yes	?	No				
4	3	6		**Materials & Resources**		13
Y			Prereq 1	**Storage & Collection of Recyclables**		Required
		5	Credit 1	**Building Reuse**		1 to 5
2			Credit 2	**Construction Waste Management**		1 to 2
		1	Credit 3	**Materials Reuse,** (5%)		1
1	1		Credit 4	**Recycled Content**		1 to 2
1	1		Credit 5	**Regional Materials, 10%** Extracted, Processed & Manufactured Regionall		1 to 2
	1		Credit 7	**Certified Wood**		1

Yes	?	No				
7	0	5		**Indoor Environmental Quality**		12
Y			Prereq 1	**Minimum IAQ Performance**		Required
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**		Required
		1	Credit 1	**Outdoor Air Delivery Monitoring**		1
		1	Credit 2	**Increased Ventilation**		1
1			Credit 3	**Construction IAQ Management Plan,** During Construction		1
1			Credit 4.1	**Low-Emitting Materials,** Adhesives & Sealants		1
1			Credit 4.2	**Low-Emitting Materials,** Paints & Coatings		1
1			Credit 4.3	**Low-Emitting Materials,** Flooring Systems		1
1			Credit 4.4	**Low-Emitting Materials,** Composite Wood & Agrifiber Products		1
		1	Credit 5	**Indoor Chemical & Pollutant Source Control**		1
		1	Credit 6	**Controllability of Systems,** Thermal Comfort		1
1			Credit 7	**Thermal Comfort,** Design		1
		1	Credit 8.1	**Daylight & Views,** Daylight 75% of Spaces		1
1			Credit 8.2	**Daylight & Views,** Views for 90% of Spaces		1

Yes	?	No				
3	3	0		**Innovation & Design Process**		6
1			Credit 1.1	**ID - Exemplary Performance in SSc4.1**		1
1			Credit 1.2	**ID - Exemplary Performance in SSc7.1**		1
	1		Credit 1.3	**ID - Pending Strategy**		1
	1		Credit 1.4	**ID - Pending Strategy**		1
	1		Credit 1.5	**ID - Pending Strategy**		1
1			Credit 2	**LEED® Accredited Professional**		1

Yes	?	No				
4	0	0		**Regional Priority Credits**		4
1			Credit 1.1	**Regional Priority for 02118:** SSc3, SSc6.1, SSc7.1, SSc7.2, EAc2 (1%), MRc1.1		1
1			Credit 1.2	**Regional Priority for 02118:** SSc3, SSc6.1, SSc7.1, SSc7.2, EAc2 (1%), MRc1.1		1
1			Credit 1.3	**Regional Priority for 02118:** SSc3, SSc6.1, SSc7.1, SSc7.2, EAc2 (1%), MRc1.1		1
1			Credit 1.4	**Regional Priority for 02118:** SSc3, SSc6.1, SSc7.1, SSc7.2, EAc2 (1%), MRc1.1		1

Yes	?	No				
54	24	32		**Project Totals (Certification Estimates)**		110

Certified: 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 8

APPENDICES

LANDMARK CENTER REDEVELOPMENT

Notice of Project Change

PREPARED BY

vhb

99 High Street
Boston, MA 02110

In association with:
Elkus Manfredi Architects
Goulston & Storrs PC
Suffolk Construction
Cosentini Associates
RWDI
McPhail Associates, Inc.

SUBMITTED TO

Boston Planning & Development Agency
One City Hall, Ninth Floor
Boston, MA 02201

PROPONENT

Fenway Enterprises LLC
on behalf of Landmark Center Ventures LLC
Samuels & Associates
136 Brookline Avenue
Boston, MA 02215

August 2017

Appendix A – Wind Study Supporting Documentation

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DRAFT REPORT

LANDMARK CENTER R + D TOWER

BOSTON, MA

PEDESTRIAN WIND COMFORT STUDY

RWDI #1702208

June 26, 2017

SUBMITTED TO

Mark Sardegna AIA, LEED AP
Vice President
msardegna@elkus-manfredi.com

CC TO

John Taylor
jtaylor@elkus-manfredi.com

Elkus Manfredi Architects
25 Drydock Avenue,
Boston, MA 02210
T: 617.368.3320

SUBMITTED BY

Nishat Nourin, M.Eng., EIT
Technical Coordinator
Nishat.Nourin@rwdi.com

Derek Kelly, M.Eng., P.Eng.
Project Manager / Principal
Derek.Kelly@rwdi.com

Rowan Williams Davies & Irwin Inc.
600 Southgate Drive,
Guelph, Canada, N1G 4P6
T: 519.823.1311
F: 519.823.1316

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1 INTRODUCTION

A pedestrian wind comfort study was conducted on the proposed Landmark Center R + D Tower in Boston, Massachusetts. The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas around the study site and provide recommendations for minimizing adverse effects.

The study involved wind simulations on a 1:300 scale model of the proposed building and surroundings. These simulations were then conducted in RWDI's boundary-layer wind tunnel at Guelph, Ontario, for the purpose of quantifying local wind speed conditions and comparing to appropriate criteria for gauging wind comfort in pedestrian areas. A list of the drawings used for the construction of the model can be found in **Appendix A**. The criteria recommended by the Boston Planning and Development Agency (BPDA) were used in this study. The present report describes the methods and presents the results of the wind tunnel simulations.

2 OVERVIEW

Major buildings, especially those that protrude above their surroundings, often cause increased local wind speeds at the pedestrian level. Typically, wind speeds increase with elevation above the ground surface, and taller buildings intercept these faster winds and deflect them down to the pedestrian level. The funneling of wind through gaps between buildings and the acceleration of wind around corners of buildings may also cause increases in wind speed. Conversely, if a building is surrounded by others of equivalent height, it may be protected from the prevailing upper-level winds, resulting in no significant changes to the local pedestrian-level wind environment. The most effective way to assess potential pedestrian-level wind impacts around a proposed new building is to conduct scale model tests in a wind tunnel.

The consideration of wind in planning outdoor activity areas is important since high winds in an area tend to deter pedestrian use. For example, winds should be light or relatively light in areas where people would be sitting, such as outdoor cafes or playgrounds. For bus stops and other locations where people would be standing, somewhat higher winds can be tolerated. For frequently used sidewalks, where people are primarily walking, stronger winds are acceptable. For infrequently used areas, the wind comfort criteria can be relaxed even further. The actual effects of wind can range from pedestrian inconvenience, due to the blowing of dust and other loose material in a moderate breeze, to severe difficulty with walking due to the wind forces on the pedestrian.

3 METHODOLOGY

3.1 Test Configurations

Information concerning the site and surroundings was derived from: information on surrounding buildings and terrain and site plans and elevations of the proposed development provided by the design team. The following configurations were simulated:

No Build: includes the existing site and all existing surrounding buildings; and,

Build: includes the proposed Landmark Center R + D Tower and all existing surroundings.

As shown in **Figures 1a and 1b**, the wind tunnel model included the proposed development and all relevant surrounding buildings and topography within a 1200 ft radius of the study site. The mean speed profile and turbulence of the natural wind approaching the modelled area were also simulated in RWDI's boundary layer wind tunnel. The scale model was equipped with 82 specially designed wind speed sensors that were connected to the wind tunnel's data acquisition system to record the mean and fluctuating components of wind speed at a full-scale height of 5 feet above grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 wind directions, in 10 degree increments, starting from true north. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the reference wind speed in the free stream above the model.

3.2 Meteorological Data

The results obtained from the wind tunnel test were combined with long-term meteorological data, recorded during the years 1991 to 2016 at Boston's Logan International Airport, in order to predict full scale wind conditions. The analysis was performed separately for each of the four seasons and for the entire year. **Figure 2** presents "wind roses", summarizing the seasonal and annual wind climates in the Boston area, based on the data from Logan Airport. The first wind rose in **Figure 2**, for example, summarizes the spring (March, April, and May) wind data. In general, the predominant winds at this time of the year are from the west-northwest, northwest, west, south-southwest and east-southeast. In addition to this directions, strong winds are also prevalent from the northeast direction as indicated by the red and yellow color bands on the wind rose.

On an annual basis (the last wind rose in **Figure 2**) the most common wind directions are from the those between southwest and northwest directions. Winds from east-southeast are also relatively common. In the case of strong winds, northeast and west through northwest are the dominant wind directions.

This study involved state-of-the-art measurement and analysis techniques to predict wind conditions at the study site. Nevertheless, some uncertainty remains in predicting wind comfort, and this must be kept in mind. For example, the sensation of comfort among individuals can be quite variable. Variations in age, individual health, clothing, and other human factors can change a particular response of an individual. The comfort limits used in this report represent an average for the total population. Also, unforeseen changes in the project area, such as

the construction or removal of buildings, can affect the conditions experienced at the site. Finally, the prediction of wind speeds is necessarily a statistical procedure. The wind speeds reported are for the frequency of occurrence stated (one percent of the time). Higher wind speeds will occur but on a less frequent basis.

4 BPDA WIND CRITERIA

The BPDA has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BPDA wind design guidance criterion states that an effective gust velocity (hourly mean wind speed +1.5 times the root-mean-square wind speed) of 31 mph should not be exceeded more than one percent of the time. The second set of criteria used by the BPDA to determine the acceptability of specific locations is based on the work of Melbourne[1]. This set of criteria is used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking. The criteria are expressed in terms of benchmarks for the 1-hour mean wind speed exceeded 1% of the time (i.e., the 99-percentile mean wind speed). They are as follows:

BPDA Mean Wind Criteria*

Comfort Category	Mean Wind Speed (mph)
Dangerous	> 27
Uncomfortable for Walking	> 19 and ≤ 27
Comfortable for Walking	> 15 and ≤ 19
Comfortable for Standing	> 12 and ≤ 15
Comfortable for Sitting	< 12

* Applicable to the hourly mean wind speed exceeded one percent of the time.

The wind climate found in a typical downtown location in Boston is generally comfortable for the pedestrian use of sidewalks and thoroughfares and meets the BPDA effective gust velocity criterion of 31 mph. However, without any mitigation measures, this wind climate is likely to be frequently uncomfortable for more passive activities such as sitting.

1. Melbourne, W.H., 1978, "Criteria for Environmental Wind Conditions", Journal of Industrial Aerodynamics, 3 (1978) 241 - 249.

5 PREDICTED WIND CONDITIONS

Figures 3a through 4b graphically depict the wind comfort conditions at each wind measurement location based on the annual winds while **Table 1** presents the mean and effective gust wind speeds for each season as well as annually. Typically the summer and fall winds tend to be more comfortable than the annual winds while the winter and spring winds are less comfortable than the annual winds. The following summary of pedestrian wind comfort is based on the annual winds for each configuration tested, except where noted below in the text.

The following is a detailed discussion of the suitability of the predicted wind comfort conditions for the anticipated pedestrian use of each area of interest including: main entrances along Brookline Avenue and surrounding sidewalks.

5.1 No Build

As shown in **Figure 3a**, wind conditions at all locations are generally expected to be comfortable for walking or better on an annual basis, which is appropriate for the intended use. Uncomfortable wind conditions exist at some isolated locations along the sidewalks of Brookline Avenue and Boylston Street, to the south, east and southeast of the proposed development on an annual basis (Locations 32, 66, 73, 74, 78, 80 and 81 in **Figure 3a**). High wind speeds categorized as Dangerous are expected at one sidewalk location along Boylston Street to the southeast of project site during the winter (Location 73 in **Table 1**).

Winds at four off-site locations to the south and southeast of the project site, along Brookline Avenue and Boylston Street are predicted to exceed the effective gust speed criterion for the No Build configuration on an annual basis (Locations 66, 73, 74 and 78 in **Figure 4a**). Wind speeds at two off-site locations along Brookline Avenue are also predicted to exceed the effective gust criterion during the spring and winter (Locations 32 and 80 in **Table 1**).

5.2 Build

With the addition of the proposed development and landscaping, winds at most off-site locations are expected to improve upon or remain similar to the No Build conditions on an annual basis (**Figure 3b**). Wind speeds comfortable for sitting are predicted at the major entrances to the development (Locations 3 and 5 in **Figure 3b**). Wind speeds at other locations around the perimeter of the proposed development are expected to be comfortable for walking or better on an annual basis (Locations 2 through 13 in **Figure 3b**). These conditions are considered appropriate for the intended use. Winds at the northwest corner of the proposed development are predicted to be Uncomfortable on an annual basis (Location 14 in **Figure 3b**). High wind activity at this corner is primarily due to the westerly winds that are accelerated at the corner. Reduced wind speeds can be achieved by including coniferous trees at the northwest corner of the proposed development, along Fullerton Street. Alternatively, vertical wind screens at least 6 ft. tall and 20 – 30% porous can be added in staggered arrangement at this corner to reduce the energy of the westerly winds. Examples of these are shown in **Image 1**.

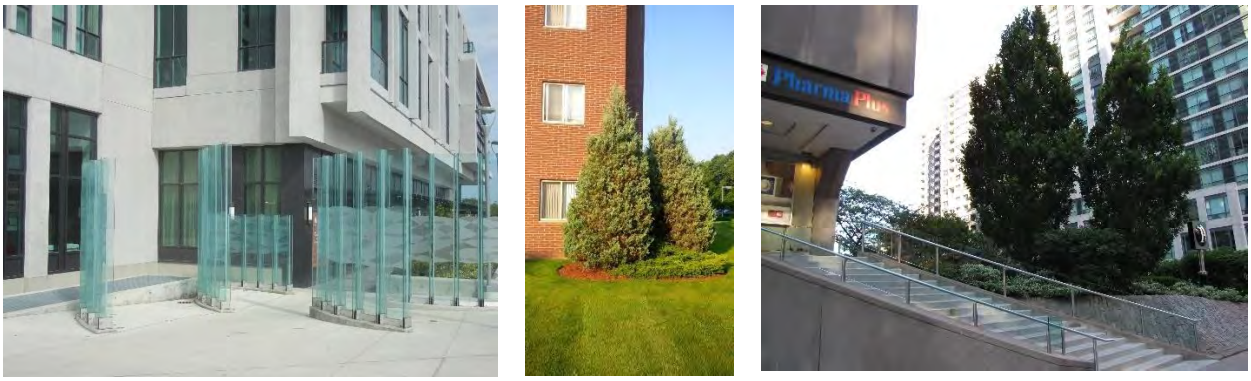


Image 1: Examples of wind screens and coniferous trees

The addition of the proposed project is expected to result in uncomfortable wind conditions at two new locations along Fullerton Avenue and Brookline Avenue, compared to the No Build configuration (Locations 1 and 55 in **Figure 3b**). Many of the Uncomfortable conditions predicted for the No Build configuration along Brookline Avenue and Boylston Street are improved (Locations 32, 73, 74, 78 and 80 in **Figure 3b**); however, the Uncomfortable wind conditions at two locations along Brookline Avenue remain unchanged (Locations 66 and 80 in **Figure 3b**). No Dangerous wind conditions are predicted in the Build configuration (**Figure 3b**).

With the addition of the proposed development, the effective gust exceedance at one location along Brookline Avenue remain similar to the No Build conditions (Location 66 in **Figure 4b**). The exceedance of the effective gust criterion at three locations along Boylston Street and are eliminated (Locations 73, 74 and 78 in **Figure 4b**). Wind speeds at the northwest corner of the proposed development is also predicted to exceed the effective gust criterion during the winter (Location 14 in **Table 1**).

6 APPLICABILITY

The wind conditions presented in this report pertain to the proposed Landmark Center R + D Tower as detailed in the architectural design drawings listed in **Appendix A**. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

7 REFERENCES

1. ASCE Task Committee on Outdoor Human Comfort (2004). *Outdoor Human Comfort and Its Assessment*, 68 pages, American Society of Civil Engineers, Reston, Virginia, USA.

2. Williams, C.J., Hunter, M.A. and Waechter, W.F. (1990). "Criteria for Assessing the Pedestrian Wind Environment," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.36, pp.811-815.

3. Williams, C.J., Soligo M.J. and Cote, J. (1992). "A Discussion of the Components for a Comprehensive Pedestrian Level Comfort Criteria," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.41-44, pp.2389-2390.

4. Soligo, M.J., Irwin, P.A., and Williams, C.J. (1993). "Pedestrian Comfort Including Wind and Thermal Effects," *Third Asia-Pacific Symposium on Wind Engineering*, Hong Kong.

5. Soligo, M.J., Irwin, P.A., Williams, C.J. and Schuyler, G.D. (1998). "A Comprehensive Assessment of Pedestrian Comfort Including Thermal Effects," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.77&78, pp.753-766.

6. Williams, C.J., Wu, H., Waechter, W.F. and Baker, H.A. (1999). "Experiences with Remedial Solutions to Control Pedestrian Wind Problems," *Tenth International Conference on Wind Engineering*, Copenhagen, Denmark.

7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

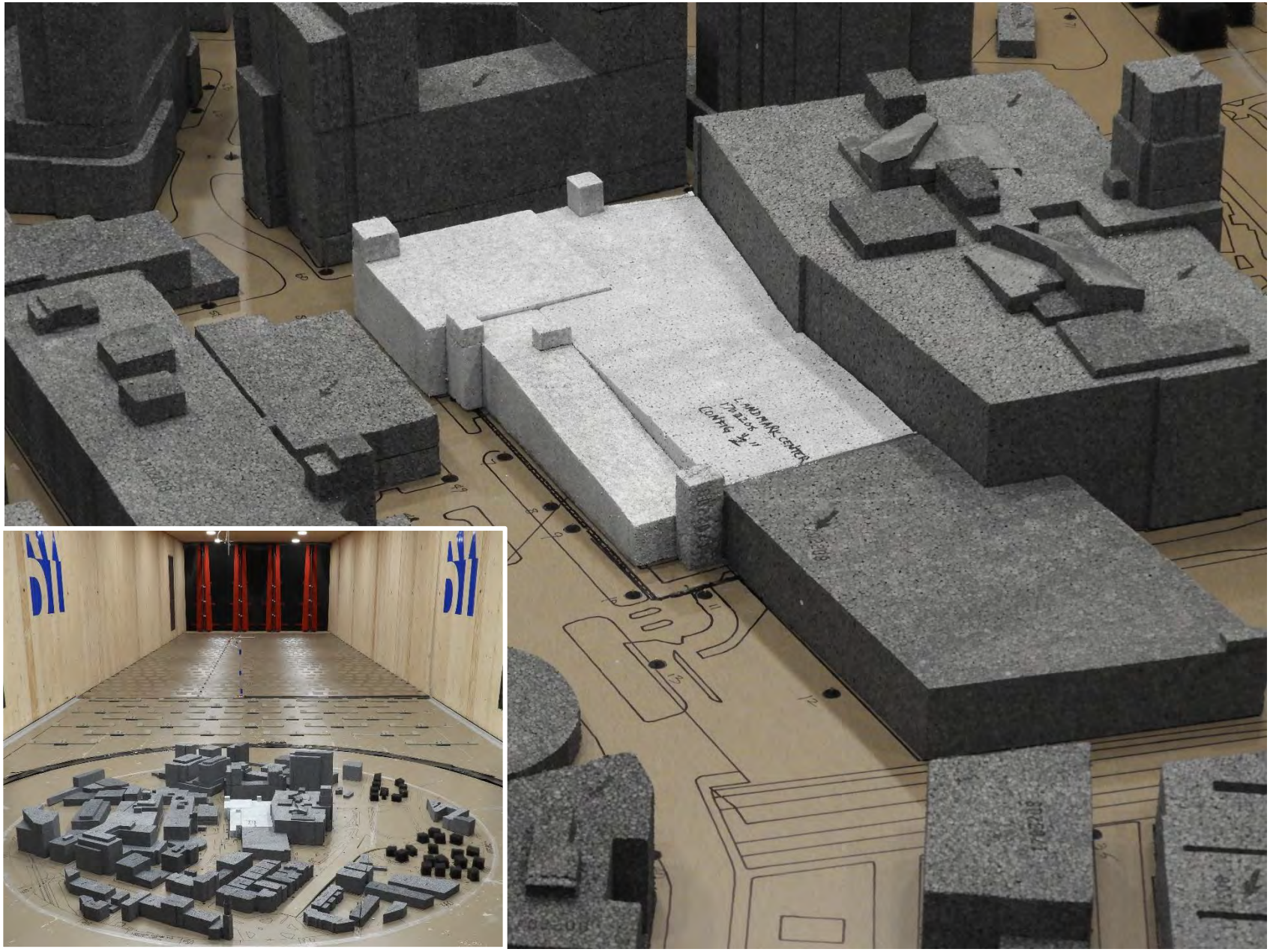
8. Durgin, F. H. (1997). "Pedestrian Level Wind Criteria Using the Equivalent average", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 66, pp. 215-226.

9. Wu, H. and Kriksic, F. (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.104-106, pp.397-407.

10. Wu, H., Williams, C.J., Baker, H.A. and Waechter, W.F. (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.

11. Williams, C.J., Wu, H., Waechter, W.F. and Baker, H.A. (1999). "Experiences with Remedial Solutions to Control Pedestrian Wind Problems," *Tenth International Conference on Wind Engineering*, Copenhagen, Denmark.

FIGURES



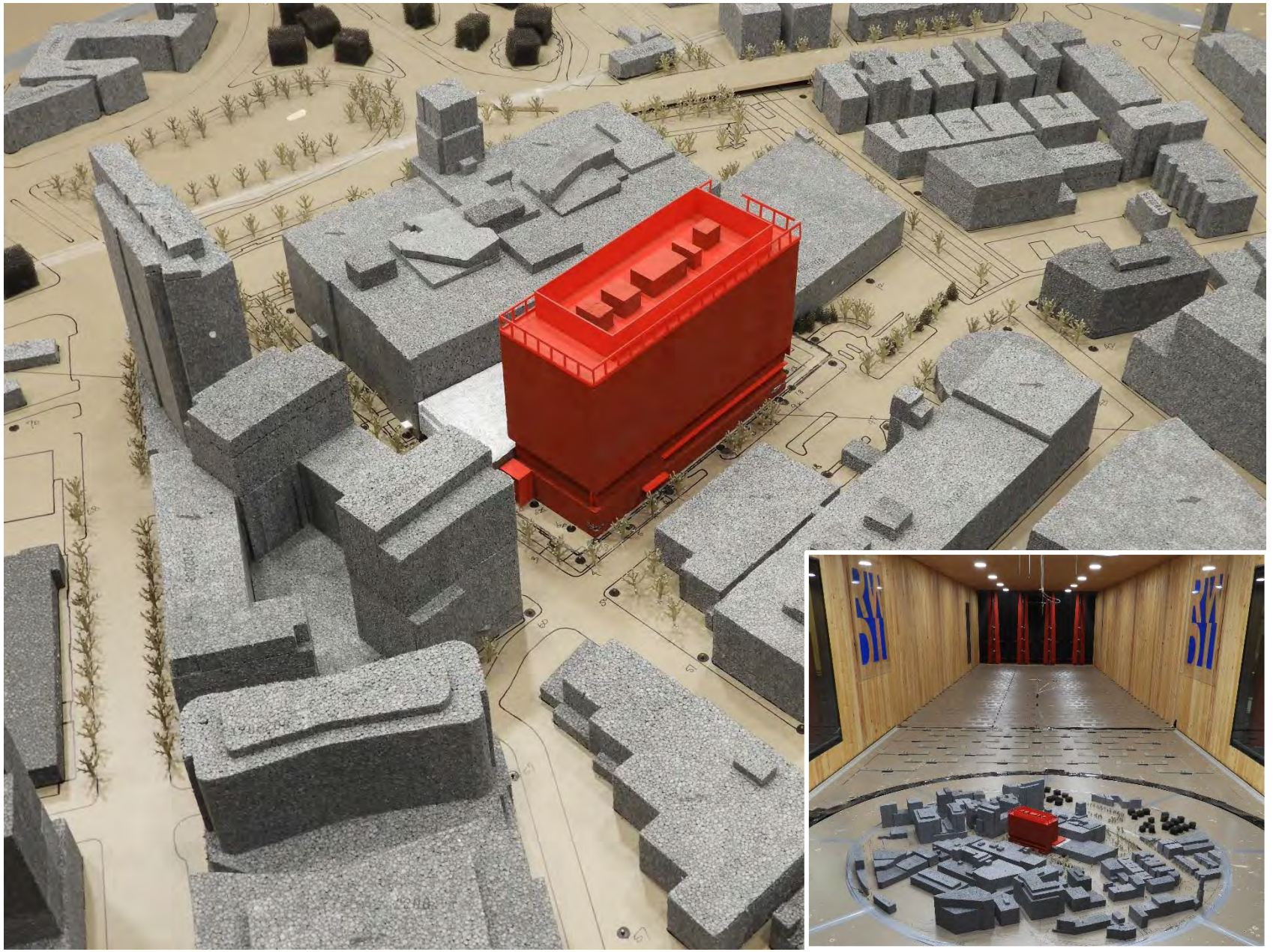
Wind Tunnel Study Model
No Build

Figure No. 1a

Landmark Center R + D Tower – Boston, MA

Project #1702208

Date: April 25, 2017



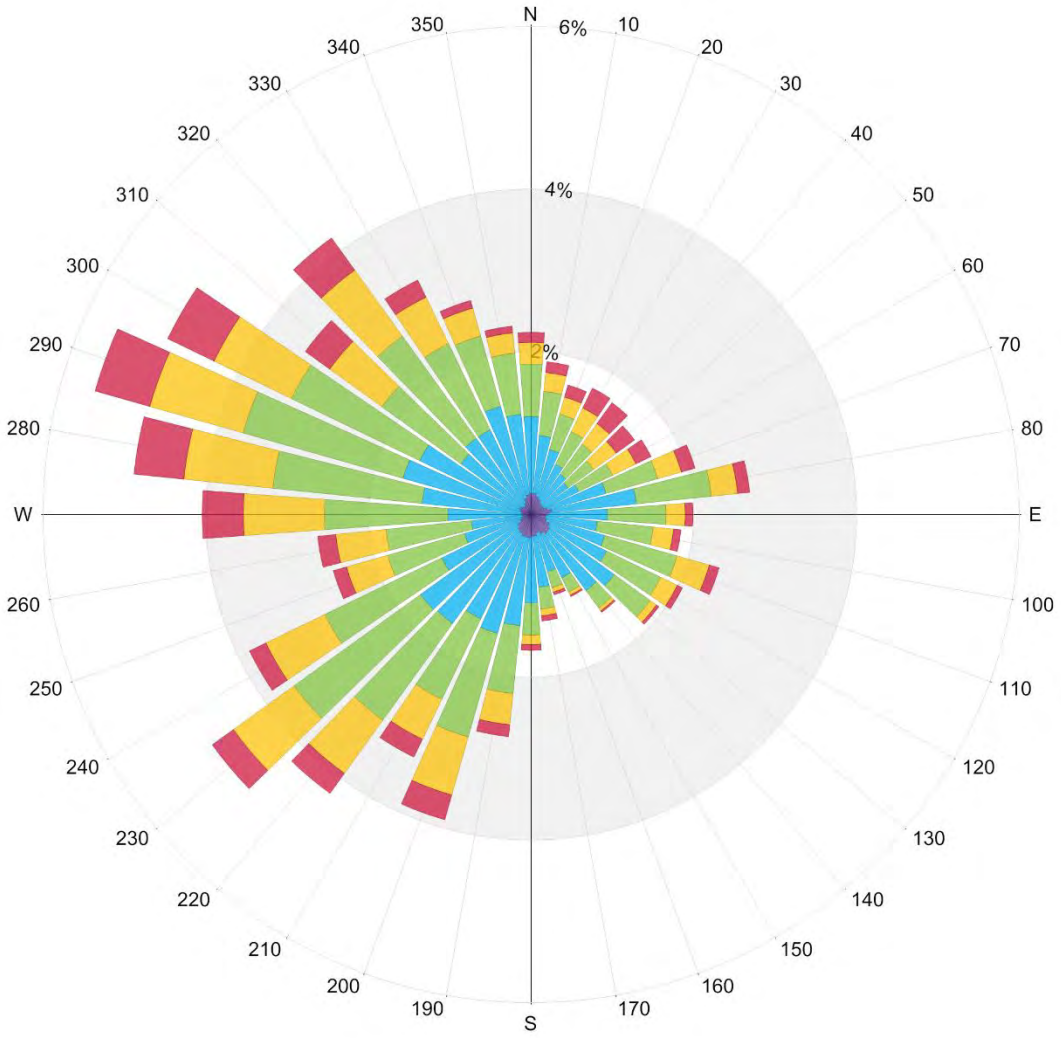
Wind Tunnel Study Model
Build

Figure No. 1b

Landmark Center R + D Tower – Boston, MA

Project #1702208

Date: June 26, 2017



Annual Winds

Wind Speed (mph)	Probability (%)
Calm	2.6
1-5	7.4
6-10	32.1
11-15	33.0
16-20	16.9
>20	8.1

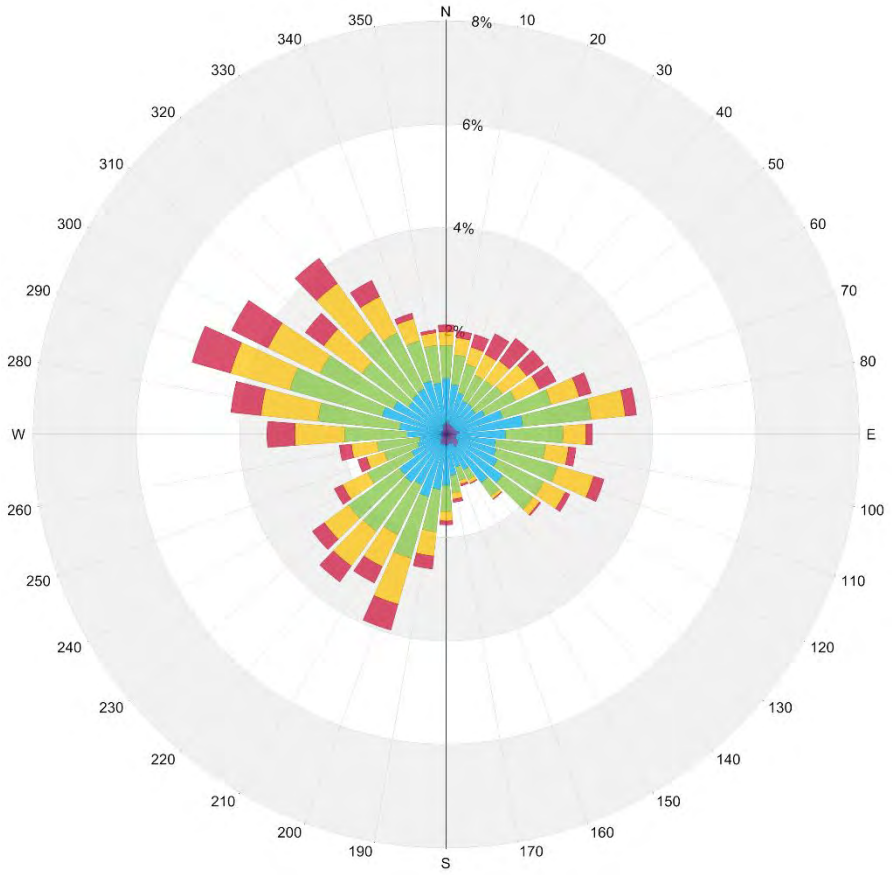
Directional Distribution (%) of Winds Approaching
Boston Logan International Airport (1991 - 2016)

Landmark Center R + D Center – Boston, MA

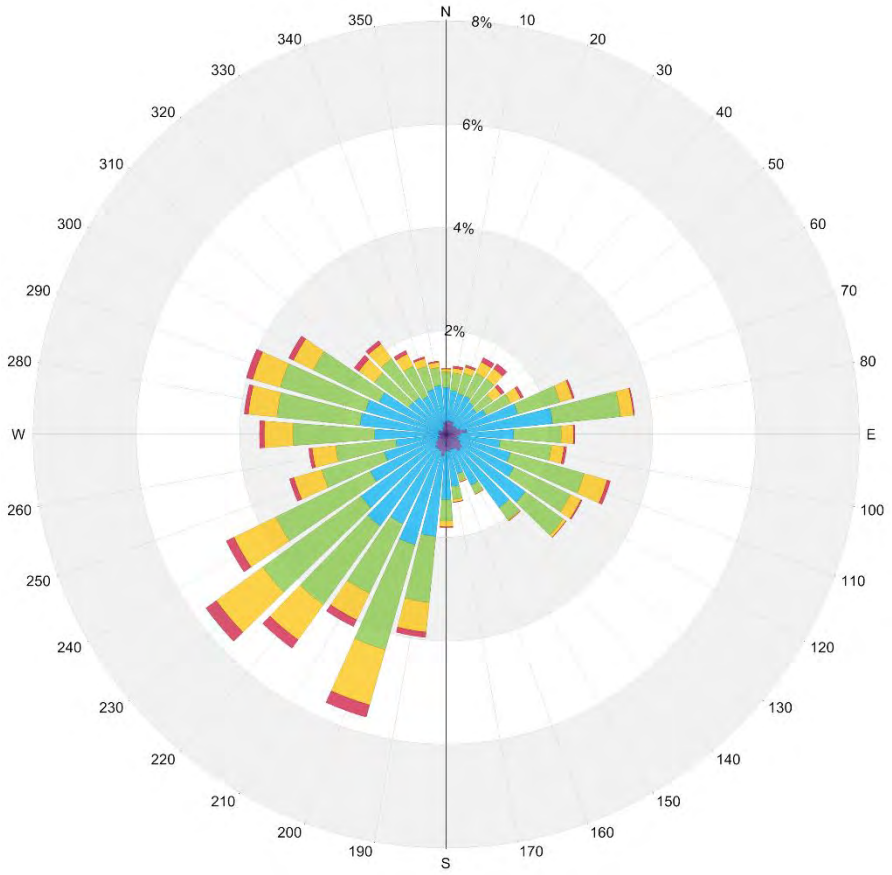
Project #1702208

Figure No. 2

Date: June 26, 2017



Spring
(March - May)



Summer
(June - August)

Wind Speed (mph)	Probability (%) Spring	Summer
Calm	2.4	2.7
1-5	6.4	8.9
6-10	28.5	38.1
11-15	32.9	35.1
16-20	19.7	12.6
>20	10.2	2.7

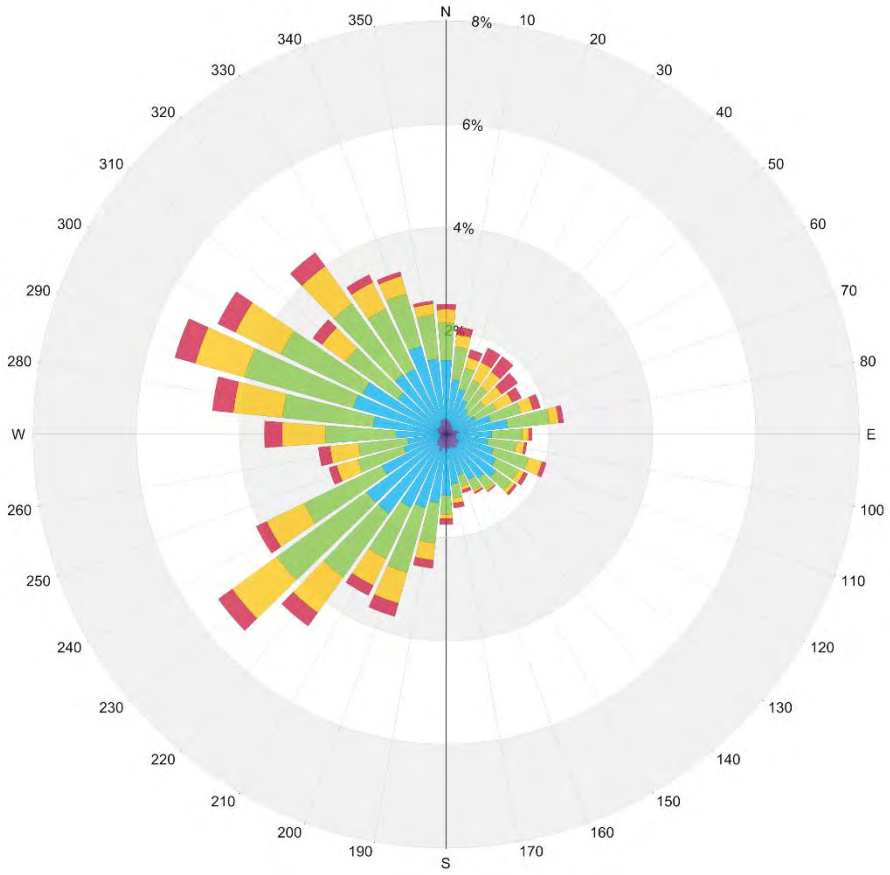
Directional Distribution (%) of Winds Approaching
Boston Logan International Airport (1991 - 2016)

Landmark Center R + D Tower – Boston, MA

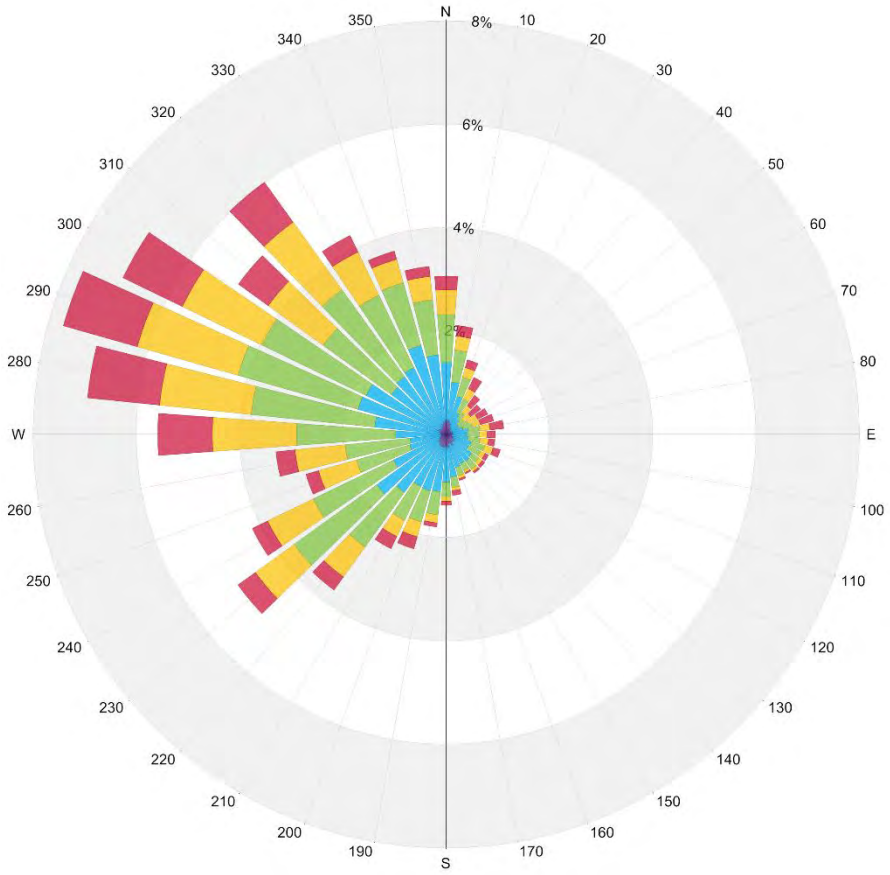
Project #1702208

Figure No. 2

Date: June 26, 2017



Fall
(September - November)



Winter
(December - February)

Wind Speed (mph)	Probability (%) Fall	Winter
Calm	2.9	2.3
1-5	8.0	6.2
6-10	34.3	27.6
11-15	32.8	31.0
16-20	15.3	20.1
>20	6.7	12.8

Directional Distribution (%) of Winds Approaching
Boston Logan International Airport (1991 - 2016)

Landmark Center R + D Tower – Boston, MA

Project #1702208

Figure No. 2

Date: June 26, 2017

OVERLAND STREET
ARUNDEL STREET
BURLINGTON AVENUE
BEACON STREET
MINER STREET
VAN NESS STREET
RICHARD ROSS WAY
FULLERTON STREET
KILMARNOCK STREET
ABERDEEN STREET
EXISTING BUILDING
BROOKLINE AVENUE
BOYLSTON STREET
PARK DRIVE
KESWICK STREET
MEDFIELD STREET
PETERBOURGH STREET

LEGEND:

MEAN SPEED CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable
- Dangerous

SENSOR LOCATION:
- Grade Level

0 75 150ft

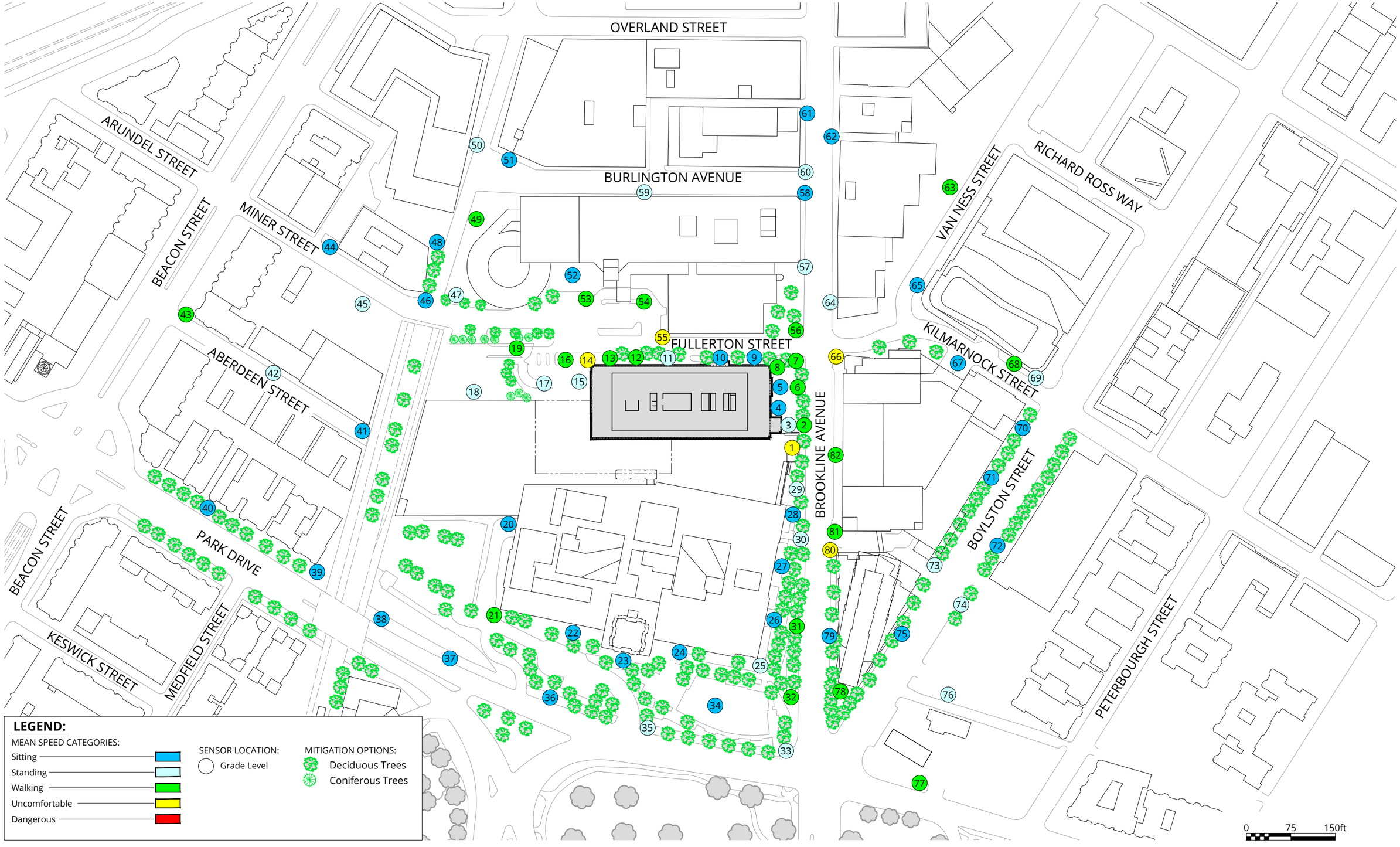
Pedestrian Wind Conditions - Mean Speed
No Build
Summer (May to October)

Landmark Center R + D Tower - Boston, MA

True North

Project #1702208

Drawn by: ESM	Figure: 3a
Approx. Scale:	1"=150'
Date Revised:	June 15, 2017



Pedestrian Wind Conditions - Mean Speed
Build
Annual

Landmark Center R + D Tower - Boston, MA

True North

Project #1702208

Drawn by: ARM	Figure: 3b
Approx. Scale:	1"=150'
Date Revised:	June 1, 2017

OVERLAND STREET
ARUNDEL STREET
BEACON STREET
MINER STREET
BURLINGTON AVENUE
RICHARD ROSS WAY
VAN NESS STREET
FULLERTON STREET
KILMARNOCK STREET
ABERDEEN STREET
EXISTING BUILDING
BROOKLINE AVENUE
BOYLSTON STREET
PARK DRIVE
KESWICK STREET
MEDFIELD STREET
PETERBOURGH STREET

LEGEND:

EFFECTIVE GUST CATEGORIES:
Acceptable
Unacceptable

SENSOR LOCATION:
Grade Level

0 75 150ft

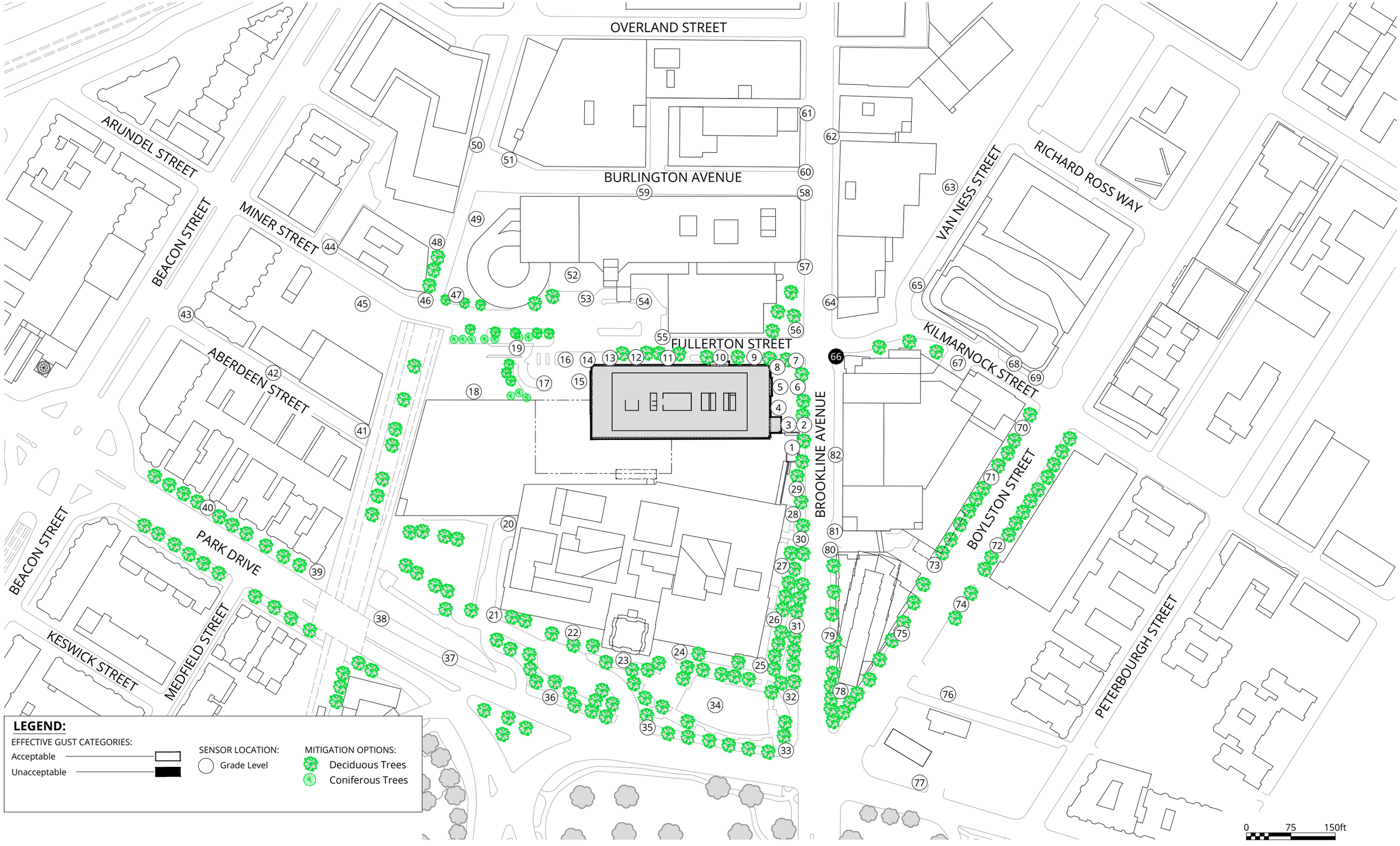
Pedestrian Wind Conditions - Effective Gust Speed
No Build
Annual

Landmark Center R + D Tower - Boston, MA

True North

Project #1702208

Drawn by: ESM	Figure: 4a
Approx. Scale:	1"=150'
Date Revised:	June 15, 2017



Pedestrian Wind Conditions - Effective Gust
Build
Annual

Landmark Center R + D Tower - Boston, MA

True North

Project #1702208

Drawn by: ARM	Figure: 4b	
Approx. Scale:	1"=150'	
Date Revised:	June 1, 2017	

TABLES

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
1	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	21		Uncomfortable	27		Acceptable
		Summer	17		Walking	21		Acceptable
		Fall	20		Uncomfortable	26		Acceptable
		Winter	24		Uncomfortable	30		Acceptable
		Annual	21		Uncomfortable	27		Acceptable
2	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	19		Walking	26		Acceptable
		Summer	15		Standing	19		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	21		Uncomfortable	27		Acceptable
		Annual	19		Walking	25		Acceptable
3	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	14		Standing	20		Acceptable
		Summer	11		Sitting	15		Acceptable
		Fall	13		Standing	18		Acceptable
		Winter	16		Walking	22		Acceptable
		Annual	14		Standing	20		Acceptable
4	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	10		Sitting	18		Acceptable
		Summer	9		Sitting	16		Acceptable
		Fall	10		Sitting	18		Acceptable
		Winter	11		Sitting	19		Acceptable
		Annual	10		Sitting	18		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
5	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	18		Acceptable
6	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	20		Uncomfortable	29		Acceptable
		Summer	14		Standing	22		Acceptable
		Fall	19		Walking	27		Acceptable
		Winter	20		Uncomfortable	30		Acceptable
		Annual	19		Walking	28		Acceptable
7	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	19		Walking	26		Acceptable
		Summer	13		Standing	18		Acceptable
		Fall	18		Walking	24		Acceptable
		Winter	18		Walking	25		Acceptable
		Annual	17		Walking	24		Acceptable
8	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	21		Uncomfortable	29		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	19		Walking	27		Acceptable
		Winter	20		Uncomfortable	28		Acceptable
		Annual	19		Walking	27		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
9	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	11		Sitting	18		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	10		Sitting	17		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	11		Sitting	17		Acceptable
10	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	19		Acceptable
11	A	Spring	11		Sitting	16		Acceptable
		Summer	8		Sitting	12		Acceptable
		Fall	10		Sitting	14		Acceptable
		Winter	12		Sitting	17		Acceptable
		Annual	10		Sitting	15		Acceptable
	B	Spring	14	27%	Standing	20	25%	Acceptable
		Summer	11	38%	Sitting	16	33%	Acceptable
		Fall	13	30%	Standing	19	36%	Acceptable
		Winter	16	33%	Walking	22	29%	Acceptable
		Annual	14	40%	Standing	20	33%	Acceptable
12	A	Spring	10		Sitting	16		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	11		Sitting	16		Acceptable
		Annual	10		Sitting	15		Acceptable
	B	Spring	17	70%	Walking	25	56%	Acceptable
		Summer	13	86%	Standing	19	58%	Acceptable
		Fall	15	67%	Standing	23	53%	Acceptable
		Winter	19	73%	Walking	28	75%	Acceptable
		Annual	17	70%	Walking	25	67%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
13	A	Spring	10		Sitting	16		Acceptable
		Summer	8		Sitting	12		Acceptable
		Fall	10		Sitting	15		Acceptable
		Winter	10		Sitting	17		Acceptable
		Annual	10		Sitting	15		Acceptable
	B	Spring	18	80%	Walking	29	81%	Acceptable
		Summer	14	75%	Standing	21	75%	Acceptable
		Fall	17	70%	Walking	26	73%	Acceptable
		Winter	20	100%	Uncomfortable	31	82%	Acceptable
		Annual	18	80%	Walking	28	87%	Acceptable
14	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	22		Uncomfortable	31		Acceptable
		Summer	17		Walking	23		Acceptable
		Fall	20		Uncomfortable	28		Acceptable
		Winter	24		Uncomfortable	32		Unacceptable
		Annual	22		Uncomfortable	30		Acceptable
15	A	N/A						
		N/A						
		N/A						
		N/A						
		N/A						
	B	Spring	14		Standing	23		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	13		Standing	22		Acceptable
		Annual	13		Standing	21		Acceptable
16	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	12		Sitting	20		Acceptable
	B	Spring	20	54%	Uncomfortable	29	45%	Acceptable
		Summer	14	40%	Standing	20	33%	Acceptable
		Fall	19	58%	Walking	26	37%	Acceptable
		Winter	19	36%	Walking	28	33%	Acceptable
		Annual	18	50%	Walking	26	30%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
17	A	Spring	9		Sitting	16		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9		Sitting	14		Acceptable
		Winter	10		Sitting	16		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	15	67%	Standing	23	44%	Acceptable
		Summer	11	57%	Sitting	17	42%	Acceptable
		Fall	14	56%	Standing	21	50%	Acceptable
		Winter	14	40%	Standing	23	44%	Acceptable
		Annual	14	56%	Standing	21	40%	Acceptable
18	A	Spring	11		Sitting	19		Acceptable
		Summer	8		Sitting	14		Acceptable
		Fall	10		Sitting	18		Acceptable
		Winter	11		Sitting	19		Acceptable
		Annual	11		Sitting	18		Acceptable
	B	Spring	15	36%	Standing	22	16%	Acceptable
		Summer	11	38%	Sitting	16	14%	Acceptable
		Fall	14	40%	Standing	21	17%	Acceptable
		Winter	15	36%	Standing	22	16%	Acceptable
		Annual	14	27%	Standing	21	17%	Acceptable
19	A	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	16		Walking	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	19	27%	Walking	27	29%	Acceptable
		Summer	14	27%	Standing	19	19%	Acceptable
		Fall	18	38%	Walking	25	32%	Acceptable
		Winter	18	13%	Walking	25	14%	Acceptable
		Annual	18	29%	Walking	24	20%	Acceptable
20	A	Spring	9		Sitting	16		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	10		Sitting	17		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	9		Sitting	15		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	8	-11%	Sitting	14		Acceptable
		Winter	9	-10%	Sitting	16		Acceptable
		Annual	9		Sitting	15		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
21	A	Spring	20		Uncomfortable	29		Acceptable
		Summer	17		Walking	25		Acceptable
		Fall	19		Walking	27		Acceptable
		Winter	20		Uncomfortable	30		Acceptable
		Annual	19		Walking	28		Acceptable
	B	Spring	18	-10%	Walking	27		Acceptable
		Summer	15	-12%	Standing	22	-12%	Acceptable
		Fall	17	-11%	Walking	25		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	18		Walking	26		Acceptable
22	A	Spring	9		Sitting	16		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9		Sitting	14		Acceptable
		Winter	10		Sitting	17		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	8	-11%	Sitting	14	-13%	Acceptable
		Summer	6	-14%	Sitting	11		Acceptable
		Fall	7	-22%	Sitting	13		Acceptable
		Winter	8	-20%	Sitting	15	-12%	Acceptable
		Annual	8	-11%	Sitting	13	-13%	Acceptable
23	A	Spring	10		Sitting	17		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	11		Sitting	18		Acceptable
		Annual	10		Sitting	16		Acceptable
	B	Spring	11	10%	Sitting	18		Acceptable
		Summer	8		Sitting	14		Acceptable
		Fall	10	11%	Sitting	17	13%	Acceptable
		Winter	12		Sitting	20	11%	Acceptable
		Annual	11	10%	Sitting	18	13%	Acceptable
24	A	Spring	9		Sitting	16		Acceptable
		Summer	7		Sitting	12		Acceptable
		Fall	9		Sitting	14		Acceptable
		Winter	10		Sitting	17		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	8	-11%	Sitting	13	-19%	Acceptable
		Summer	6	-14%	Sitting	10	-17%	Acceptable
		Fall	7	-22%	Sitting	12	-14%	Acceptable
		Winter	8	-20%	Sitting	14	-18%	Acceptable
		Annual	8	-11%	Sitting	13	-13%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
25	A	Spring	17		Walking	26		Acceptable
		Summer	15		Standing	22		Acceptable
		Fall	16		Walking	25		Acceptable
		Winter	19		Walking	28		Acceptable
		Annual	17		Walking	26		Acceptable
	B	Spring	15	-12%	Standing	22	-15%	Acceptable
		Summer	12	-20%	Sitting	18	-18%	Acceptable
		Fall	14	-13%	Standing	21	-16%	Acceptable
		Winter	16	-16%	Walking	24	-14%	Acceptable
		Annual	15	-12%	Standing	22	-15%	Acceptable
26	A	Spring	14		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	11	-21%	Sitting	17	-19%	Acceptable
		Summer	9	-18%	Sitting	15	-12%	Acceptable
		Fall	10	-23%	Sitting	16	-20%	Acceptable
		Winter	11	-21%	Sitting	18	-18%	Acceptable
		Annual	11	-15%	Sitting	17	-15%	Acceptable
27	A	Spring	10		Sitting	17		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	10		Sitting	16		Acceptable
		Winter	11		Sitting	17		Acceptable
		Annual	10		Sitting	16		Acceptable
	B	Spring	10		Sitting	15	-12%	Acceptable
		Summer	7	-13%	Sitting	12		Acceptable
		Fall	9	-10%	Sitting	14	-13%	Acceptable
		Winter	10		Sitting	15	-12%	Acceptable
		Annual	9	-10%	Sitting	14	-13%	Acceptable
28	A	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	12	-20%	Sitting	18	-14%	Acceptable
		Summer	9	-18%	Sitting	14	-13%	Acceptable
		Fall	11	-21%	Sitting	16	-20%	Acceptable
		Winter	12	-20%	Sitting	19	-14%	Acceptable
		Annual	11	-21%	Sitting	17	-15%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
29	A	Spring	15		Standing	21		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	21		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	14		Standing	19	-10%	Acceptable
		Summer	12		Sitting	16		Acceptable
		Fall	13		Standing	17	-15%	Acceptable
		Winter	14		Standing	19	-10%	Acceptable
		Annual	13		Standing	18	-10%	Acceptable
30	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	22		Acceptable
31	A	Spring	20		Uncomfortable	29		Acceptable
		Summer	16		Walking	24		Acceptable
		Fall	19		Walking	27		Acceptable
		Winter	21		Uncomfortable	31		Acceptable
		Annual	19		Walking	29		Acceptable
	B	Spring	18	-10%	Walking	26	-10%	Acceptable
		Summer	14	-13%	Standing	20	-17%	Acceptable
		Fall	17	-11%	Walking	24	-11%	Acceptable
		Winter	20		Uncomfortable	29		Acceptable
		Annual	18		Walking	26	-10%	Acceptable
32	A	Spring	22		Uncomfortable	32		Unacceptable
		Summer	17		Walking	24		Acceptable
		Fall	21		Uncomfortable	30		Acceptable
		Winter	24		Uncomfortable	33		Unacceptable
		Annual	22		Uncomfortable	31		Acceptable
	B	Spring	19	-14%	Walking	27	-16%	Acceptable
		Summer	15	-12%	Standing	21	-13%	Acceptable
		Fall	17	-19%	Walking	25	-17%	Acceptable
		Winter	20	-17%	Uncomfortable	29	-12%	Acceptable
		Annual	18	-18%	Walking	26	-16%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
33	A	Spring	19		Walking	26		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	17		Walking	25		Acceptable
		Winter	20		Uncomfortable	28		Acceptable
		Annual	18		Walking	26		Acceptable
	B	Spring	15	-21%	Standing	22	-15%	Acceptable
		Summer	13	-13%	Standing	18	-14%	Acceptable
		Fall	14	-18%	Standing	21	-16%	Acceptable
		Winter	16	-20%	Walking	24	-14%	Acceptable
		Annual	15	-17%	Standing	22	-15%	Acceptable
34	A	Spring	16		Walking	24		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	16		Walking	24		Acceptable
	B	Spring	12	-25%	Sitting	20	-17%	Acceptable
		Summer	10	-23%	Sitting	16	-16%	Acceptable
		Fall	12	-20%	Sitting	19	-17%	Acceptable
		Winter	14	-22%	Standing	21	-22%	Acceptable
		Annual	12	-25%	Sitting	19	-21%	Acceptable
35	A	Spring	15		Standing	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	22		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	15		Standing	23		Acceptable
	B	Spring	13	-13%	Standing	21		Acceptable
		Summer	10	-17%	Sitting	16	-11%	Acceptable
		Fall	12	-14%	Sitting	20		Acceptable
		Winter	15	-12%	Standing	23	-12%	Acceptable
		Annual	13	-13%	Standing	21		Acceptable
36	A	Spring	15		Standing	22		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	10	-33%	Sitting	16	-27%	Acceptable
		Summer	8	-27%	Sitting	13	-24%	Acceptable
		Fall	9	-36%	Sitting	15	-29%	Acceptable
		Winter	10	-33%	Sitting	17	-26%	Acceptable
		Annual	9	-36%	Sitting	15	-29%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
37	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	12		Sitting	18		Acceptable
	B	Spring	9	-31%	Sitting	14	-26%	Acceptable
		Summer	7	-30%	Sitting	11	-31%	Acceptable
		Fall	9	-25%	Sitting	13	-28%	Acceptable
		Winter	9	-25%	Sitting	14	-26%	Acceptable
		Annual	9	-25%	Sitting	14	-22%	Acceptable
38	A	Spring	9		Sitting	14		Acceptable
		Summer	7		Sitting	11		Acceptable
		Fall	8		Sitting	13		Acceptable
		Winter	9		Sitting	15		Acceptable
		Annual	8		Sitting	13		Acceptable
	B	Spring	8	-11%	Sitting	12	-14%	Acceptable
		Summer	6	-14%	Sitting	9	-18%	Acceptable
		Fall	7	-13%	Sitting	11	-15%	Acceptable
		Winter	8	-11%	Sitting	12	-20%	Acceptable
		Annual	7	-13%	Sitting	11	-15%	Acceptable
39	A	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	17		Walking	24		Acceptable
		Annual	15		Standing	21		Acceptable
	B	Spring	11	-27%	Sitting	17	-19%	Acceptable
		Summer	9	-18%	Sitting	13	-24%	Acceptable
		Fall	10	-29%	Sitting	16	-20%	Acceptable
		Winter	12	-29%	Sitting	18	-25%	Acceptable
		Annual	11	-27%	Sitting	17	-19%	Acceptable
40	A	Spring	17		Walking	24		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	15		Standing	22		Acceptable
		Winter	18		Walking	27		Acceptable
		Annual	16		Walking	24		Acceptable
	B	Spring	11	-35%	Sitting	17	-29%	Acceptable
		Summer	10	-23%	Sitting	15	-21%	Acceptable
		Fall	10	-33%	Sitting	16	-27%	Acceptable
		Winter	12	-33%	Sitting	19	-30%	Acceptable
		Annual	11	-31%	Sitting	17	-29%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
41	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
42	A	Spring	16		Walking	23		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	18		Walking	26		Acceptable
		Annual	16		Walking	23		Acceptable
	B	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	17		Walking	25		Acceptable
		Annual	15		Standing	22		Acceptable
43	A	Spring	16		Walking	25		Acceptable
		Summer	13		Standing	19		Acceptable
		Fall	15		Standing	23		Acceptable
		Winter	17		Walking	26		Acceptable
		Annual	16		Walking	24		Acceptable
	B	Spring	19	19%	Walking	27		Acceptable
		Summer	15	15%	Standing	21	11%	Acceptable
		Fall	18	20%	Walking	25		Acceptable
		Winter	20	18%	Uncomfortable	28		Acceptable
		Annual	18	13%	Walking	26		Acceptable
44	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	12		Sitting	19		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
45	A	Spring	14		Standing	22		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	16		Walking	25		Acceptable
		Annual	14		Standing	22		Acceptable
	B	Spring	13		Standing	21		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	12		Sitting	19	-10%	Acceptable
		Winter	14	-13%	Standing	23		Acceptable
		Annual	13		Standing	20		Acceptable
46	A	Spring	14		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	12	-14%	Sitting	20		Acceptable
		Summer	9	-10%	Sitting	15		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	12		Sitting	19		Acceptable
47	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
48	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
49	A	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	17		Walking	24		Acceptable
	B	Spring	17		Walking	24		Acceptable
		Summer	14		Standing	19		Acceptable
		Fall	16		Walking	22		Acceptable
		Winter	19		Walking	27		Acceptable
		Annual	17		Walking	24		Acceptable
50	A	Spring	14		Standing	20		Acceptable
		Summer	12		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	16		Walking	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	14		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	13		Standing	18		Acceptable
		Winter	16		Walking	21		Acceptable
		Annual	14		Standing	19		Acceptable
51	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	12		Sitting	18	-10%	Acceptable
		Summer	9	-10%	Sitting	14		Acceptable
		Fall	11		Sitting	17		Acceptable
		Winter	13	-13%	Standing	20		Acceptable
		Annual	12		Sitting	18	-10%	Acceptable
52	A	Spring	9		Sitting	15		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	9		Sitting	14		Acceptable
		Winter	10		Sitting	16		Acceptable
		Annual	9		Sitting	15		Acceptable
	B	Spring	10	11%	Sitting	16		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	10		Sitting	17		Acceptable
		Annual	10	11%	Sitting	16		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
53	A	Spring	12		Sitting	19		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	18		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	19	58%	Walking	26	37%	Acceptable
		Summer	13	30%	Standing	19	19%	Acceptable
		Fall	17	42%	Walking	24	33%	Acceptable
		Winter	18	38%	Walking	25	19%	Acceptable
		Annual	17	42%	Walking	24	26%	Acceptable
54	A	Spring	11		Sitting	18		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	10		Sitting	16		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	11		Sitting	17		Acceptable
	B	Spring	16	45%	Walking	25	39%	Acceptable
		Summer	12	33%	Sitting	19	36%	Acceptable
		Fall	15	50%	Standing	23	44%	Acceptable
		Winter	17	42%	Walking	26	37%	Acceptable
		Annual	16	45%	Walking	24	41%	Acceptable
55	A	Spring	14		Standing	21		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	13		Standing	19		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	21	50%	Uncomfortable	29	38%	Acceptable
		Summer	16	60%	Walking	22	38%	Acceptable
		Fall	20	54%	Uncomfortable	27	42%	Acceptable
		Winter	23	53%	Uncomfortable	31	35%	Acceptable
		Annual	21	50%	Uncomfortable	29	38%	Acceptable
56	A	Spring	12		Sitting	19		Acceptable
		Summer	9		Sitting	14		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	12		Sitting	20		Acceptable
		Annual	11		Sitting	18		Acceptable
	B	Spring	19	58%	Walking	27	42%	Acceptable
		Summer	15	67%	Standing	21	50%	Acceptable
		Fall	18	64%	Walking	25	39%	Acceptable
		Winter	21	75%	Uncomfortable	29	45%	Acceptable
		Annual	19	73%	Walking	26	44%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
57	A	Spring	15		Standing	21		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	14		Standing	19		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	20		Acceptable
	B	Spring	13	-13%	Standing	18	-14%	Acceptable
		Summer	10		Sitting	14	-13%	Acceptable
		Fall	12	-14%	Sitting	17	-11%	Acceptable
		Winter	14		Standing	20		Acceptable
		Annual	13		Standing	18	-10%	Acceptable
58	A	Spring	10		Sitting	16		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	9		Sitting	14		Acceptable
		Winter	10		Sitting	16		Acceptable
		Annual	10		Sitting	15		Acceptable
	B	Spring	10		Sitting	16		Acceptable
		Summer	8		Sitting	13		Acceptable
		Fall	9		Sitting	15		Acceptable
		Winter	11	10%	Sitting	17		Acceptable
		Annual	10		Sitting	15		Acceptable
59	A	Spring	13		Standing	18		Acceptable
		Summer	10		Sitting	14		Acceptable
		Fall	12		Sitting	17		Acceptable
		Winter	15		Standing	21		Acceptable
		Annual	13		Standing	18		Acceptable
	B	Spring	13		Standing	18		Acceptable
		Summer	10		Sitting	14		Acceptable
		Fall	12		Sitting	17		Acceptable
		Winter	14		Standing	20		Acceptable
		Annual	13		Standing	18		Acceptable
60	A	Spring	15		Standing	21		Acceptable
		Summer	12		Sitting	16		Acceptable
		Fall	14		Standing	19		Acceptable
		Winter	17		Walking	23		Acceptable
		Annual	15		Standing	20		Acceptable
	B	Spring	14		Standing	19	-10%	Acceptable
		Summer	10	-17%	Sitting	14	-13%	Acceptable
		Fall	12	-14%	Sitting	17	-11%	Acceptable
		Winter	15	-12%	Standing	21		Acceptable
		Annual	13	-13%	Standing	19		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
61	A	Spring	13		Standing	21		Acceptable
		Summer	10		Sitting	15		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	13		Standing	20		Acceptable
		Annual	12		Sitting	19		Acceptable
	B	Spring	13		Standing	20		Acceptable
		Summer	9	-10%	Sitting	14		Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	11		Sitting	18		Acceptable
62	A	Spring	13		Standing	19		Acceptable
		Summer	10		Sitting	14		Acceptable
		Fall	12		Sitting	17		Acceptable
		Winter	15		Standing	21		Acceptable
		Annual	13		Standing	18		Acceptable
	B	Spring	11	-15%	Sitting	16	-16%	Acceptable
		Summer	9	-10%	Sitting	13		Acceptable
		Fall	10	-17%	Sitting	15	-12%	Acceptable
		Winter	12	-20%	Sitting	18	-14%	Acceptable
		Annual	11	-15%	Sitting	16	-11%	Acceptable
63	A	Spring	19		Walking	28		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	17		Walking	25		Acceptable
		Winter	20		Uncomfortable	29		Acceptable
		Annual	18		Walking	27		Acceptable
	B	Spring	17	-11%	Walking	26		Acceptable
		Summer	13	-13%	Standing	20		Acceptable
		Fall	16		Walking	23		Acceptable
		Winter	18	-10%	Walking	27		Acceptable
		Annual	17		Walking	25		Acceptable
64	A	Spring	13		Standing	20		Acceptable
		Summer	11		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	15		Standing	23		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	14		Standing	21		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	16		Walking	23		Acceptable
		Annual	14		Standing	21		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
65	A	Spring	16		Walking	25		Acceptable
		Summer	11		Sitting	18		Acceptable
		Fall	14		Standing	23		Acceptable
		Winter	16		Walking	25		Acceptable
		Annual	15		Standing	23		Acceptable
	B	Spring	14	-13%	Standing	23		Acceptable
		Summer	10		Sitting	16	-11%	Acceptable
		Fall	13		Standing	21		Acceptable
		Winter	12	-25%	Sitting	21	-16%	Acceptable
		Annual	12	-20%	Sitting	21		Acceptable
66	A	Spring	25		Uncomfortable	35		Unacceptable
		Summer	19		Walking	26		Acceptable
		Fall	23		Uncomfortable	32		Unacceptable
		Winter	27		Uncomfortable	37		Unacceptable
		Annual	25		Uncomfortable	34		Unacceptable
	B	Spring	24		Uncomfortable	33		Unacceptable
		Summer	19		Walking	26		Acceptable
		Fall	23		Uncomfortable	31		Acceptable
		Winter	27		Uncomfortable	37		Unacceptable
		Annual	24		Uncomfortable	33		Unacceptable
67	A	Spring	15		Standing	22		Acceptable
		Summer	11		Sitting	17		Acceptable
		Fall	14		Standing	20		Acceptable
		Winter	15		Standing	22		Acceptable
		Annual	14		Standing	21		Acceptable
	B	Spring	13	-13%	Standing	20		Acceptable
		Summer	10		Sitting	15	-12%	Acceptable
		Fall	12	-14%	Sitting	19		Acceptable
		Winter	13	-13%	Standing	20		Acceptable
		Annual	12	-14%	Sitting	19	-10%	Acceptable
68	A	Spring	20		Uncomfortable	28		Acceptable
		Summer	17		Walking	24		Acceptable
		Fall	18		Walking	26		Acceptable
		Winter	19		Walking	26		Acceptable
		Annual	19		Walking	26		Acceptable
	B	Spring	19		Walking	26		Acceptable
		Summer	16		Walking	22		Acceptable
		Fall	17		Walking	24		Acceptable
		Winter	18		Walking	24		Acceptable
		Annual	17	-11%	Walking	24		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
69	A	Spring	14		Standing	21		Acceptable
		Summer	12		Sitting	18		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	13		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	14		Standing	22		Acceptable
		Summer	12		Sitting	19		Acceptable
		Fall	13		Standing	20		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	21		Acceptable
70	A	Spring	12		Sitting	20		Acceptable
		Summer	10		Sitting	17		Acceptable
		Fall	11		Sitting	19		Acceptable
		Winter	12		Sitting	20		Acceptable
		Annual	11		Sitting	19		Acceptable
	B	Spring	12		Sitting	19		Acceptable
		Summer	9	-10%	Sitting	15	-12%	Acceptable
		Fall	11		Sitting	18		Acceptable
		Winter	12		Sitting	19		Acceptable
		Annual	12		Sitting	18		Acceptable
71	A	Spring	10		Sitting	18		Acceptable
		Summer	9		Sitting	15		Acceptable
		Fall	10		Sitting	17		Acceptable
		Winter	10		Sitting	18		Acceptable
		Annual	10		Sitting	17		Acceptable
	B	Spring	9	-10%	Sitting	14	-22%	Acceptable
		Summer	7	-22%	Sitting	12	-20%	Acceptable
		Fall	8	-20%	Sitting	14	-18%	Acceptable
		Winter	9	-10%	Sitting	15	-17%	Acceptable
		Annual	9	-10%	Sitting	14	-18%	Acceptable
72	A	Spring	13		Standing	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	12		Sitting	19		Acceptable
		Winter	14		Standing	21		Acceptable
		Annual	13		Standing	20		Acceptable
	B	Spring	11	-15%	Sitting	17	-15%	Acceptable
		Summer	9	-10%	Sitting	14	-13%	Acceptable
		Fall	10	-17%	Sitting	16	-16%	Acceptable
		Winter	11	-21%	Sitting	18	-14%	Acceptable
		Annual	11	-15%	Sitting	17	-15%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
73	A	Spring	25		Uncomfortable	33		Unacceptable
		Summer	19		Walking	25		Acceptable
		Fall	23		Uncomfortable	30		Acceptable
		Winter	28		Dangerous	37		Unacceptable
		Annual	25		Uncomfortable	33		Unacceptable
	B	Spring	15	-40%	Standing	21	-36%	Acceptable
		Summer	12	-37%	Sitting	16	-36%	Acceptable
		Fall	14	-39%	Standing	19	-37%	Acceptable
		Winter	17	-39%	Walking	23	-38%	Acceptable
		Annual	15	-40%	Standing	21	-36%	Acceptable
74	A	Spring	23		Uncomfortable	34		Unacceptable
		Summer	18		Walking	26		Acceptable
		Fall	21		Uncomfortable	31		Acceptable
		Winter	26		Uncomfortable	38		Unacceptable
		Annual	23		Uncomfortable	34		Unacceptable
	B	Spring	15	-35%	Standing	25	-26%	Acceptable
		Summer	12	-33%	Sitting	19	-27%	Acceptable
		Fall	14	-33%	Standing	23	-26%	Acceptable
		Winter	17	-35%	Walking	28	-26%	Acceptable
		Annual	15	-35%	Standing	25	-26%	Acceptable
75	A	Spring	12		Sitting	20		Acceptable
		Summer	10		Sitting	16		Acceptable
		Fall	11		Sitting	19		Acceptable
		Winter	13		Standing	22		Acceptable
		Annual	12		Sitting	20		Acceptable
	B	Spring	11		Sitting	18	-10%	Acceptable
		Summer	8	-20%	Sitting	14	-13%	Acceptable
		Fall	10		Sitting	17	-11%	Acceptable
		Winter	11	-15%	Sitting	20		Acceptable
		Annual	10	-17%	Sitting	18	-10%	Acceptable
76	A	Spring	18		Walking	28		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	16		Walking	26		Acceptable
		Winter	20		Uncomfortable	31		Acceptable
		Annual	18		Walking	28		Acceptable
	B	Spring	16	-11%	Walking	24	-14%	Acceptable
		Summer	12	-14%	Sitting	19	-10%	Acceptable
		Fall	14	-13%	Standing	23	-12%	Acceptable
		Winter	17	-15%	Walking	27	-13%	Acceptable
		Annual	15	-17%	Standing	24	-14%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
77	A	Spring	19		Walking	27		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	21		Uncomfortable	29		Acceptable
		Annual	19		Walking	26		Acceptable
	B	Spring	17	-11%	Walking	23	-15%	Acceptable
		Summer	13	-13%	Standing	18	-14%	Acceptable
		Fall	15	-17%	Standing	21	-16%	Acceptable
		Winter	18	-14%	Walking	25	-14%	Acceptable
		Annual	17	-11%	Walking	23	-12%	Acceptable
78	A	Spring	25		Uncomfortable	34		Unacceptable
		Summer	19		Walking	27		Acceptable
		Fall	23		Uncomfortable	31		Acceptable
		Winter	26		Uncomfortable	36		Unacceptable
		Annual	24		Uncomfortable	33		Unacceptable
	B	Spring	19	-24%	Walking	26	-24%	Acceptable
		Summer	15	-21%	Standing	20	-26%	Acceptable
		Fall	17	-26%	Walking	24	-23%	Acceptable
		Winter	20	-23%	Uncomfortable	28	-22%	Acceptable
		Annual	18	-25%	Walking	25	-24%	Acceptable
79	A	Spring	15		Standing	22		Acceptable
		Summer	12		Sitting	17		Acceptable
		Fall	14		Standing	21		Acceptable
		Winter	16		Walking	24		Acceptable
		Annual	14		Standing	22		Acceptable
	B	Spring	12	-20%	Sitting	18	-18%	Acceptable
		Summer	9	-25%	Sitting	14	-18%	Acceptable
		Fall	11	-21%	Sitting	17	-19%	Acceptable
		Winter	13	-19%	Standing	19	-21%	Acceptable
		Annual	11	-21%	Sitting	18	-18%	Acceptable
80	A	Spring	23		Uncomfortable	32		Unacceptable
		Summer	18		Walking	24		Acceptable
		Fall	21		Uncomfortable	29		Acceptable
		Winter	26		Uncomfortable	36		Unacceptable
		Annual	23		Uncomfortable	31		Acceptable
	B	Spring	20	-13%	Uncomfortable	27	-16%	Acceptable
		Summer	16	-11%	Walking	21	-13%	Acceptable
		Fall	19	-10%	Walking	25	-14%	Acceptable
		Winter	22	-15%	Uncomfortable	30	-17%	Acceptable
		Annual	20	-13%	Uncomfortable	27	-13%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Multiple Seasons

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
81	A	Spring	23		Uncomfortable	30		Acceptable
		Summer	20		Uncomfortable	26		Acceptable
		Fall	21		Uncomfortable	28		Acceptable
		Winter	22		Uncomfortable	29		Acceptable
		Annual	22		Uncomfortable	29		Acceptable
	B	Spring	17	-26%	Walking	24	-20%	Acceptable
		Summer	14	-30%	Standing	20	-23%	Acceptable
		Fall	15	-29%	Standing	22	-21%	Acceptable
		Winter	17	-23%	Walking	24	-17%	Acceptable
		Annual	16	-27%	Walking	23	-21%	Acceptable
82	A	Spring	19		Walking	27		Acceptable
		Summer	15		Standing	21		Acceptable
		Fall	18		Walking	25		Acceptable
		Winter	21		Uncomfortable	31		Acceptable
		Annual	19		Walking	27		Acceptable
	B	Spring	19		Walking	27		Acceptable
		Summer	14		Standing	21		Acceptable
		Fall	17		Walking	25		Acceptable
		Winter	20		Uncomfortable	30		Acceptable
		Annual	18		Walking	27		Acceptable

Configurations		Mean Wind Criteria Speed (mph)		Effective Gust Criteria (mph)	
A	No Build	≤ 12	Comfortable for Sitting	≤ 31	Acceptable
B	Build	13 - 15	Comfortable for Standing	> 31	Unacceptable
		16 - 19	Comfortable for Walking		
		20 - 27	Uncomfortable for Walking		
		> 27	Dangerous Conditions		

1) Wind Speeds are for a 1% probability of exceedance; and,
2) % Change is based on comaprison with Configuration A and only those that are greater than 10% are listed

APPENDIX A

DRAWING LIST FOR MODEL CONSTRUCTION

The drawings and information listed below were received from Elkus Manfredi Architects and were used to construct the scale model of the proposed Landmark Center R + D Tower. Should there be any design changes that deviate from this list of drawings, the results may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
LM Renovation_16.rvt	Revit	14/3/2017
LM EXIST_Shell_16.rvt	Revit	14/3/2017
LM Office_Arch_16.rvt	Revit	14/3/2017
LM Landscape_16.rvt	Revit	14/3/2017
17_0202_Samuels Presentation R&D Tower.pdf	Adobe Portable Document Format	14/3/2017
17_0313 LM Office Lab - Existing Northeast Axon w_Context_8_5x11.pdf	Adobe Portable Document Format	14/3/2017
17_0313 LM Office Lab - Existing Northeast Axon_8_5x11.pdf	Adobe Portable Document Format	14/3/2017
17_0313 LM Office Lab - Phase 2 Northeast Axon w_Context_8_5x11.pdf	Adobe Portable Document Format	14/3/2017
17_0313 LM Office Lab - Phase 2 Northeast Axon_8_5x11.pdf	Adobe Portable Document Format	14/3/2017
LM Office_Arch_16.rvt	Revit	25/4/2017

Appendix B – Solar Glare Supporting Documentation

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REPORT

LANDMARK CENTER R&D TOWER

DETAILED SOLAR REFLECTION ANALYSIS

PROJECT #: 1702208

JULY 6, 2017

SUBMITTED TO

Mark Sardegna AIA, LEED AP
Vice President
msardegna@elkus-manfredi.com

cc: John Taylor
jtaylor@elkus-manfredi.com

Elkus Manfredi Architects
25 Drydock Avenue
Boston, Massachusetts 02210
T: 617.368.3320

SUBMITTED BY

Derek Kelly, M.Eng, P.Eng
Project Manager/Principal
derek.kelly@rwdi.com

Ryan Danks, B.A.Sc., P.Eng.
Senior Engineer
ryan.danks@rwdi.com

Sina Hajitaheri, M.A.Sc.
Technical Coordinator
sina.hajitaheri@rwdi.com

RWDI
600 Southgate Drive,
Guelph, Canada, N1G 4P6
T: 519.823.1311
F: 519.823.1316

EXECUTIVE SUMMARY

RWDI was retained to investigate the impact that solar reflections emanating from the proposed Landmark Center R&D Tower will have on the surrounding urban realm.

Overall Impact

As with any modern building, the proposed tower naturally creates reflections within its surroundings. However, the design of the building including the planar nature of the facades and the low visible reflectance of the glazing, acts to reduce the severity and frequency of the impacts in the surrounding area. Based on our experience, we would consider this building's reflections to be less impactful than many buildings we have studied.

Visual Glare Impacts for Drivers

Reflection impacts are generally predicted to be moderate to low for drivers in the area. Some high impact reflections are noted to occur, particularly along Miner and Fullerton Streets, however these impacts are generally short in duration, infrequent and/or occur early in the morning when road traffic levels are lower. This reduces the impact they will have on drivers.

Visual Glare Impacts for Pedestrians and Facades

Moderate levels of visual impact fall on all of the pedestrian and facade receptors in the surrounding neighborhood throughout the year. This is noted to occur most often on the skylights and northeast facade of the existing Landmark Center building. Visible reflections may also occur on adjacent buildings (e.g. 180 Brookline Avenue and the Harvard Vanguard Medical Associates Building). These reflections would likely be considered at worst a nuisance, which can be remedied with interior shading devices. Most impacts on the surrounding buildings occur only in the morning hours.

Thermal Impacts from Glare

The planar facades of the proposed development ensure that reflected sunlight will not focus (multiply) in any particular area. Therefore, RWDI does not expect any significant thermal impacts (i.e. risks to human safety or property damage) to occur.

Mitigation Recommendations

Based on these findings we do not feel mitigation is mandatory for this development. However should mitigation be desired, recommendations for strategies to reduce reflection impacts have been provided. For further details, refer to the Mitigation Options section on page 28.

TABLE OF CONTENTS

INTRODUCTION

This report provides the computer modeling results of reflected sunlight from the proposed Landmark Center R & D Tower development. The project consists of a new tower, approximately 253 feet tall, situated adjacent to the existing Landmark Center in Boston, Massachusetts.

RWDI was retained to investigate the impact that solar reflections emanating from the proposed tower will have on the surrounding urban terrain which includes typical urban spaces such as busy roadways, public parks, and other buildings (Figure 1).

A preliminary set of simulations was conducted to determine peak reflection intensities and the frequency of occurrence of reflections for a broad area around the development. This served to identify areas which may experience high intensity or very frequent reflections. This information informed the selection of 20 points for a more detailed analysis.

These receptor points represent drivers, pedestrians, and building facades and the detailed results allow us to quantify the frequency, intensity and duration of glare events at the receptors as well as the sources of those reflections.

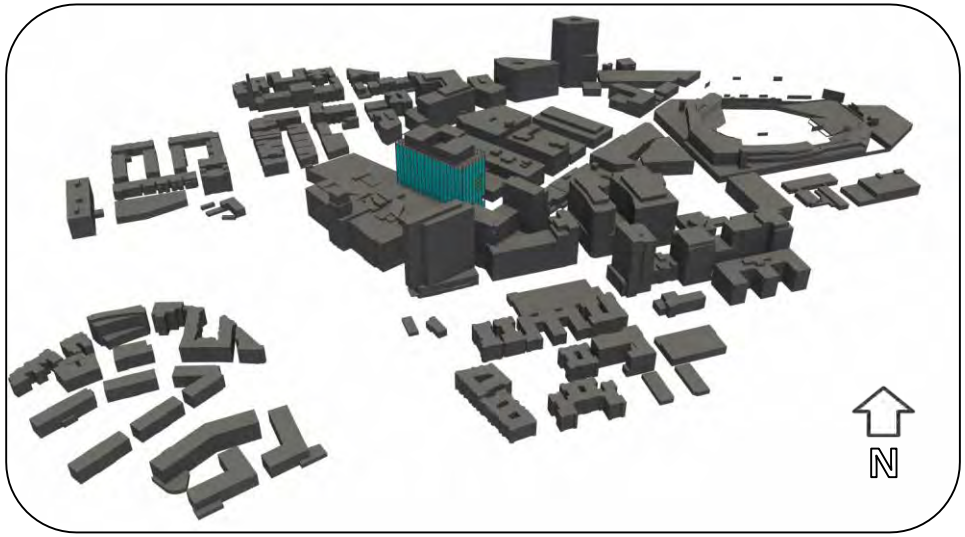


Figure 1: Location of proposed development (glazing colored)

Urban Reflections

While a common occurrence, solar reflections from buildings can lead to numerous visual and thermal issues.

Visual glare can:

- Impair the vision of motorists and others who cannot easily look away from the source;
- Cause nuisance to pedestrians or occupants of nearby buildings; and,
- Create undesirable patterns of light throughout the urban fabric.

Heat gain can:

- Affect human thermal comfort;
- Be a safety concern for people and materials, particularly if multiple reflections are focused in the same area; and
- Create increased cooling needs in conditioned spaces affected by the reflections.

The most significant safety concerns with solar reflections occur with concave facades (Figure 2) which act to focus the reflected light in a single area. RWDI does not expect issues with solar focusing to be present in this development as all surfaces on the tower are planar.

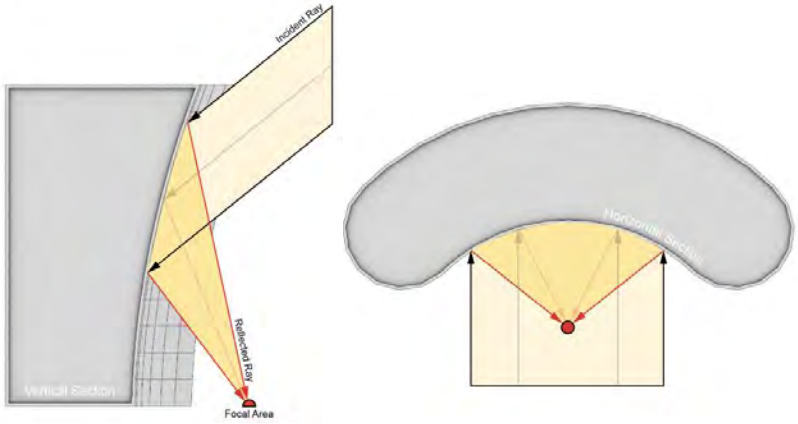


Figure 2: Illustration of reflection focusing due to a concave facade shape

Methodology

RWDI assessed the potential reflection issues using RWDI's proprietary *Eclipse* software, in two phases as per the steps outlined below:

- The Phase 1 "Screening" assessment began with the development of a 3D model of the area of interest (as shown in Figure 3). This was then subdivided into many smaller triangular patches (see Figure 4).

- For each hour in a year, the expected solar position was determined, and "virtual rays" were drawn from the sun to each triangular patch of the 3D model. Each ray that was considered to be "unobstructed" was reflected from the building surface tracked through the surrounding area. The study domain included the entire pedestrian realm within 1500 feet of the proposed building.

- The total reflected energy at that hour from all of the patches was computed and its potential for visual and thermal impacts was assessed.

- Finally, a statistical analysis was performed to assess the frequency, and intensity of the glare events occurring throughout the year within the nearby airspace. The criteria used to assess the level of impact can be found in Appendix B of this report.

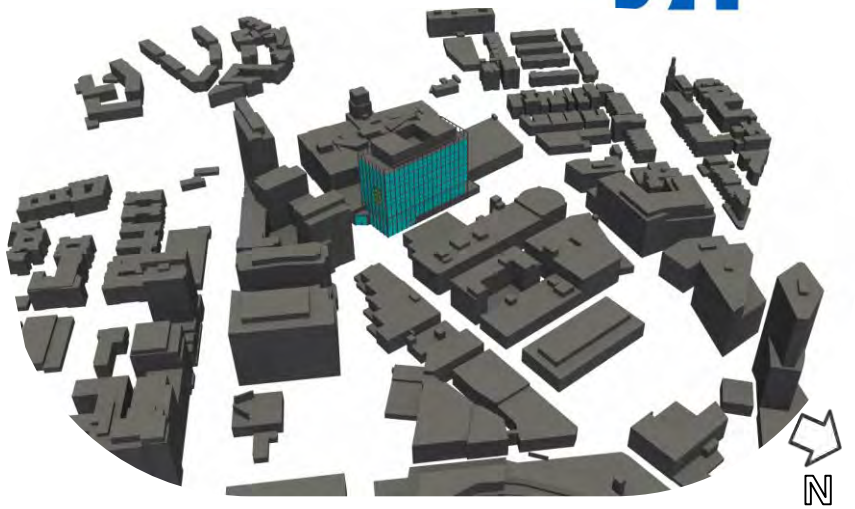


Figure 3: 3D computer model of the proposed development with the surrounding neighborhood

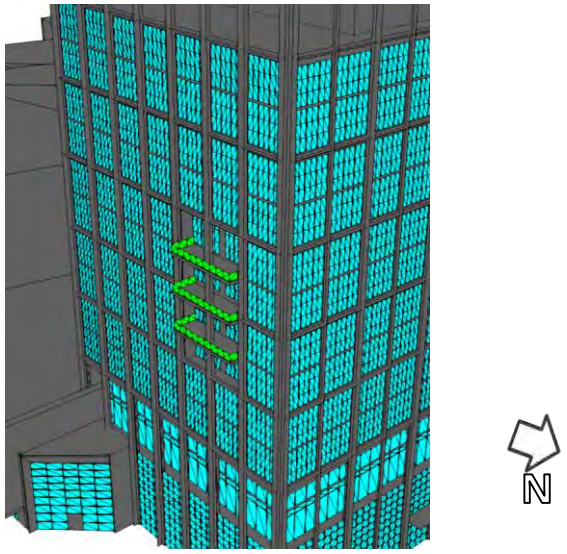


Figure 4: Close-up view of the model, showing surface subdivisions

Methodology (cont'd)

- Based on the findings of the Screening analysis, 20 representative 'receptor points' were selected to undergo the more detailed, Phase 2 analysis.

- The points were chosen to understand in greater detail how reflections from the building will impact drivers, pedestrians and other buildings.

- The analysis process is similar in the detailed phase of work, except reflections are analyzed at 1 minute increments for the entire year.

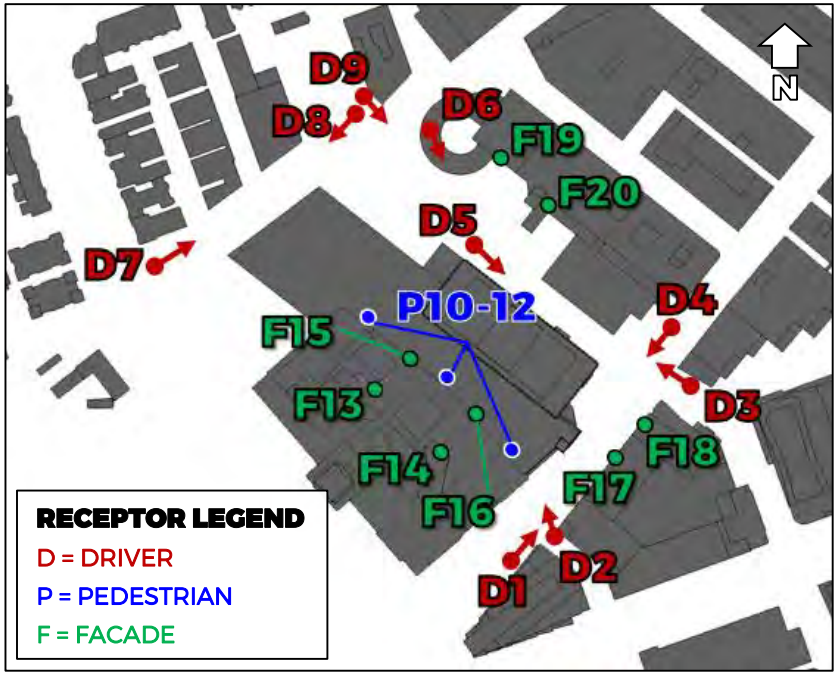
- In addition to the frequency and duration of reflection impacts, the more detailed analysis allows for the prediction of when those impacts will occur, how long they occur for and which building element is the cause.

- These points are illustrated on the following page. For points that represent people undertaking tasks with a defined direction of view (i.e. motorists who must maintain forward visual contact) the assumed direction of view is indicated with an arrow.

Receptor Locations

Table 1: Proposed receptor descriptions

Receptor Number	Receptor Description
D1	Drivers travelling northeast on Brookline Ave.
D2	Drivers turning right onto Brookline Ave. from a laneway
D3	Drivers traveling northwest on Kilmarnock St.
D4	Drivers traveling southwest on Brookline Ave.
D5	Drivers traveling southeast on Fullerton St.
D6	Driver on parking structure ramp
D7-D8	MBTA train drivers exiting tunnels under Park Drive and Miner Street.
D9	Drivers travelling southeast on Miner St.
P10-P12	Pedestrians on podium/rooftop of the development
F13-F14	Skylights on existing Landmark Center building
F15-F16	Northeast facade of existing Landmark Center
F17-F18	Northwest facade of 180 Brookline Ave.
F19-F20	Southwest facade of Harvard Vanguard Medical Associates Building



Assumptions and Limitations

Meteorological Data

This analysis used "clear sky" solar data at the location of Boston Logan International Airport. This approach uses mathematical algorithms to derive solar intensity values for a given location, ignoring local effects such as cloud cover. This provides a "worst case" scenario showing the full extent of when and where glare could ever occur.

Radiation Model

RWDI's analysis is only applicable to the thermal and visual impacts of solar radiation (i.e. ultraviolet, visible and infrared wavelengths) on people and property in the vicinity of the development. It does not consider the impact of the building related to any other forms of radiation, such as cellular telephone signals, RADAR arrays, etc.

Study Building and Surrounds Models

The analysis was conducted based on the geometry provided by Elkus Manfredi to RWDI on June 15, 2017. It should be noted that this study is highly dependent on building geometry, and any significant changes to the building's geometry will likely require a new analysis.

Potential reductions of solar reflections due to the presence of Vegetation or other non-architectural obstructions were not included, nor are reflections from other buildings. Only a single reflection from the development was included in the analysis. As such, light that has reflected off several surfaces is assumed to have a negligible impact.

Assumptions and Limitations (cont'd)

Facade Material Reflectance

The reflective properties of the glazing units located on the proposed tower facade were determined based on the glazing information provided by Elkus Manfredi on June 29, 2017.

It is RWDI's understanding that the current basis-of-design for the glazing units in the tower is Viracon VE1-2M IGUs. Thus we have assigned reflectance properties to all glazed surfaces in the model as per this specification. The only exception to this is the glazed guardrails found on the south-east elevation. It is unlikely that these elements would be insulated glazing units, thus we have assigned reflectance values to these elements assuming that are typical clear laminated safety glass panels.

The reflectance properties of the glazing units are summarized in Table 2. Figure 5 shows the location of the reflective materials on the facades.

Applicability of Results

The results presented in this report are highly dependent on both the form and materiality of the facade. Should there be any design changes to the design, it is recommended that RWDI be contacted and requested to review their potential effects on solar reflection.

Assumptions and Limitations (cont'd)

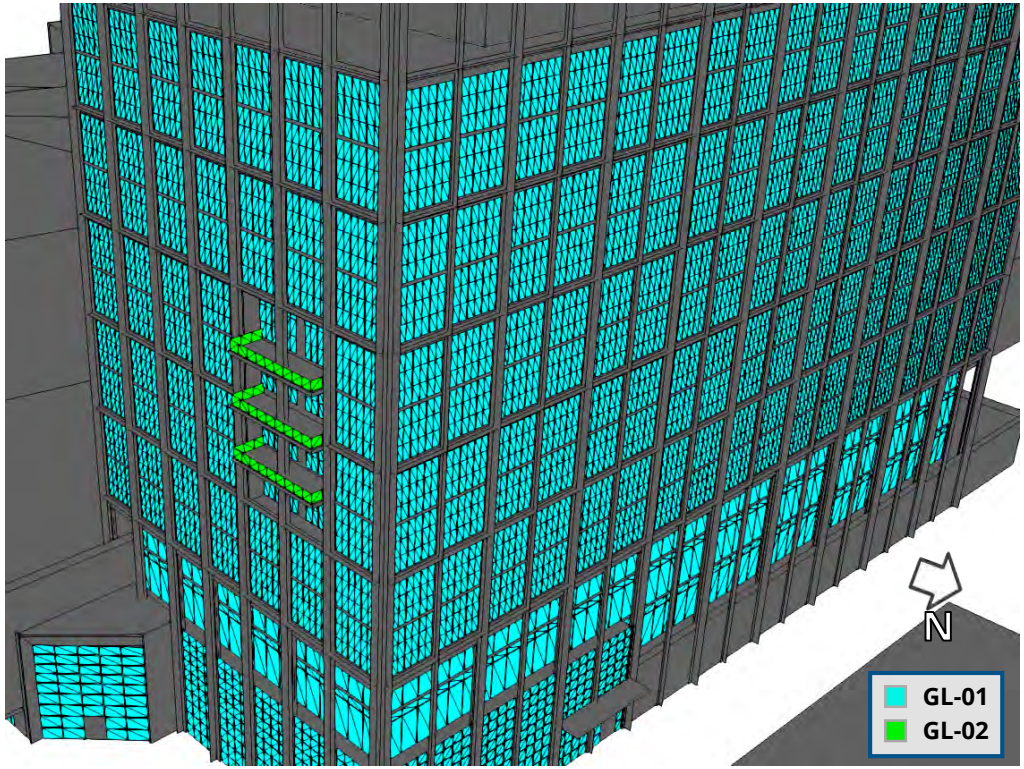


Figure 5: Glazed locations on the building facade.

Table 2: Nominal visible and full spectrum reflectance values of the facade glazing

Glazing Location	Glazing Unit	Visible Reflectance	Full Spectrum Reflectance
GL-01	VE1-2M	11%	31%
GL-02	Laminated safety glass	8%	7%

Presentation of Results

The following plots are presented in this section:

Peak Annual Reflected Irradiance
This plot displays the annual peak intensity of all reflections emanating from the development at a typical pedestrian height (5 ft.) above local grade over an entire year. In order to attain a better understanding of the impact of the solar reflections from the development, other factors must be considered such as the frequency and duration of the reflections. These factors are analyzed in detail in the next stage of the study.

Two versions of this plot are included:

- **Visible Reflectance (Visual Glare):** These plots display the intensity of reflected visible light only. Depending on the ambient conditions, reflection intensities as low as 150 W/m² could be visible to people.

- **Full Spectrum Reflectance (Heat Gain):** These plots present the total intensity of a reflection, including both visible light and thermal energy which relates to the overall heat gain. For full spectrum reflectance, RWDI considers 1500 W/m² as a short term thermal comfort threshold and reflections above 2500 W/m² as a human safety threshold (refer to Appendix B).

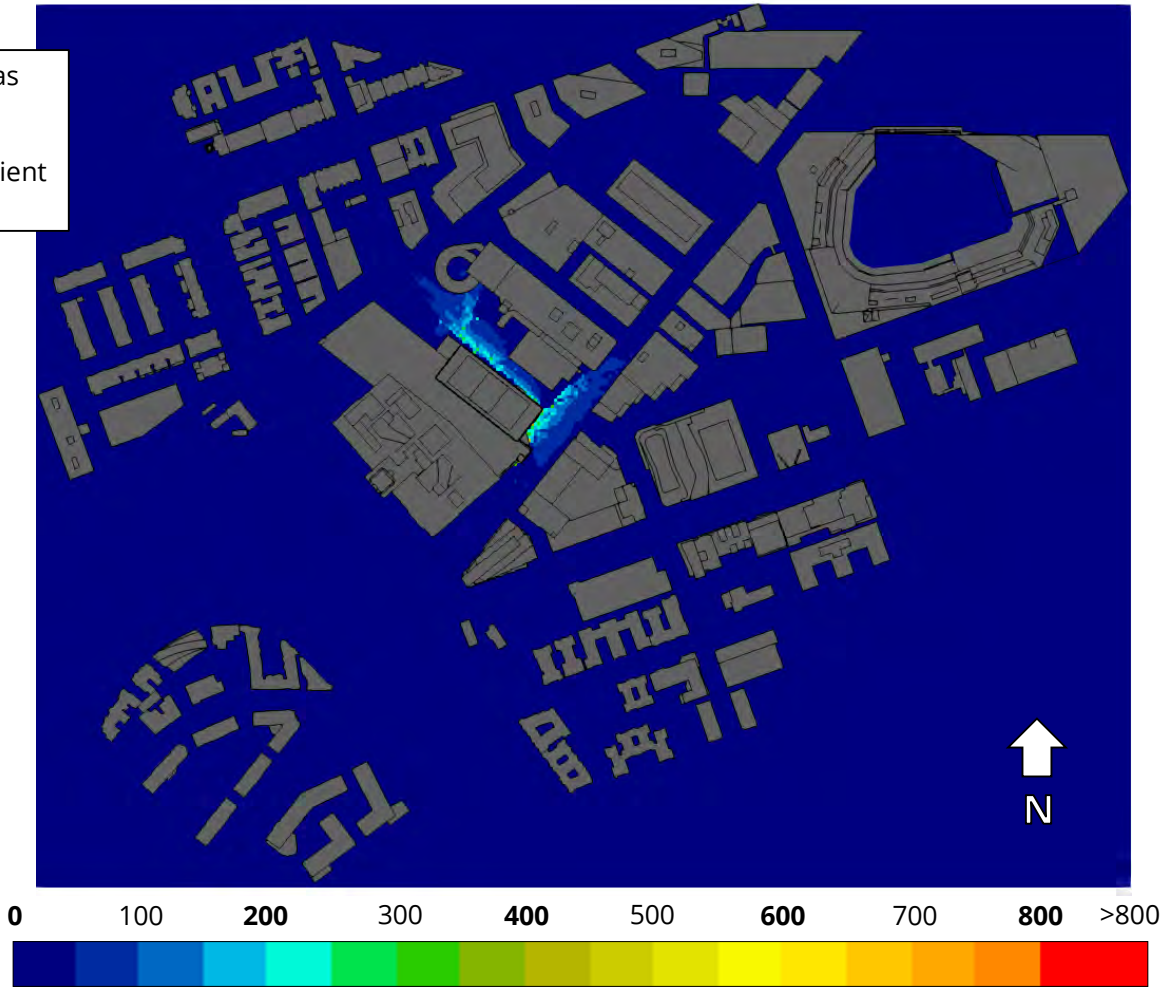
Percentage of Daylit Hours (or Frequency) of Reflected Light

This plot identifies the locations of the most frequent significant reflections emanating from the facades. In this context a 'significant' reflection is one that is at least 50% as intense as one that would cause after imaging on a viewer (refer to Appendix B).

As this criteria is visually based, the visible light reflectance of the facades was used.

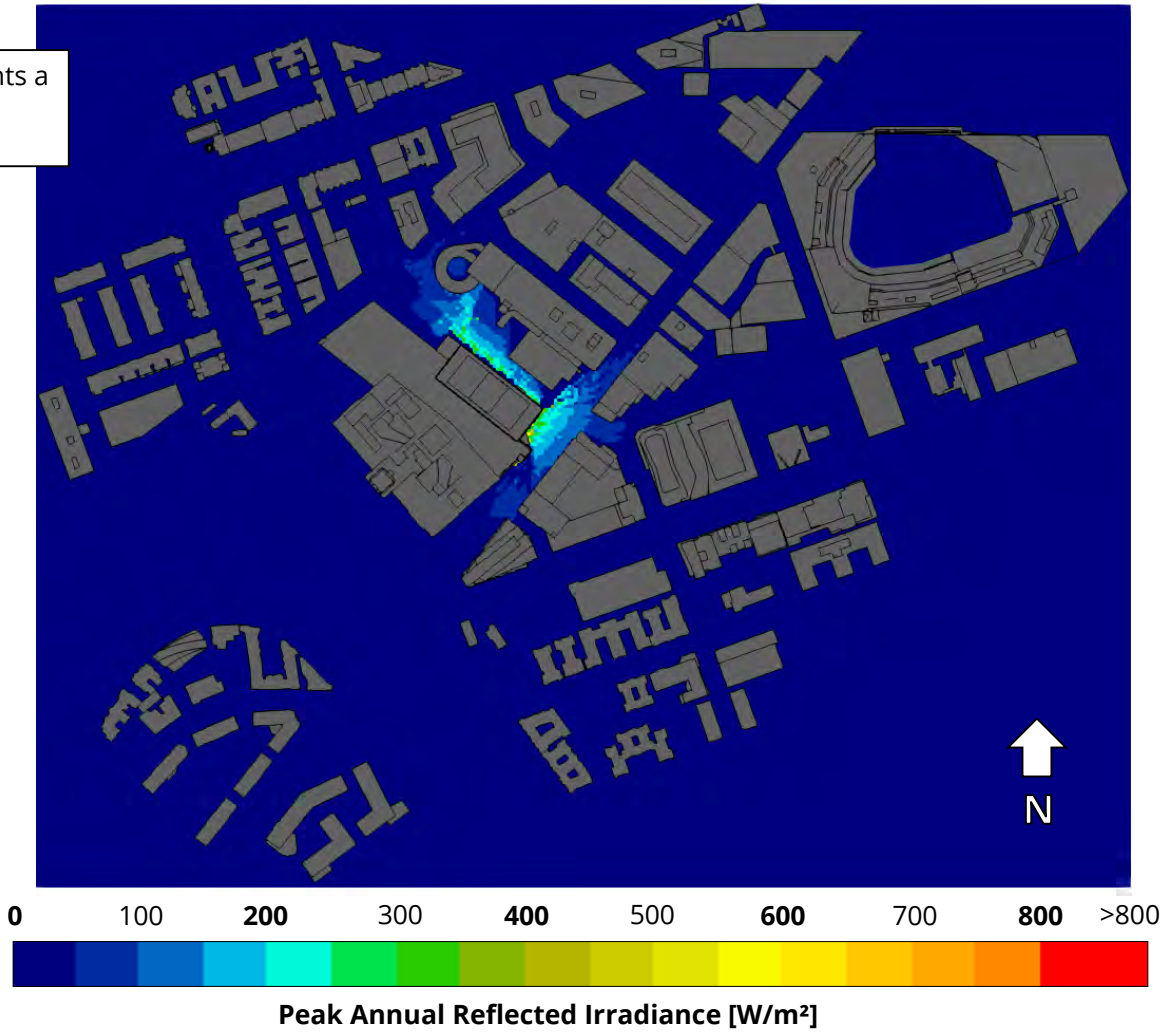
Peak Annual Reflected Irradiance - Visible Reflectance (Visual Glare)

Reflections as low as 150 W/m² may be visible to people, depending on ambient lighting levels.



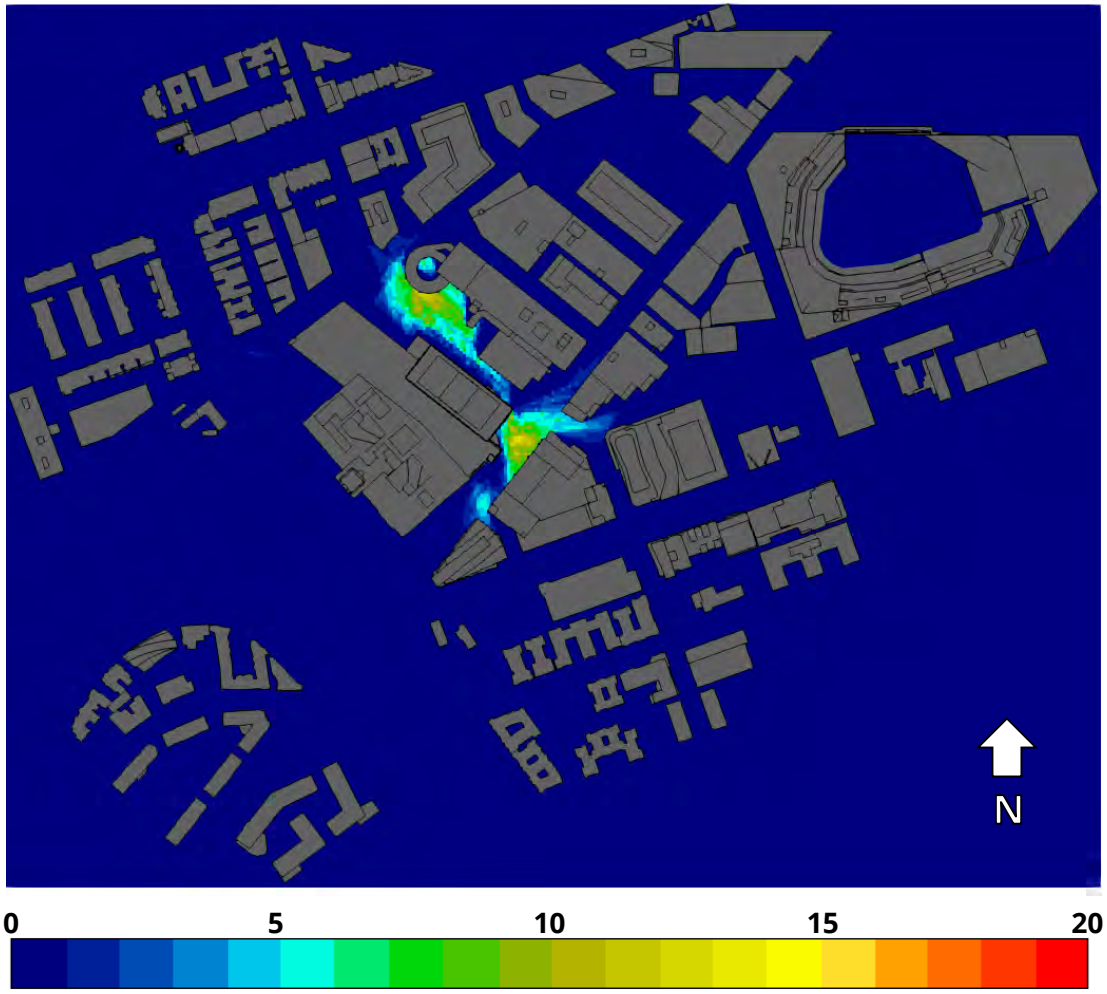
Peak Annual Reflected Irradiance - Full Spectrum Reflectance (Heat Gain)

800 W/m² represents a typical intensity for direct sunlight.



RESULTS – SCREENING ANALYSIS

Percentage of Daylit Hours (Frequency) of Reflected Light - Visible Reflectance



SCREENING ANALYSIS OBSERVATIONS

1. Like any contemporary building, the reflective surfaces of the proposed Landmark Center R&D Tower are naturally causing solar reflections in the surrounding neighborhood.
2. The planar nature of the facades of the proposed tower prevents reflections emanating from the development from focusing (concentrating) in any particular area. Thus, RWDI does not anticipate any heat gain issues on people or property.
3. At pedestrian level, reflections are predicted to fall most frequently onto the areas immediately north and southeast of the tower, in particular along Brookline Avenue and Miner Street. The maximum frequency of glare occurrence found at pedestrian level is approximately 13% of daytime hours.
4. Reflections emanating from the southeast facades are expected to fall onto Brookline Avenue. The reflections from this facade may impact drivers travelling along Brookline as they approach the intersection with Fullerton Street. Similarly there may be some impacts on drivers travelling north on Kilmarnock Street as they approach Brookline Avenue. Similar impacts may exist for drivers turning onto Brookline from the laneway south of the site.
6. The occupants of the buildings located in the vicinity of the tower are expected to experience visible reflections from the development. That being said, they do not pose a risk to safety, and are likely a nuisance at worst, as the occupants can easily look away or close blinds.
7. Frequent reflections are expected to impact the podium area located between the existing Landmark Center and the proposed tower. The reflections impacting these areas have the potential to occur frequently and for long durations. If the podium area is planned to be used as an amenity space where people may linger, then mitigation measures are advisable. The preliminary simulations also indicate the possibility of frequent reflections impacting the skylights of the existing Landmark Center, which could potentially penetrate inside. The second phase of this analysis explores the potential impact of these reflections in greater detail.
8. The deep mullions on the current facade design are a positive design feature and aid in reducing the frequency and intensity of some glancing reflections, particularly to the east and south of the development.
9. No reflection impacts are predicted to occur at Fenway Park, Higginson Circle, nor anywhere else along the Riverway.

Presentation of Results

The frequency, duration, and intensity of glare events throughout the year computed in the detailed analysis phase is illustrated using "annual glare impact diagrams" (see Figure 6 below for the general layout of these plots). The color of the plot for a given combination of date and time indicates the relative impact of any glare sources found. The horizontal axis of the diagram indicates the date, and the vertical axis indicates the hour of the day.

We note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.

The following pages present the impact categories for three types of Annual Impact Diagrams: Visual Impact, Thermal Impact on People, and Thermal Impact on Property. More information on RWDI's criteria is available in Appendix B.

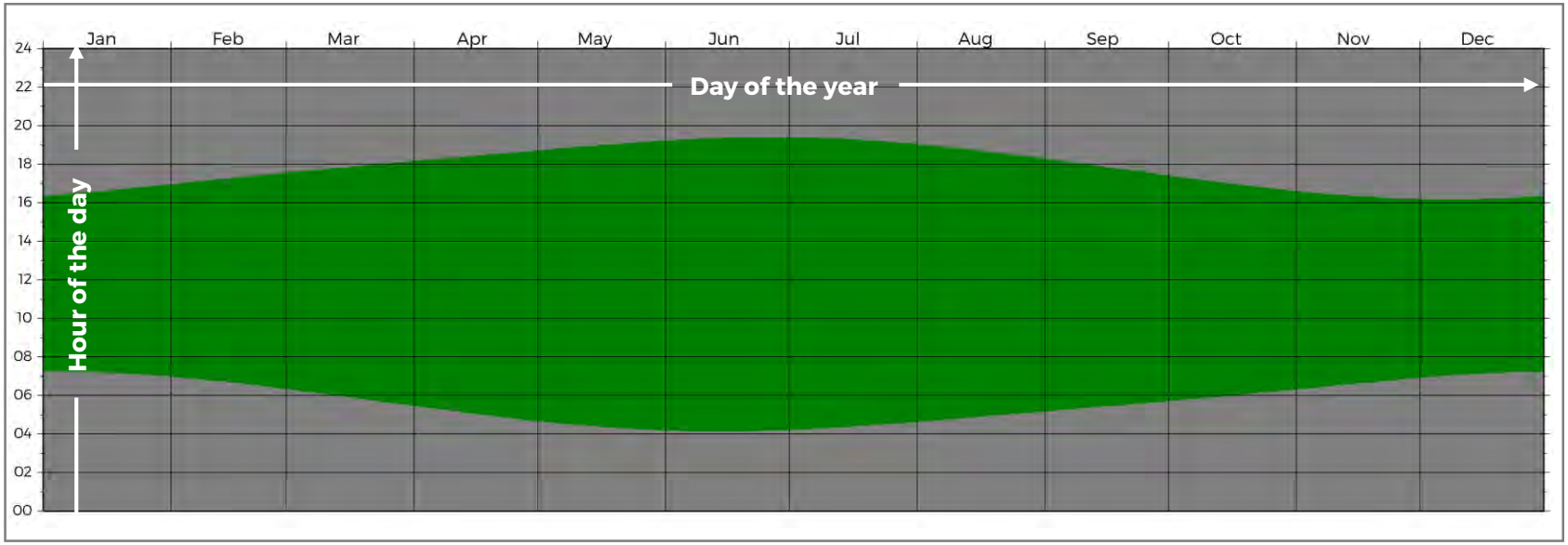


Figure 6: Layout of Sample Annual Glare Impact Diagram

Visual Impact Categories

Low: Either no significant reflections occur or the reflections will have a minimal effect on a viewer, even when looking directly at the source.

Moderate: The reflections can cause some visual nuisance only to viewers looking directly at the source.

High: The reflections can reduce visual acuity for viewers operating vehicles or performing other high-risk tasks who are unable to look away from the source, posing a significant risk of distraction.

Damaging: The brightest glare source is bright enough to permanently damage the eye for a viewer looking directly at the source.

Hatched areas indicate times and dates when the sun would also be in a driver's field of view.

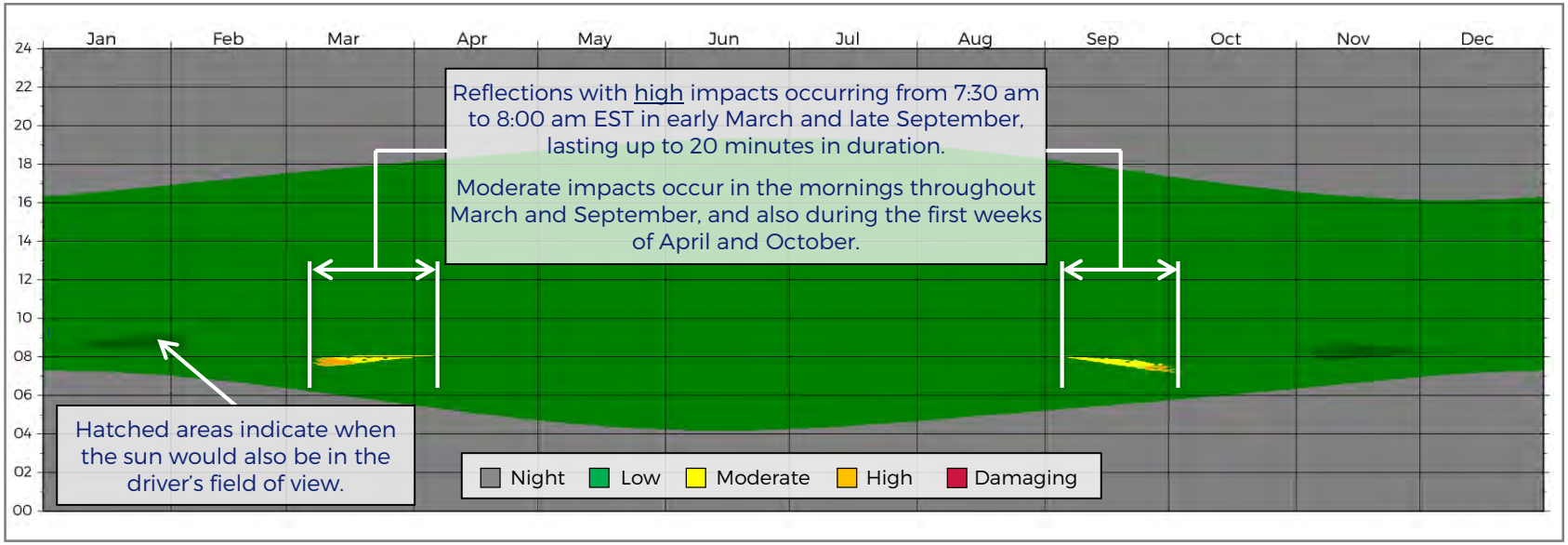


Figure 7: Example of Annual Visual Glare Impact Diagram – Receptor D9

Thermal Impact Categories for People

Low: Either no significant reflections occur or the reflection intensity is below the short-term exposure threshold of 1500 W/m².

Moderate: The reflection intensity is above the short-term exposure threshold of 1500 W/m² but below the safety threshold of 2500 W/m². Such reflections would quickly cause thermal discomfort in people.

High: The reflection intensity is above the safety threshold of 2500 W/m² but below 3500 W/m². This level of exposure to bare skin would lead to the onset of pain within 30 seconds.

Very High: Reflection intensity exceeds 3500 W/m². This level of exposure leads to second degree burns on bare skin within 1 minute.

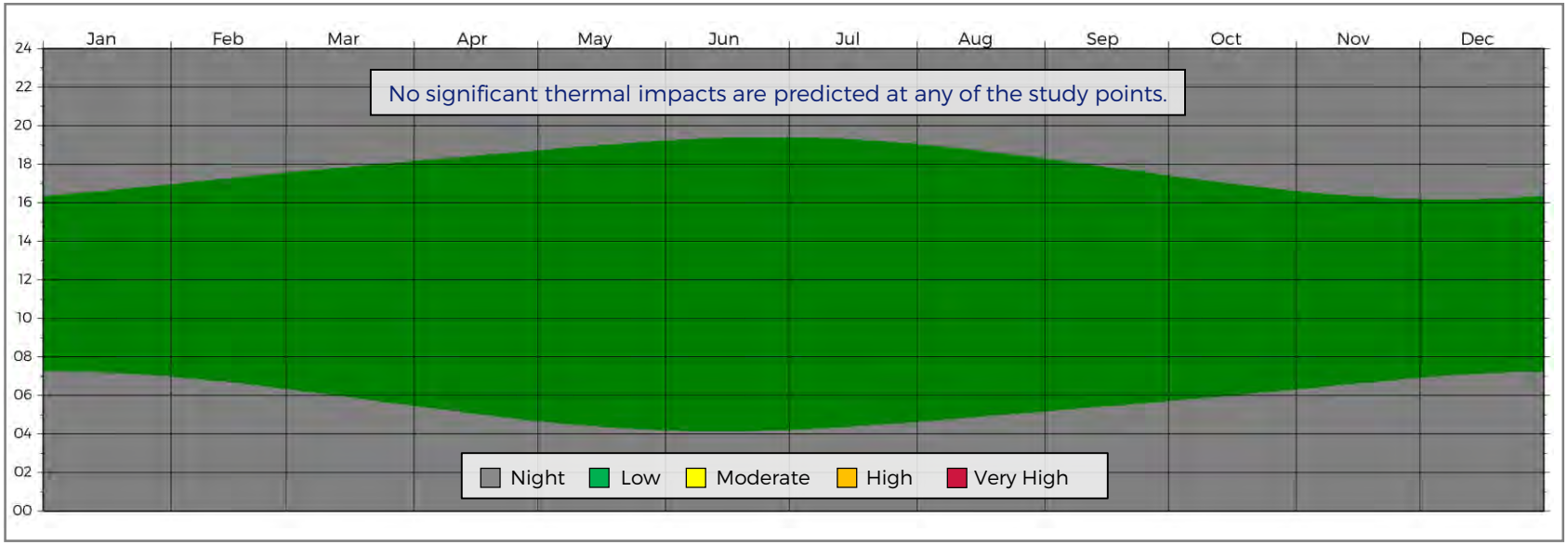


Figure 8: Example of Annual Thermal Impact Diagram – Receptor P12

Thermal Impact Categories for Property

A different scale is used to illustrate the reflected thermal energy on facades in order to provide further clarity on the potential for heat gain issues (Figure 9). The diagrams illustrate the irradiance levels of all predicted reflection events along with their frequency and duration.

The format of the diagram is similar to the diagrams described in the previous pages. The color of the plot for a given combination of date and time indicates the intensity of the reflected light at that point in time.

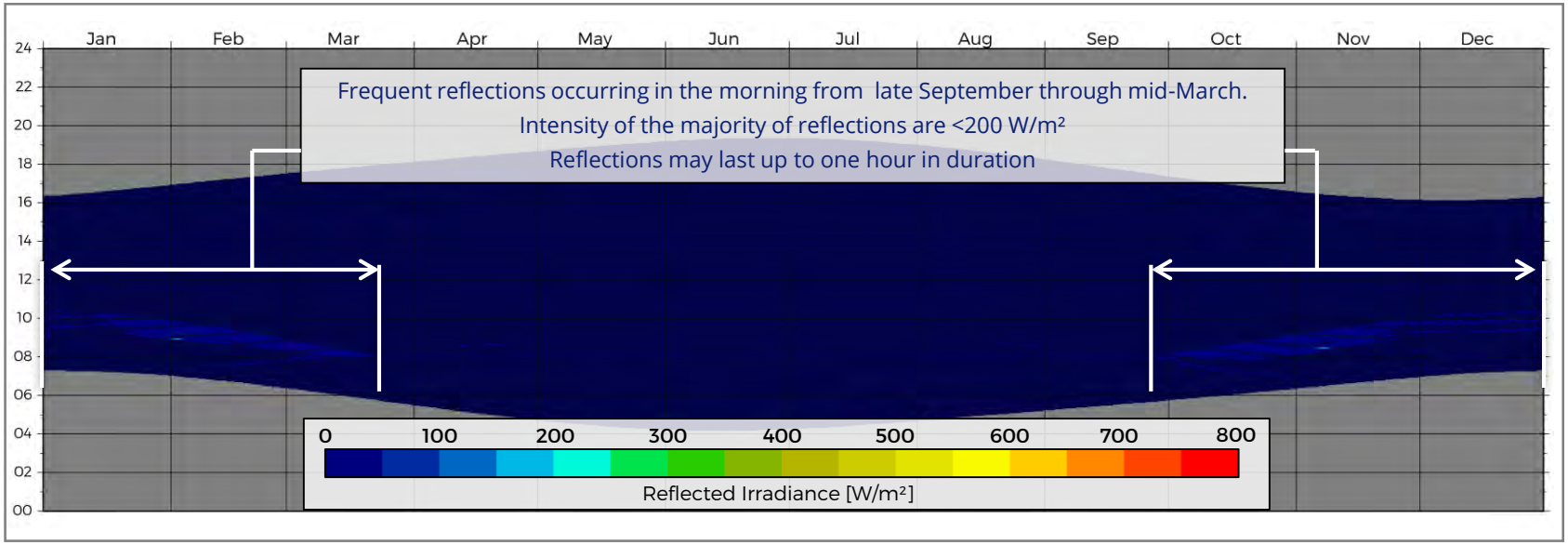


Figure 9: Example of Annual Thermal Impact Diagram – Receptor F18

DETAILED ANALYSIS OBSERVATIONS

Table 3 on the following page summarizes the level of visual and thermal impact from the reflections from the Landmark Center R&D Tower at the selected receptor locations. Visual and thermal impact diagrams for each of the receptor points are provided in Appendix A.

Figures 10 to 12 illustrate the source of the glare from the development on selected points at selected times. This is not an exhaustive list of all potential glare impacts, but rather serves to illustrate important results and observations.

DETAILED ANALYSIS OBSERVATIONS

Table 3: Summary of Overall Predicted Impacts on Receptors

Receptor Number	Receptor Type	Assumed Activity Risk Level	Assumed Ability to Self-Mitigate	Peak Reflected Light Visual Impact	Sun in Field of View During High Impact Reflection (Y/N)	Duration / Number of Days with High Impact Reflection	Peak Reflected Solar Thermal Impact on People	Peak Reflected Solar Thermal Impact on Facade
D1	Driver	High	Low	***Moderate***	N/A	N/A	***Low***	N/A
D2	Driver	High	Low	***High****	***No***	Longest Duration: **11 minutes** Average Duration: **4 minutes** No. of days: **29**	***Low***	N/A
D3-D5	Driver	High	Low	***Moderate***	N/A	N/A	***Low***	N/A
D6	Driver	High	Low	***High****	***No***	Longest Duration: **10 minutes** Average Duration: **5 minutes** No. of days: **40**	***Low***	N/A
D7-D8	Driver	High	Low	***Low***	N/A	N/A	***Low***	N/A
D9	Driver	High	Low	***High****	***No***	Longest Duration: **25 minutes** Average Duration: **5 minutes** No. of days: **23**	***Low***	N/A
P10-P12	Pedestrian	Low	High	***Moderate***	N/A	N/A	***Low***	N/A
F13-F20	Facade	Low	High	***Moderate***	N/A	N/A	N/A	***Low***

* The high impact reflections are infrequent and short in duration.
** The high impact reflections are infrequent and last up to 25 minutes in duration.

OVERALL OBSERVATIONS & CONCLUSIONS

Thermal Impacts on Pedestrians, Drivers, and Facades

1. The planar facades of the proposed Landmark Center R&D Tower ensure that reflected sunlight will not focus (multiply) in any particular area. Therefore, RWDI does not expect any significant thermal impacts (i.e. risks to human safety or property damage) to occur within the development nor in the surrounding neighborhood.

Visual Glare Impact on Drivers

2. As with the addition of any glazed building, drivers travelling in the vicinity of the development are expected to experience an increased level of visual glare impact. Some reflections with a high visual impact potential were noted, but they are generally infrequent and short in duration.

3. Drivers turning right onto Brookline Avenue from the private laneway to the south of the site (receptor D2) may experience high impact reflections at approximately 4:00 pm EST during late March and mid September. These reflections last on average no more than 5 minutes. (Refer to Figure 10 for a representative example image of the glare source.)

4. Drivers descending the ramp of the parking structure to the north of the site (receptor D6) may experience high impact reflections between 6:00 am and 7:30 am EST from mid-March to mid-April and again in mid-September. These reflections are again typically short in duration (5 minutes on average) and occur at times when the parking ramp will be less frequently used. (Refer to Figure 11 for a representative example image of the glare source.)

5. Drivers travelling southeast on Miner Street (receptor D9), also have the potential to experience high impact reflections. These reflections are predicted to begin between 7:15 am and 7:45 am EST in mid-March and late September. They can persist up to 25 minutes but on average last less than 10 minutes. No impacts in this area are expected after 8:00am EST. (Refer to Figure 12 for a representative example image of the glare source.)

Visual Glare Impact on Pedestrians and Facades – Off-Site

6. Moderate levels of visual impact are predicted to fall on the pedestrian and facade receptors in the surrounding neighborhood (receptors F17-F20). Many of these reflections are frequent and long in duration. However most only occur in the morning hours.

OVERALL OBSERVATIONS & CONCLUSIONS

7. These types of reflection impacts would occur for any glazed building and represent at worst a visual nuisance, as viewers can easily look away or close blinds. The low visible reflectivity of the selected glazing units is a positive design feature which will reduce the impact of these reflections compared to typical construction.

8. The deep mullions of the current design are another positive design feature which significantly reduces the impact of reflections from this building on the surrounding urban terrain.

Visual Glare Impacts Within Landmark Center Site

9. Moderate levels of visual impact fall on the pedestrian receptors located on the roof of the podium between the existing Landmark Center and the proposed tower (e.g. receptors P10-P12). While not posing a risk to safety, the reflections have the potential to occur frequently and be long in duration, which may be a nuisance for people in these areas. If the podium roof is intended to be used as an amenity space then mitigation would be advisable. Since the reflections would be coming from above, mitigation can easily be achieved through employing shading devices like umbrellas or canopies in spaces where people are expected to linger.

10. Reflections from the proposed tower also have the potential to reach the windows and skylights of the existing Landmark center building (receptors F13-F14). The skylight impacts are expected to occur in the afternoon to evening hours. This means that the additional reflected light may be masked by direct sunlight which could also be entering the spaces below. Further, based on Google earth imagery, the skylights appear to be darkly tinted. This will further mute the appearance of any reflections.

11. The proposed tower may also create reflections impacting the windows of the northeast facade of the existing Landmark center (receptors F15-F16). Depending on the time of year, intermittent reflection impacts are predicted to begin between 9:30 am and 2:00 pm EST and persist until between 3:00 pm and 6:00pm EST. These impacts are all quite low in intensity and do not represent a risk to the safety of occupants of the building, nor are the reflections expected to represent a significant additional heat gain in the space. At worst these impacts are expected to be a nuisance which can be remedied by the occupants closing blinds.

OVERALL OBSERVATIONS & CONCLUSIONS

Overall Impact

12. As with any modern building, the proposed tower naturally creates reflections in the urban realm. However, the design of the building, including the planar nature of the facades and the low visible reflectance of the glazing, acts to reduce the severity and frequency of the impacts in the surrounding area.

13. The low visible reflectance of the current glazing choice means that any impacts which do occur are because of other factors (i.e. the natural enhancement of glazing reflectivity due to the angle at which light strikes the glass). Thus, these impacts would likely remain even for glazing with a lower visible reflectance. Selecting glazing with a higher visible reflectance would potentially increase the frequencies and durations at which these impacts occur.

14. Based on our experience, we would consider this building's reflections to be less impactful than many buildings we have studied.

OVERALL OBSERVATIONS & CONCLUSIONS

Glare Source Diagram for Selected Impacts on Driver Receptor D2

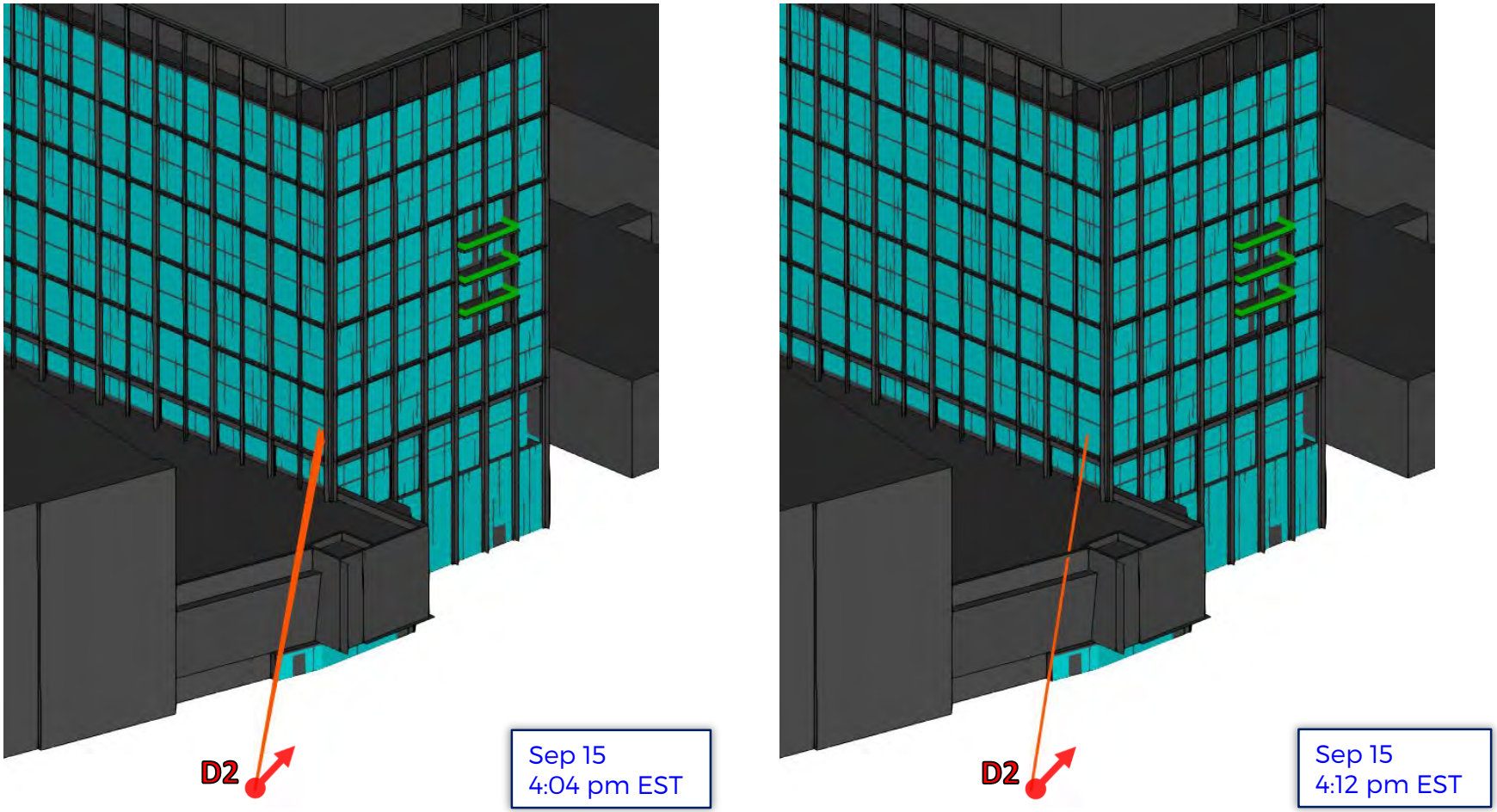


Figure 10: Illustration of reflections with high visual impacts on receptor D2 on September 15. (Some surrounding buildings removed for clarity.)

Glare Source Diagram for Selected Impacts on Driver Receptor D6

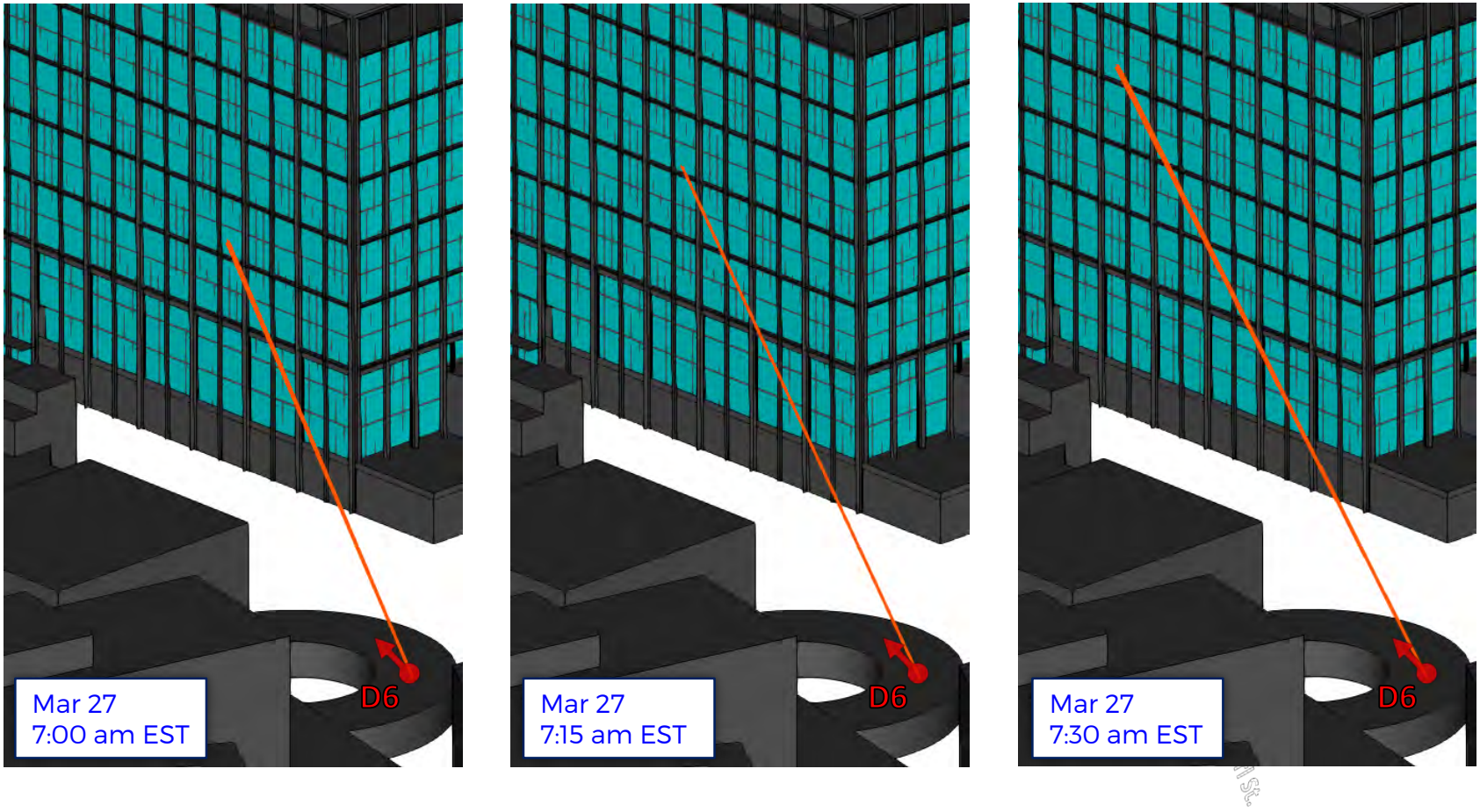


Figure 11: Illustration of reflections with high visual impacts on receptor D6 on March 27.

OVERALL OBSERVATIONS & CONCLUSIONS

Glare Source Diagram for Selected Impacts on Driver Receptor D9

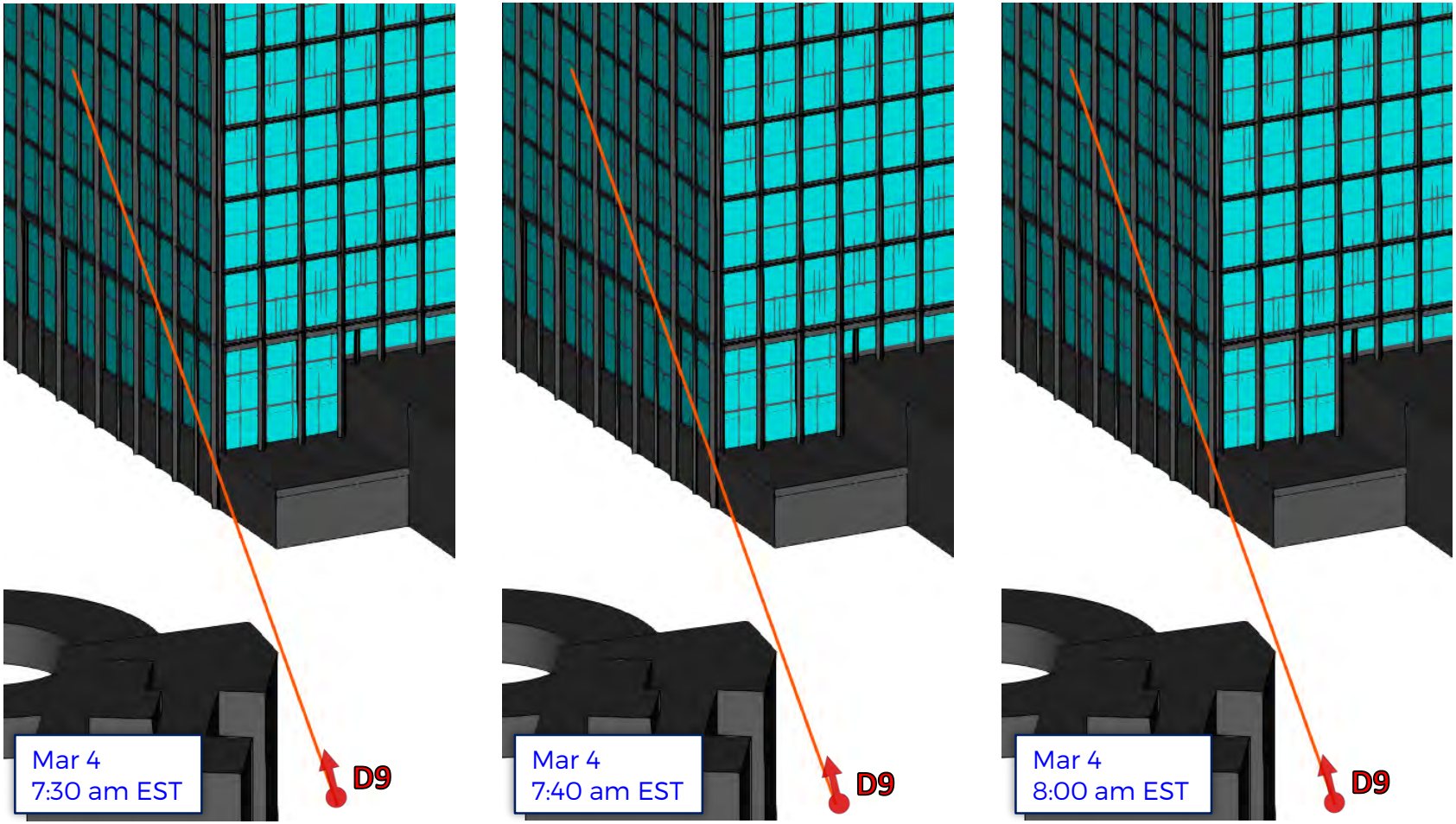


Figure 12: Illustration of reflections with high visual impacts on receptor D9 on March 4.

MITIGATION OPTIONS

Overall, it is RWDI's opinion that the reflections emanating from the proposed Landmark Center R&D Tower onto the surrounding neighborhood are comparable to reflections elsewhere in the city and do not require mitigation. If however, there are concerns about the predicted levels of reflection impact, RWDI offers the following suggestions for further consideration (refer to Figures 13-15 for a mark-up of these recommendations):

1. **Building Mounted Shading Devices:** Breaking up some of the reflections emanating from the facades of the development could be accomplished by constructing physical blockages. In particular, mounting vertical fins to the northwest facade (areas inside the yellow and purple boxes in Figure 13) between glazing units would aid in reducing the frequency of impacts on the area north and northwest of the development. To eliminate the impacts at D6, the fins would need to be 12-14 inches deep. To eliminate the impacts at D9, shorter fins could be employed (6-8 inches). This could also be a viable approach to eliminate the impacts at D2, though the fins would need to be deeper (16-18 inches). Refer to Figure 14 for locations.

2. **Glazing Surface Modification:** Given the very low visible reflectance of the current glazing system, changing the glazing unit to something less reflective could be challenging architecturally and would likely provide only minimal benefit. However, modifying the exterior surface of the highlighted areas in Figures 13-15 to diffuse reflected light (i.e. by "frosting" or roughening the exterior surface) could help in reducing the frequency of reflections falling onto the receptors D2, D6, D9 as well as on the podium roof and existing Landmark Center building facade.

3. **Free-Standing External Shading Devices:** A more practical approach to mitigate the frequent reflections falling onto the podium roof (receptors P10-P12) would be to block reflections closer to pedestrian level. Strategic use of shading devices (umbrellas, canopies, vegetation, etc.) will limit the impact of reflections from the tower's facades.

4. **Operationalized Mitigation:** Mitigation for the podium roof can also be achieved through operational means (e.g. scheduling any activities on the rooftops in the morning when no significant reflections are expected). This would not be necessary if the pedestrian areas are sufficiently shaded.

5. **Internal Shading Devices:** Reflection impacts at the skylights and northeastern facade windows of the existing Landmark center can easily be mitigated if found to be problematic, through the use of interior shades.

MITIGATION OPTIONS

It should be noted that building mounted shading devices need careful design to ensure that they do not lead to potential problems with wind induced loading, noise or vibration, snow and ice build up, etc. Thus, if mitigation via facade mounted shading structures is desired, RWDI would recommend re-running the simulations with the proposed shading devices included to predict their effectiveness.

MITIGATION OPTIONS

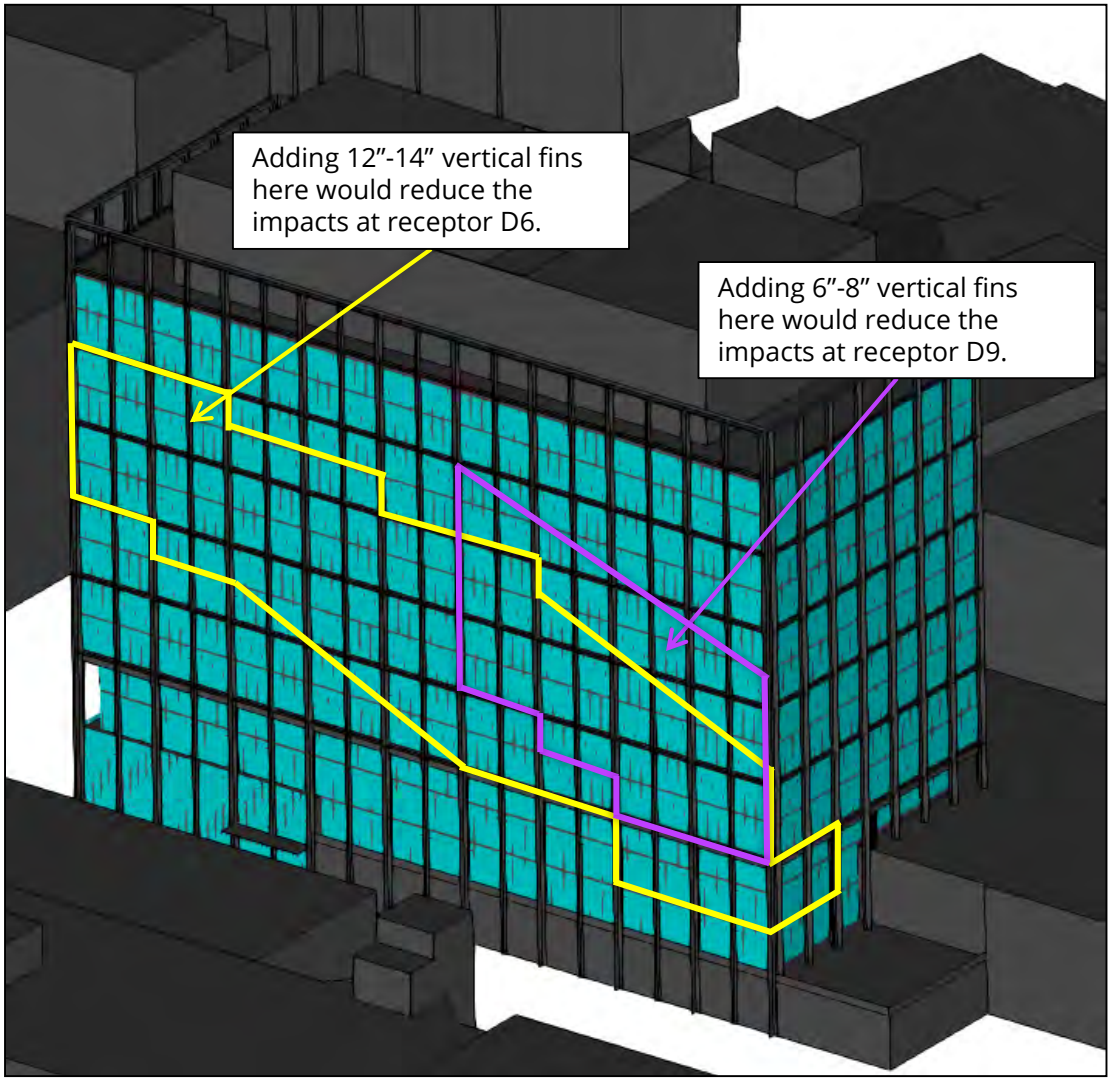


Figure 13: Markup of building-mounted shading locations to reduce impacts at receptors D6 and D9.

MITIGATION OPTIONS

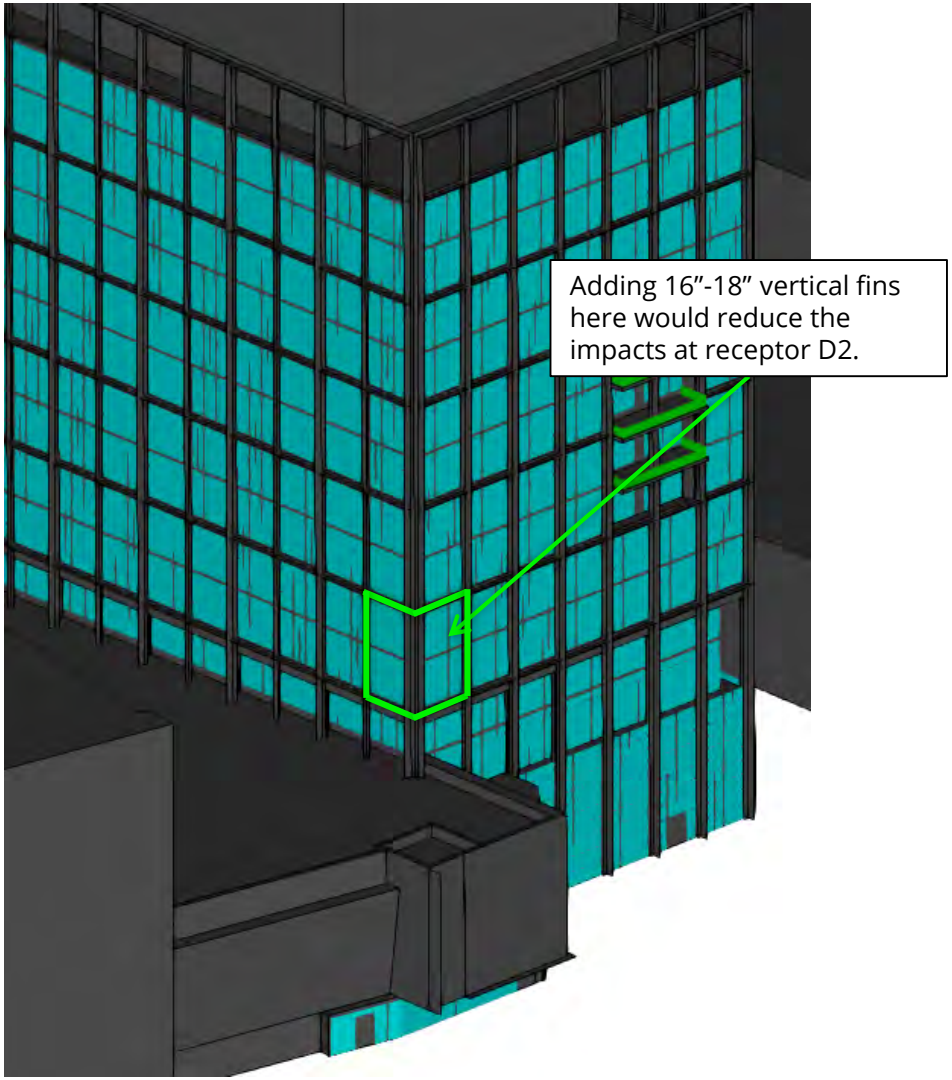


Figure 14: Markup of building-mounted shading locations to reduce impacts at receptor D2.

MITIGATION OPTIONS

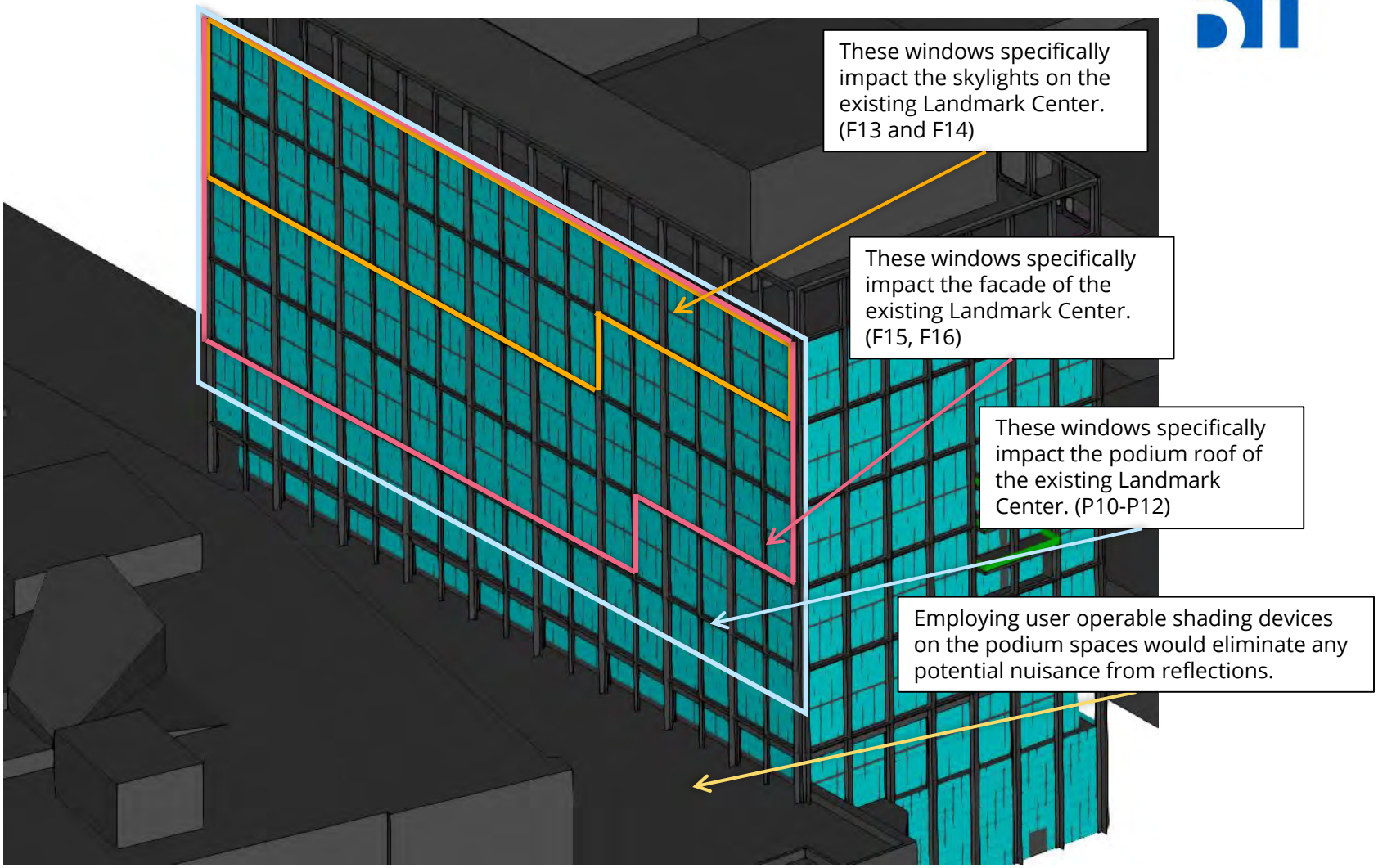


Figure 15: Markup of mitigation options for the podium area.

APPENDIX A

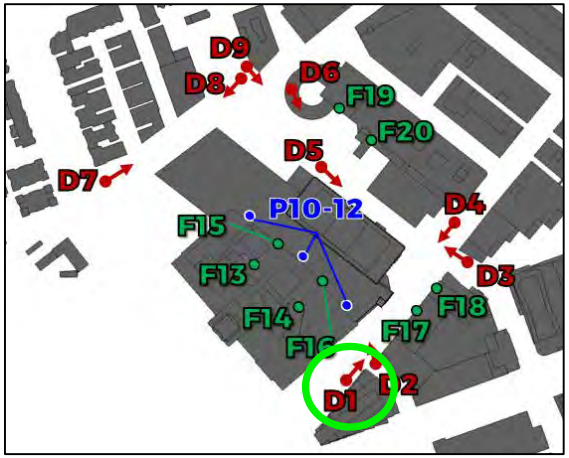
DETAILED REFLECTION RESULTS

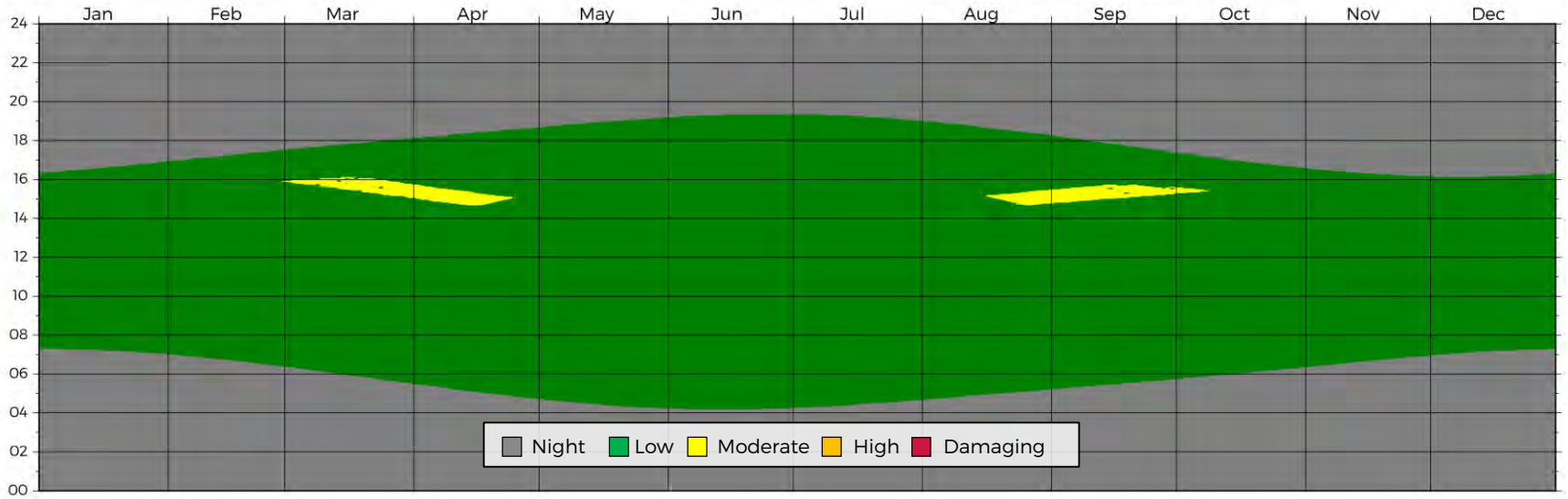
ANNUAL VISUAL IMPACT

Driver Receptor D1

Receptor D1 was chosen to assess the visual risk associated with solar reflections affecting drivers traveling northeast on Brookline Ave.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



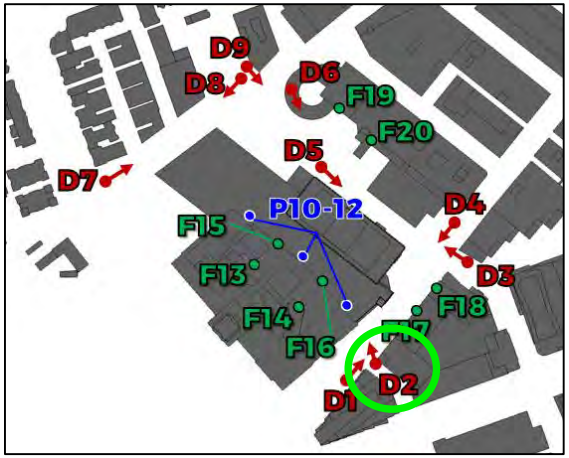


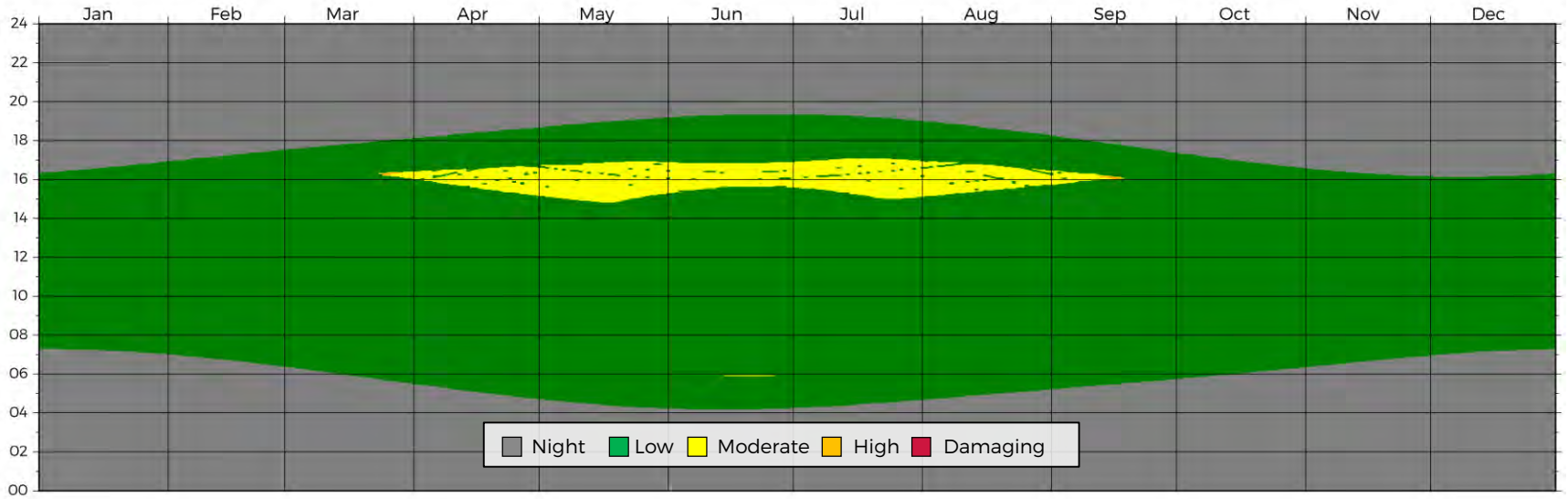
ANNUAL VISUAL IMPACT

Driver Receptor D2

Receptor D2 was chosen to assess the visual risk associated with solar reflections affecting drivers turning right on to Brookline Ave.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



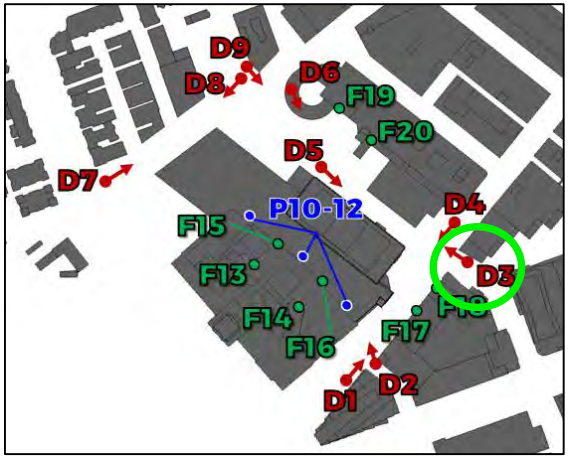


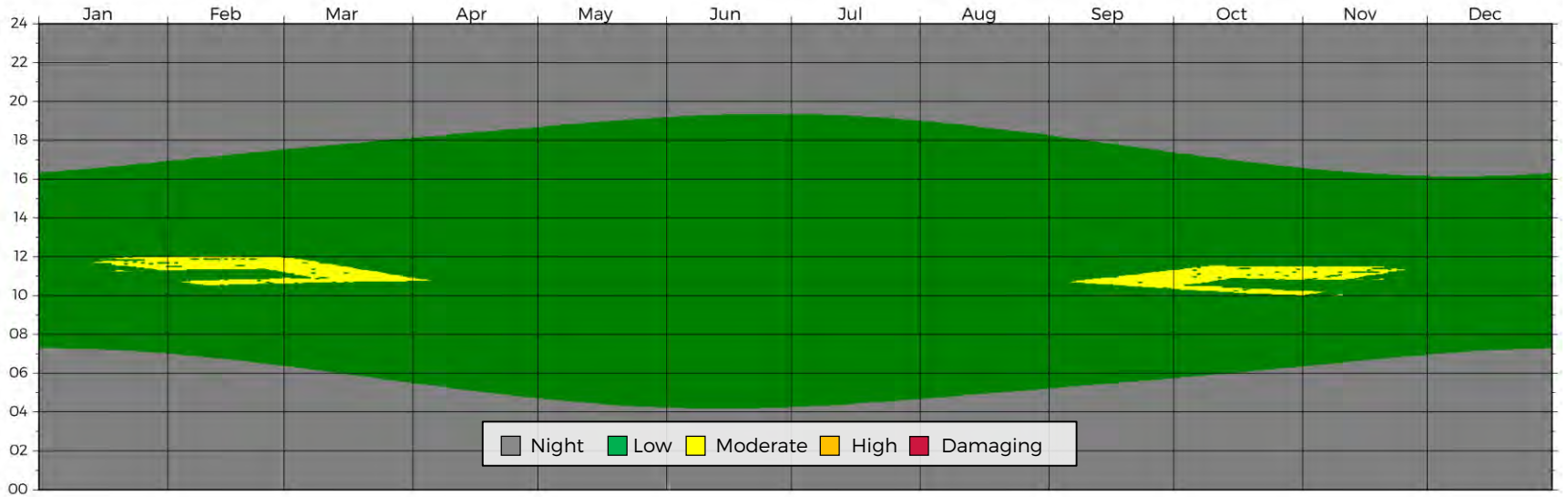
ANNUAL VISUAL IMPACT

Driver Receptor D3

Receptor D3 was chosen to assess the visual risk associated with solar reflections affecting drivers travelling northwest on Kilmarnock St.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



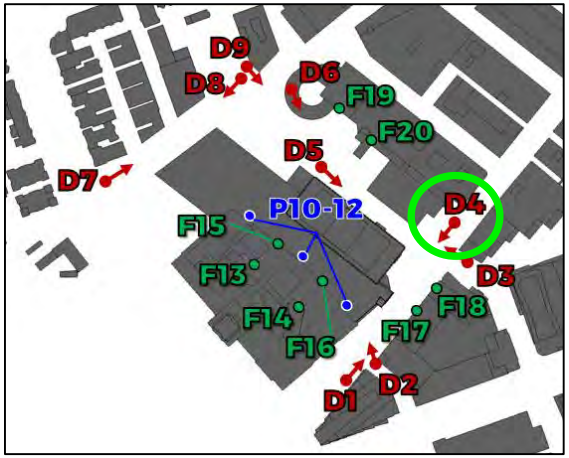


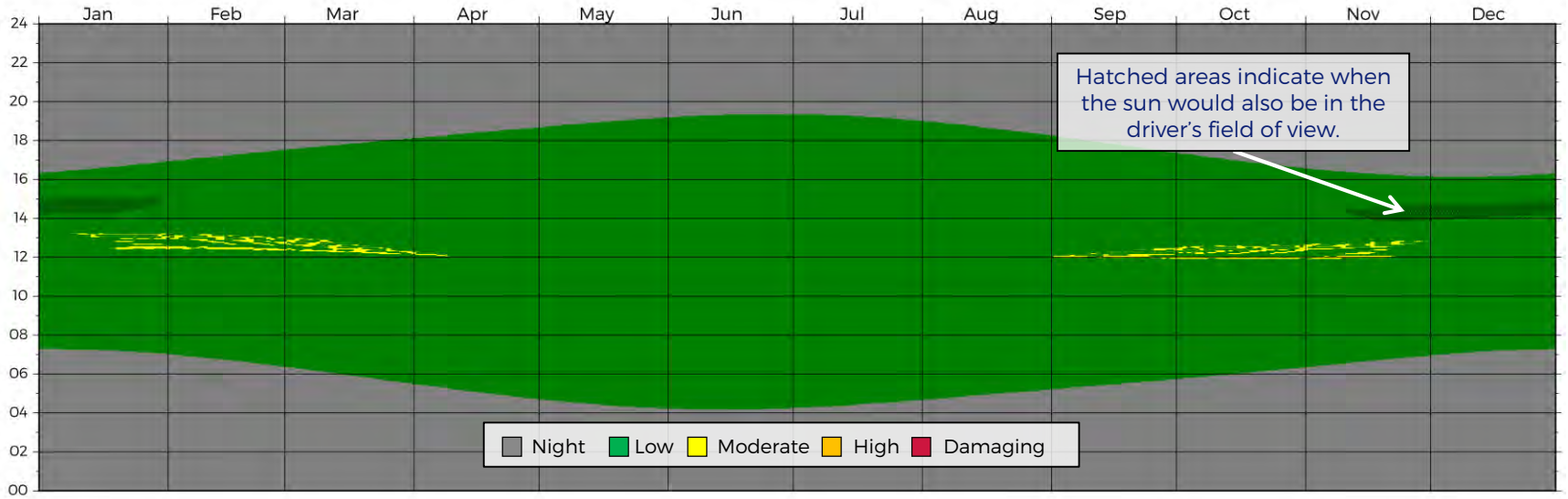
ANNUAL VISUAL IMPACT

Driver Receptor D4

Receptor D4 was chosen to assess the visual risk associated with solar reflections affecting drivers travelling southwest on Brookline Ave.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



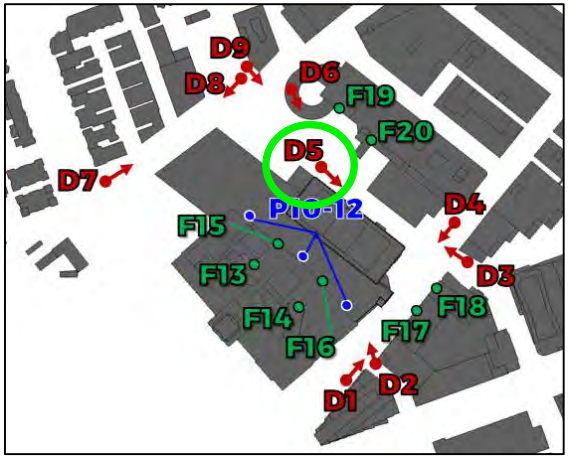


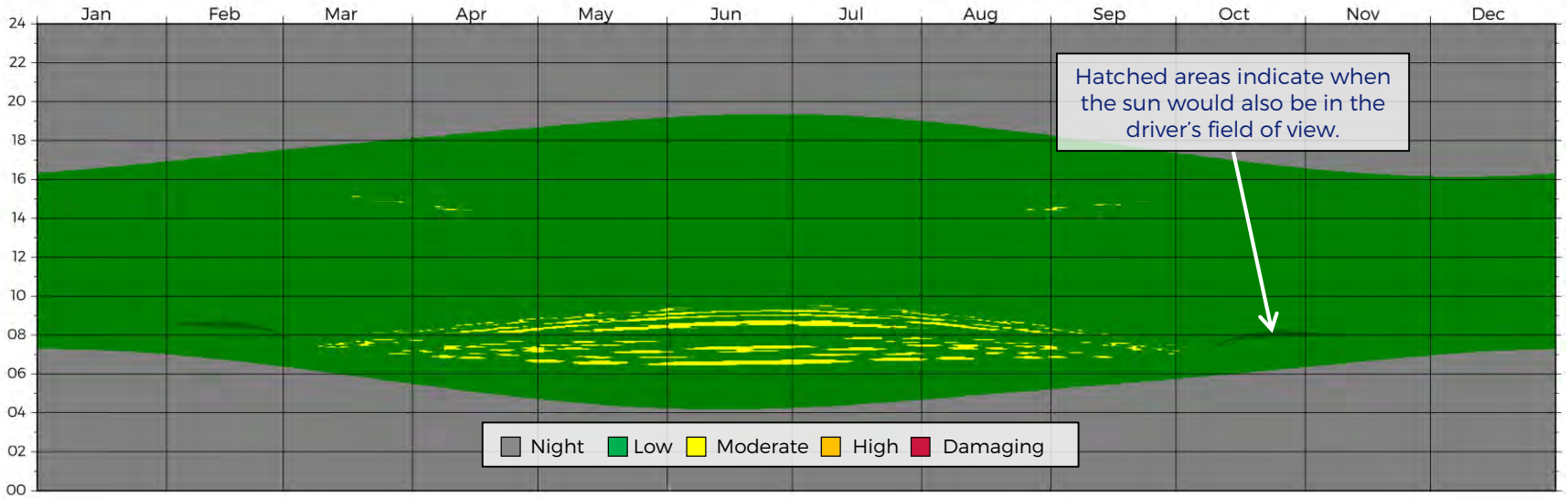
ANNUAL VISUAL IMPACT

Driver Receptor D5

Receptor D5 was chosen to assess the visual risk associated with solar reflections affecting drivers travelling southeast on Fullerton St.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



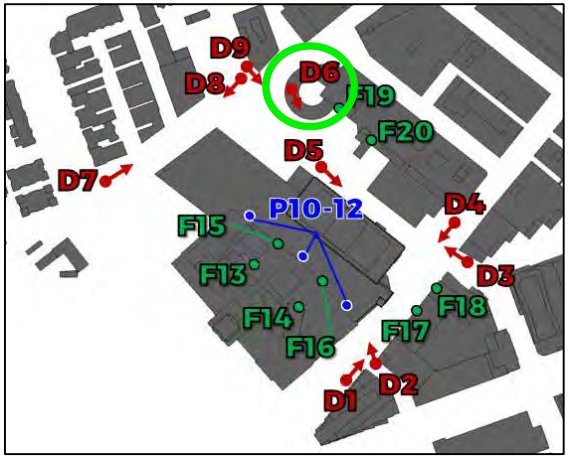


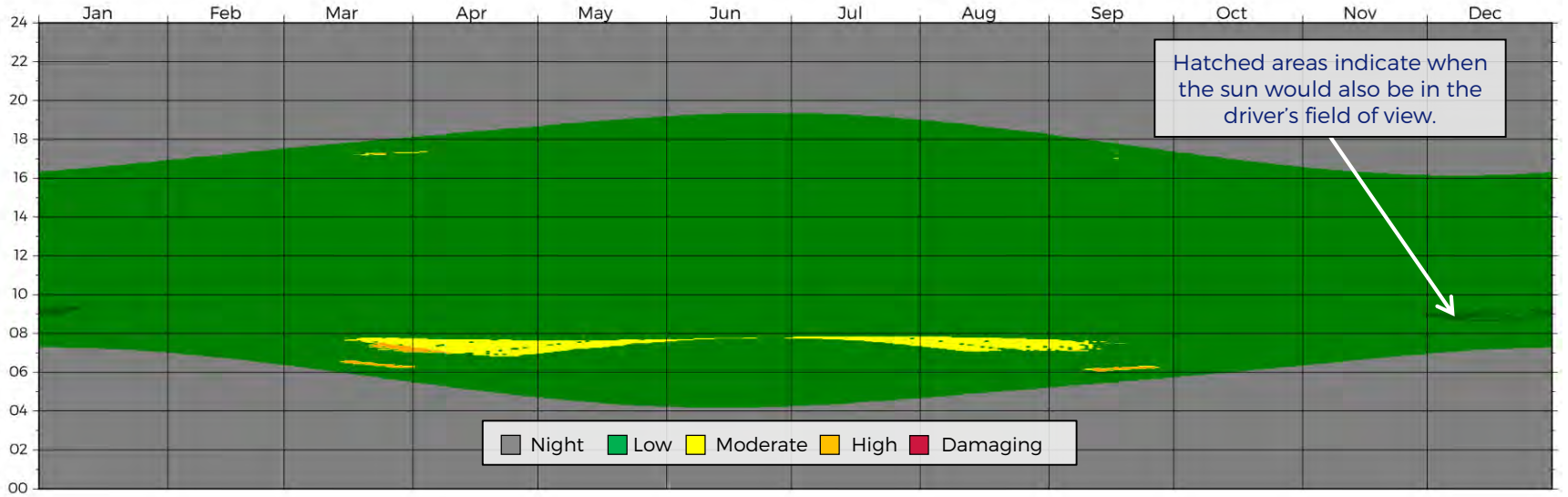
ANNUAL VISUAL IMPACT

Driver Receptor D6

Receptor D6 was chosen to assess the visual risk associated with solar reflections affecting drivers on the parking garage ramp.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



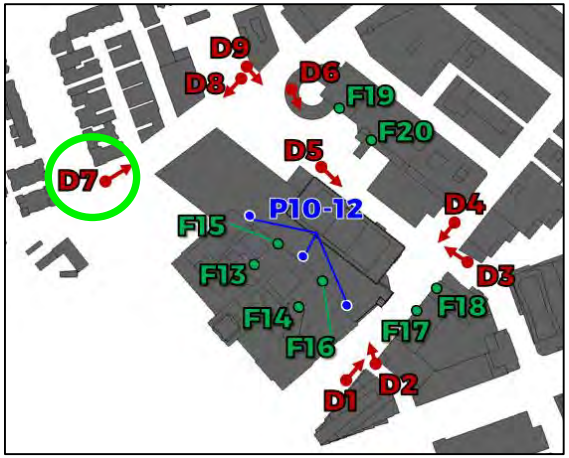


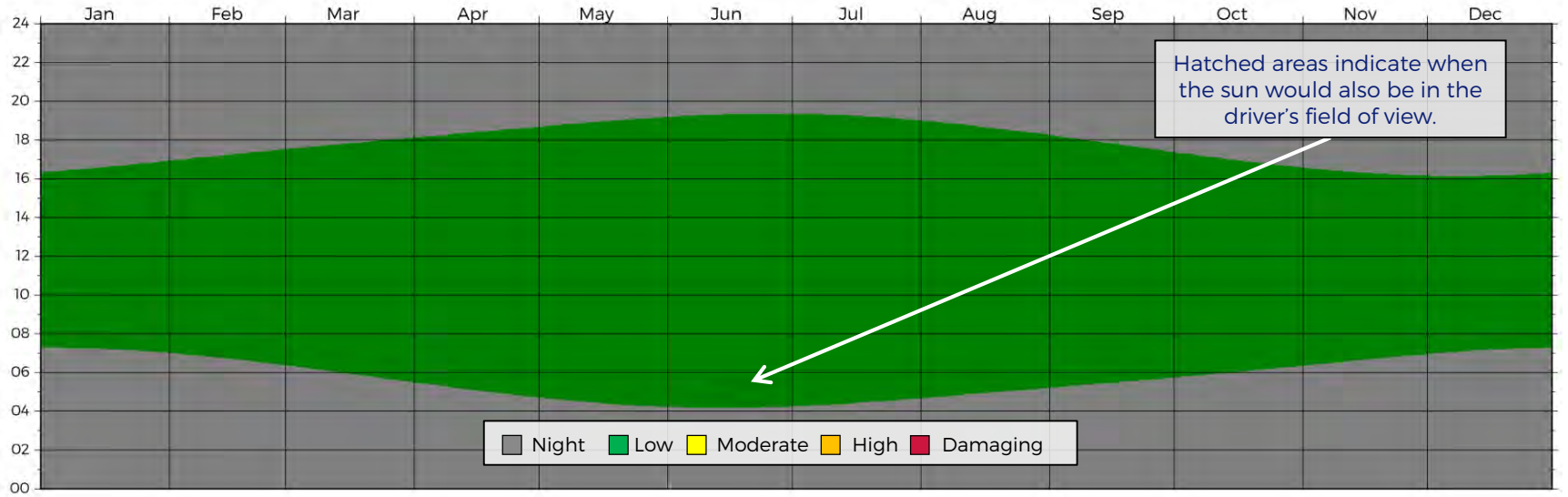
ANNUAL VISUAL IMPACT

Driver Receptor D7

Receptor D7 was chosen to assess the visual risk associated with solar reflections affecting MBTA train drivers exiting the tunnel under Park Drive.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



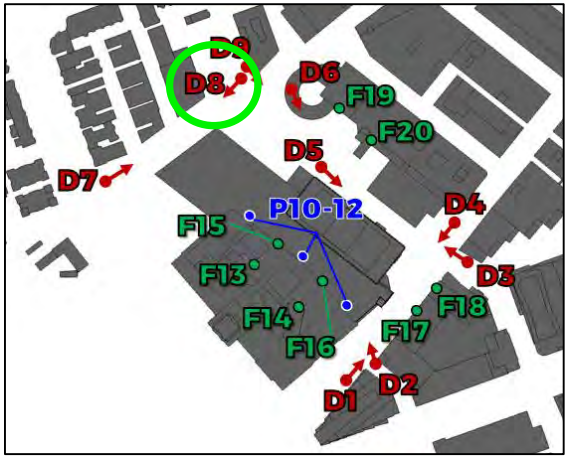


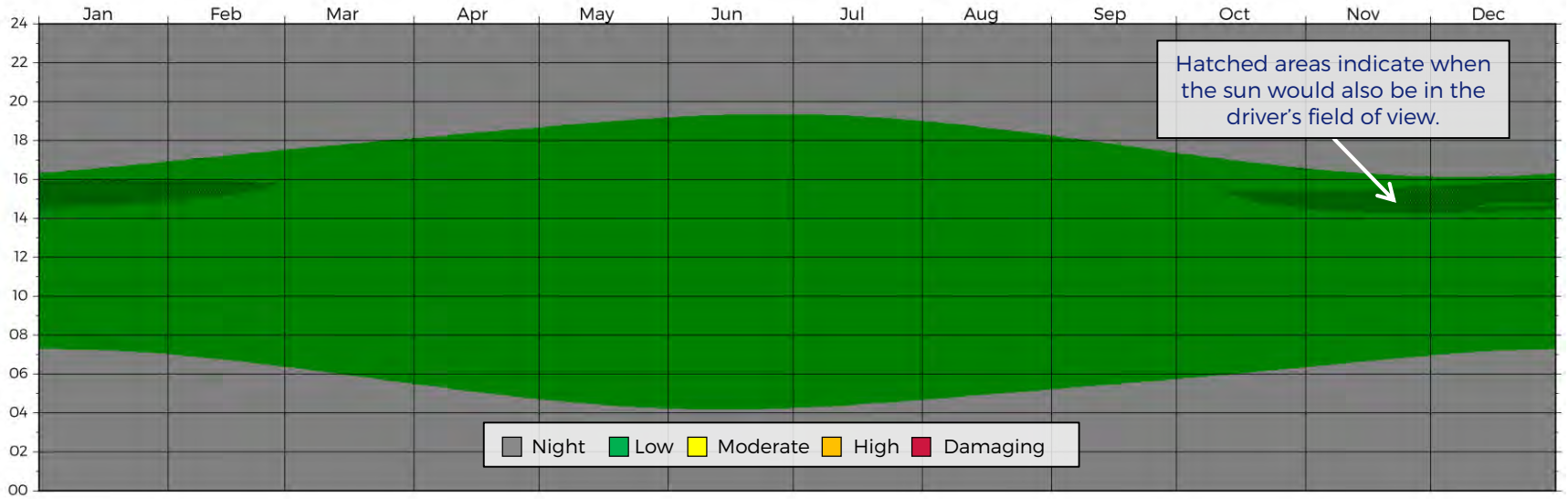
ANNUAL VISUAL IMPACT

Driver Receptor D8

Receptor D8 was chosen to assess the visual risk associated with solar reflections affecting MBTA train drivers exiting the tunnel under Miner Street.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



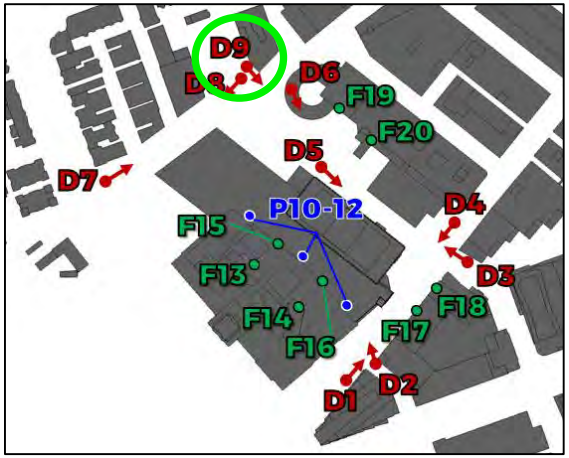


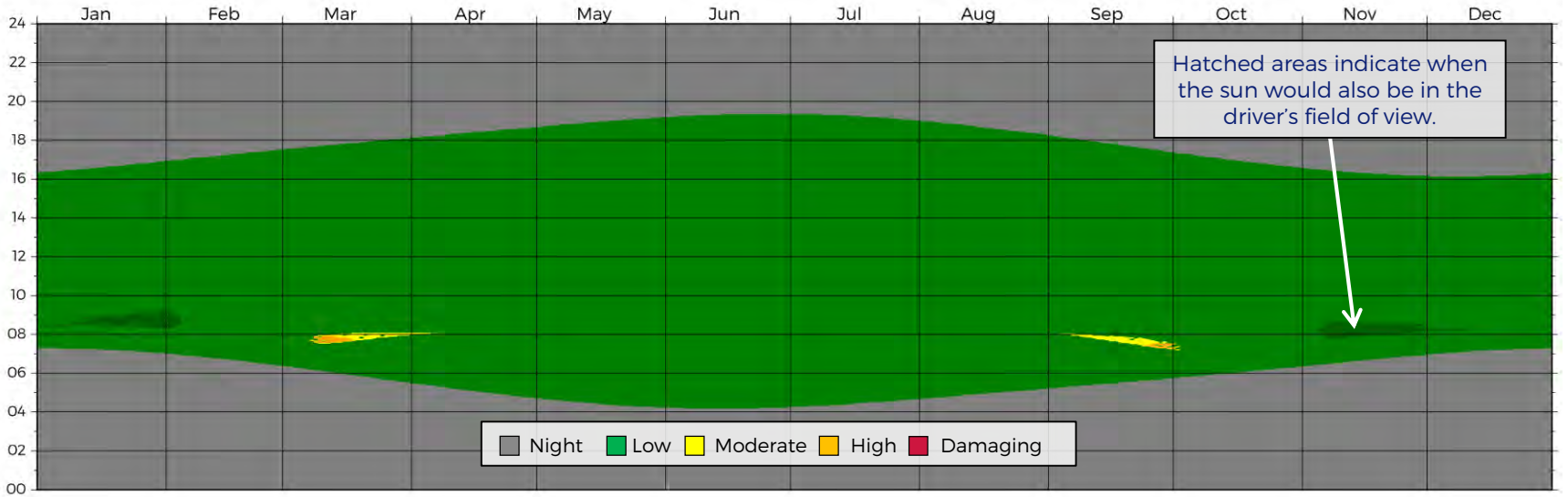
ANNUAL VISUAL IMPACT

Driver Receptor D9

Receptor D9 was chosen to assess the visual risk associated with solar reflections affecting drivers travelling southeast on Miner Street.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



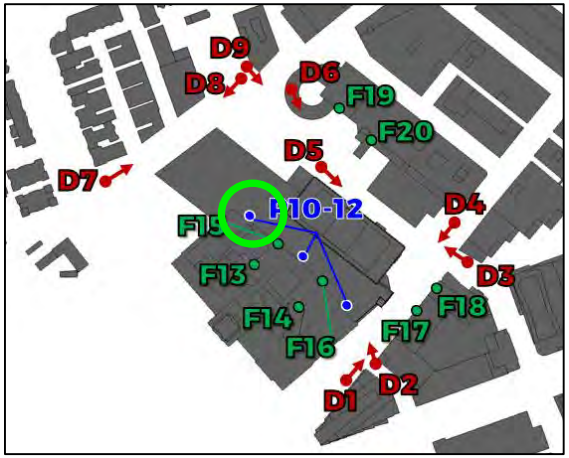


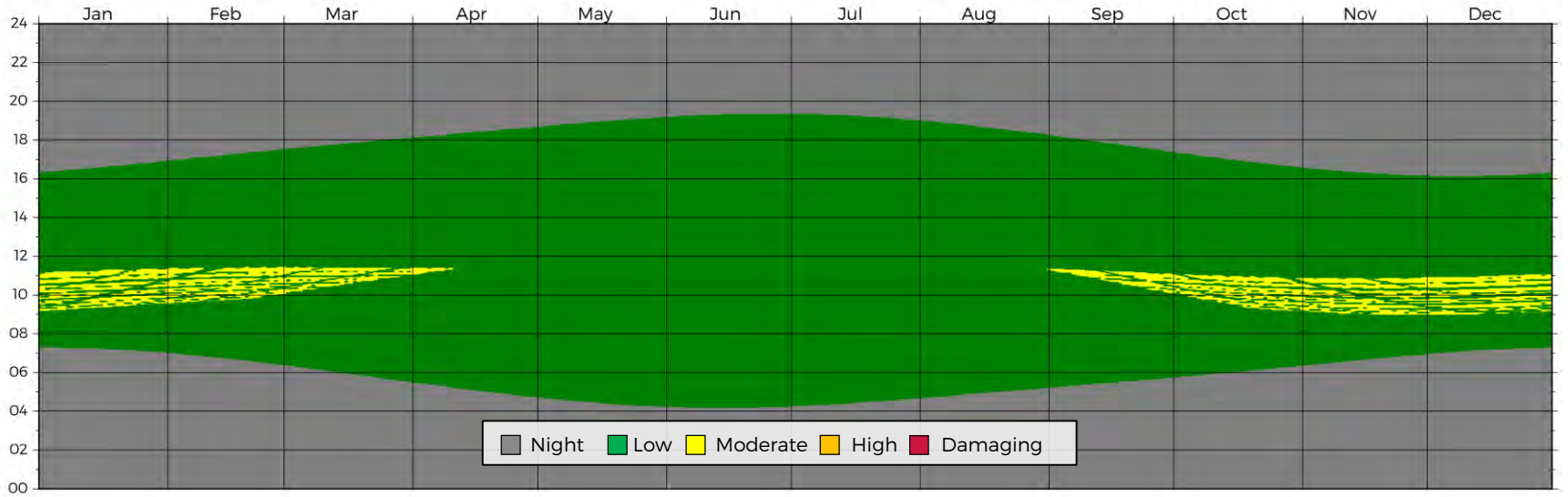
ANNUAL VISUAL IMPACT

Pedestrian Receptor P10

Receptor P10 was chosen to assess the visual impact associated with solar reflections affecting pedestrians on the podium roof between the existing Landmark Center and the new tower.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



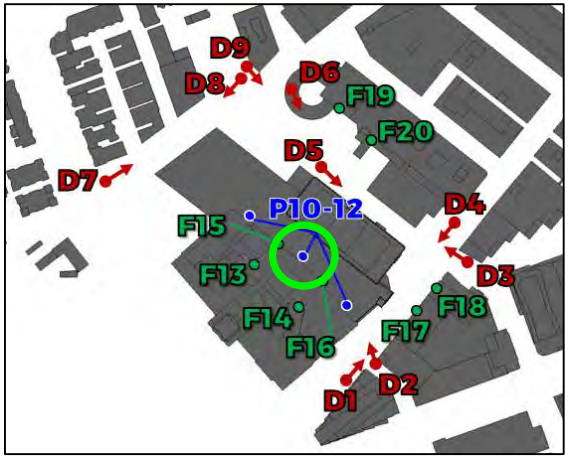


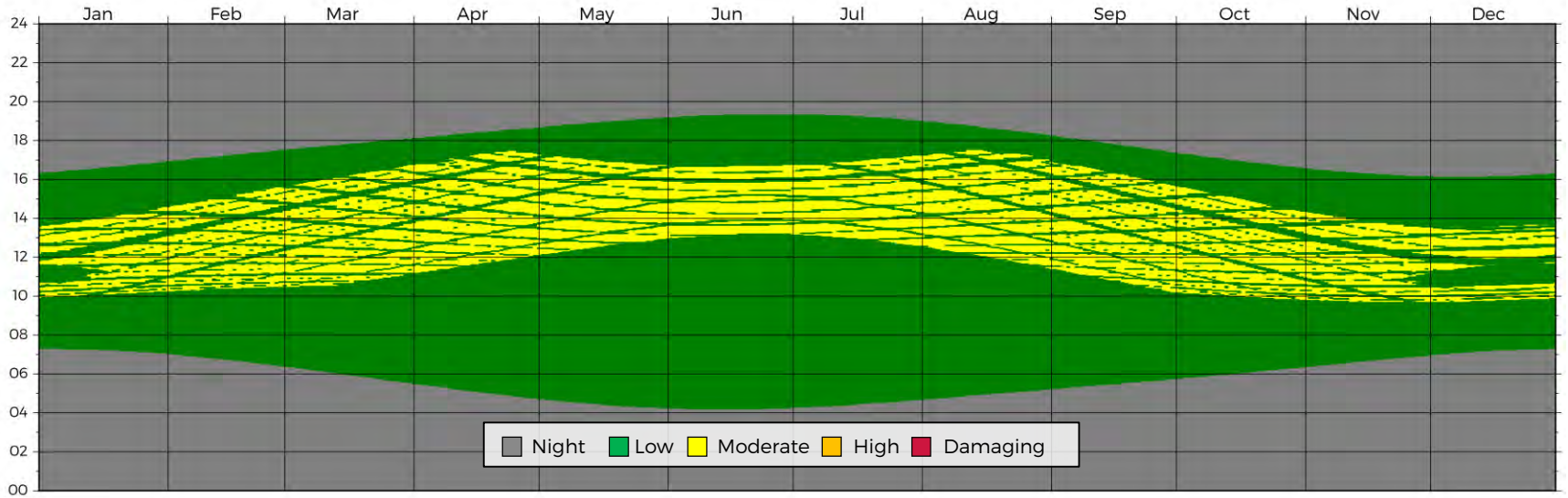
ANNUAL VISUAL IMPACT

Pedestrian Receptor P11

Receptor P11 was chosen to assess the visual impact associated with solar reflections affecting pedestrians on the podium roof between the existing Landmark Center and the new tower.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



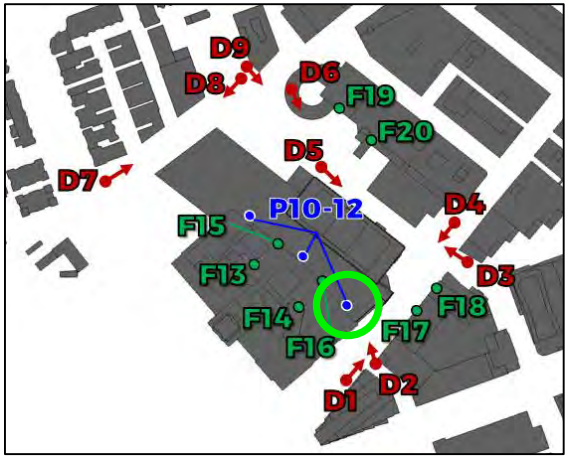


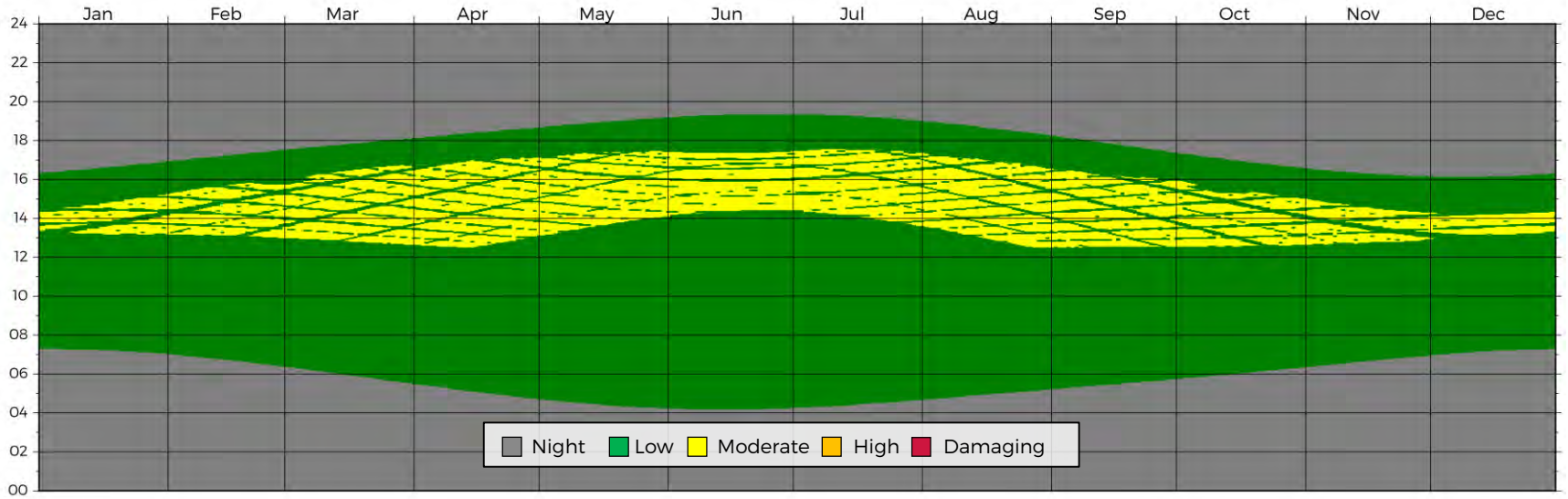
ANNUAL VISUAL IMPACT

Pedestrian Receptor P12

Receptor P12 was chosen to assess the visual impact associated with solar reflections affecting pedestrians on the podium roof between the existing Landmark Center and the new tower.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



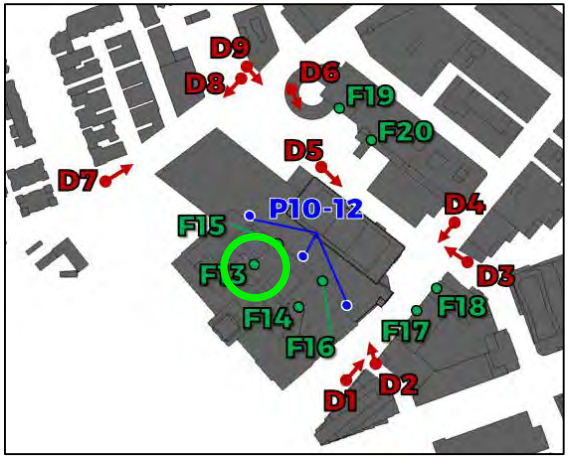


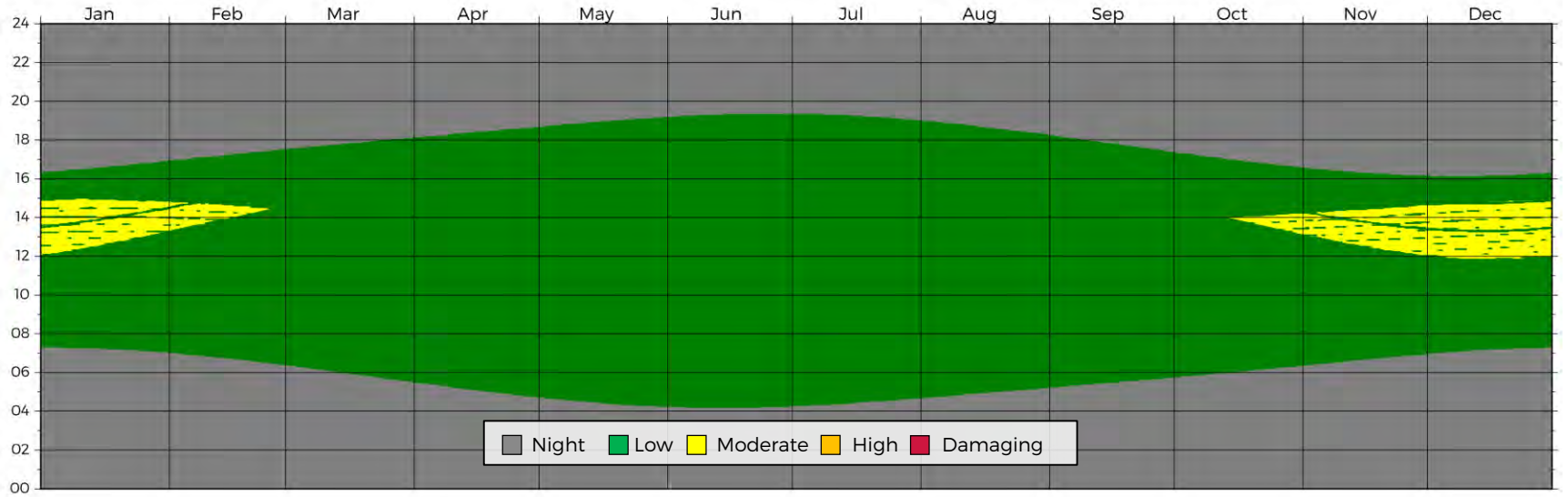
ANNUAL VISUAL IMPACT

Facade Receptor F13

Receptor F13 was chosen to assess the visual impact associated with solar reflections impacting the skylights of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



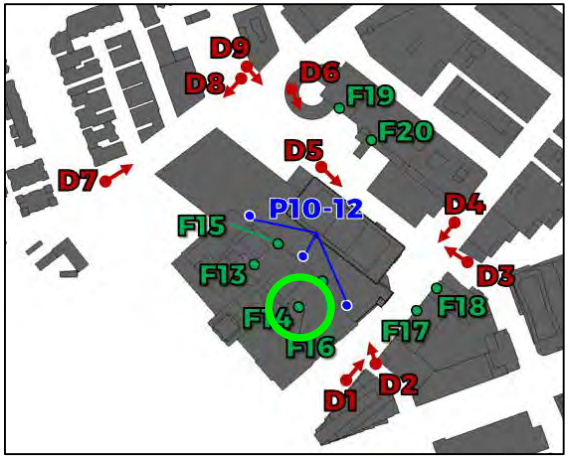


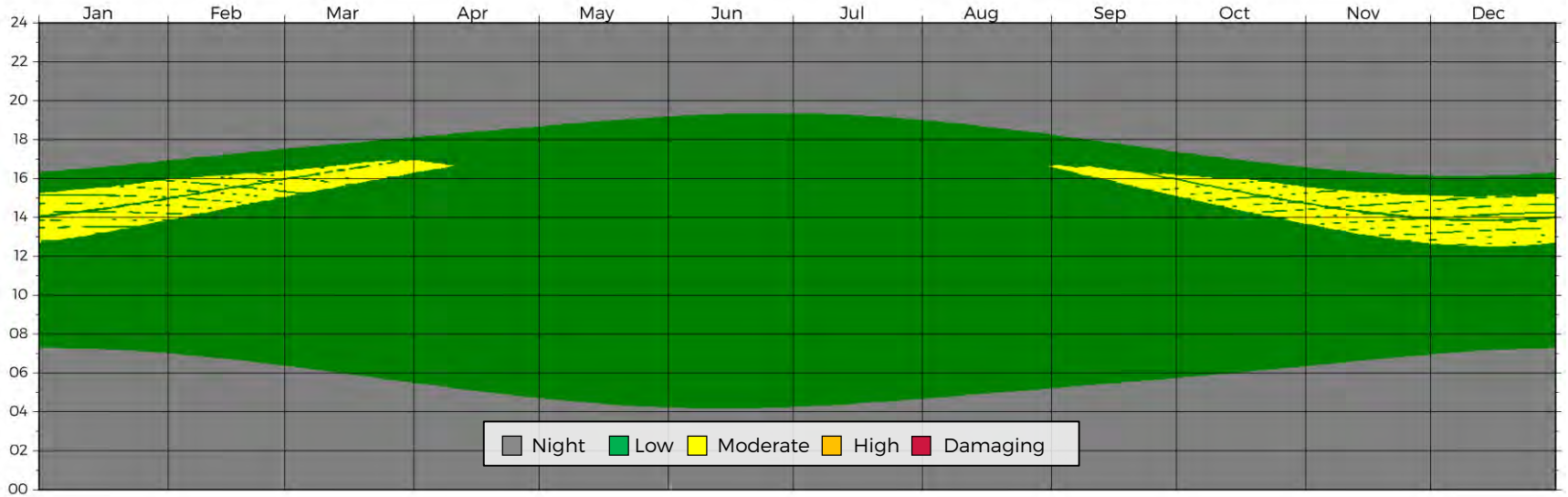
ANNUAL VISUAL IMPACT

Facade Receptor F14

Receptor F14 was chosen to assess the visual impact associated with solar reflections impacting the skylights of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



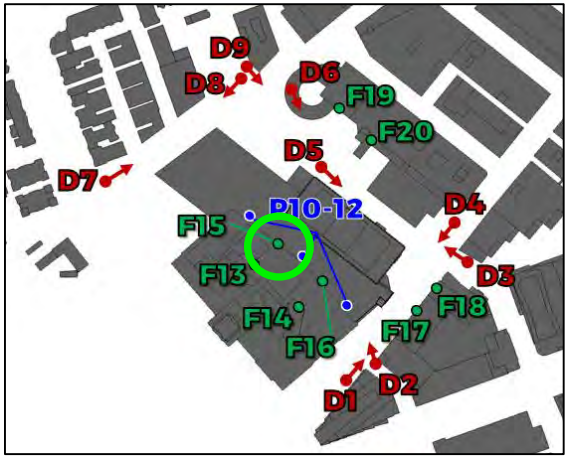


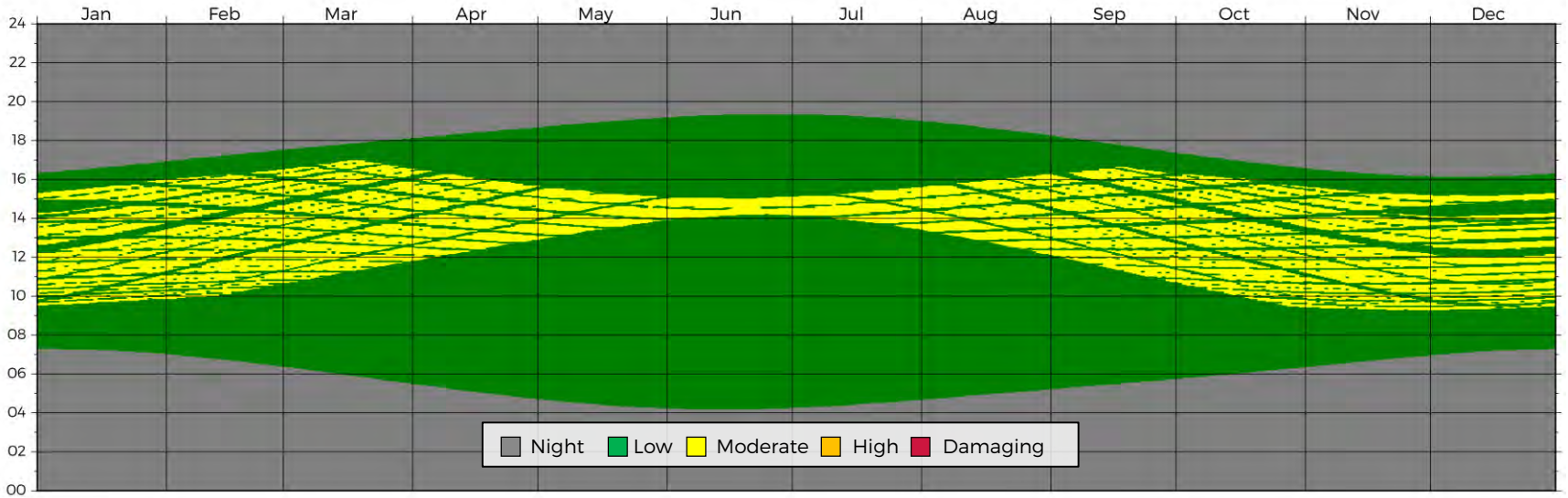
ANNUAL VISUAL IMPACT

Facade Receptor F15

Receptor F15 was chosen to assess the visual impact associated with solar reflections impacting the windows on the northeast facade of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



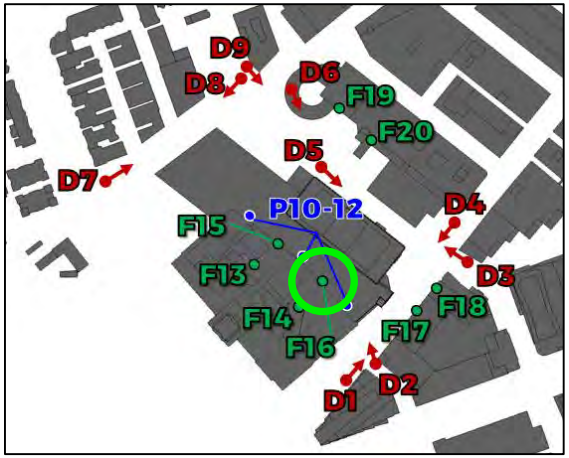


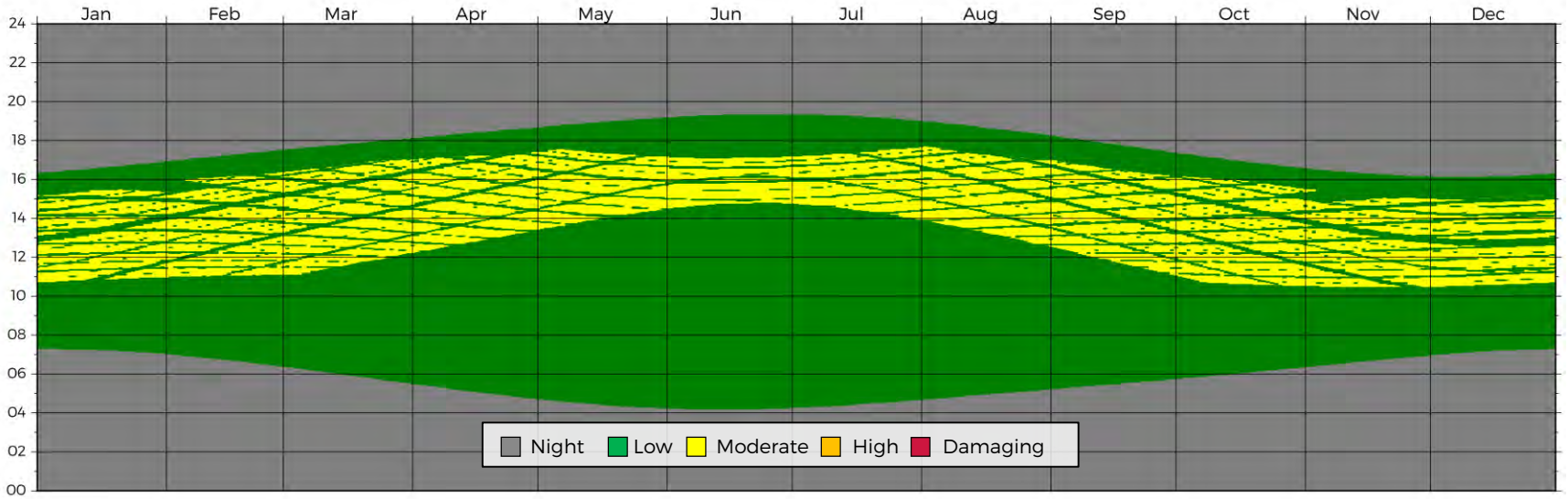
ANNUAL VISUAL IMPACT

Facade Receptor F16

Receptor F16 was chosen to assess the visual impact associated with solar reflections impacting the windows on the northeast facade of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



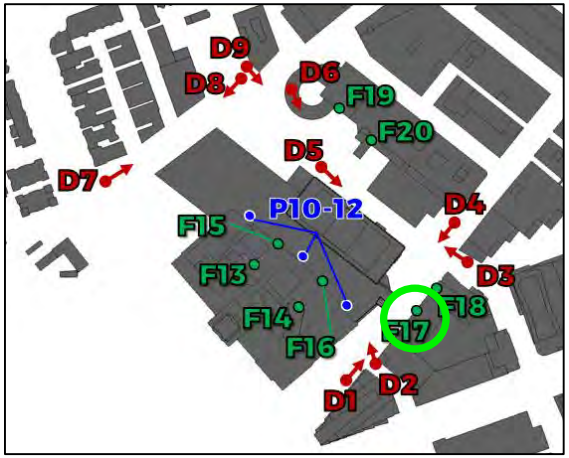


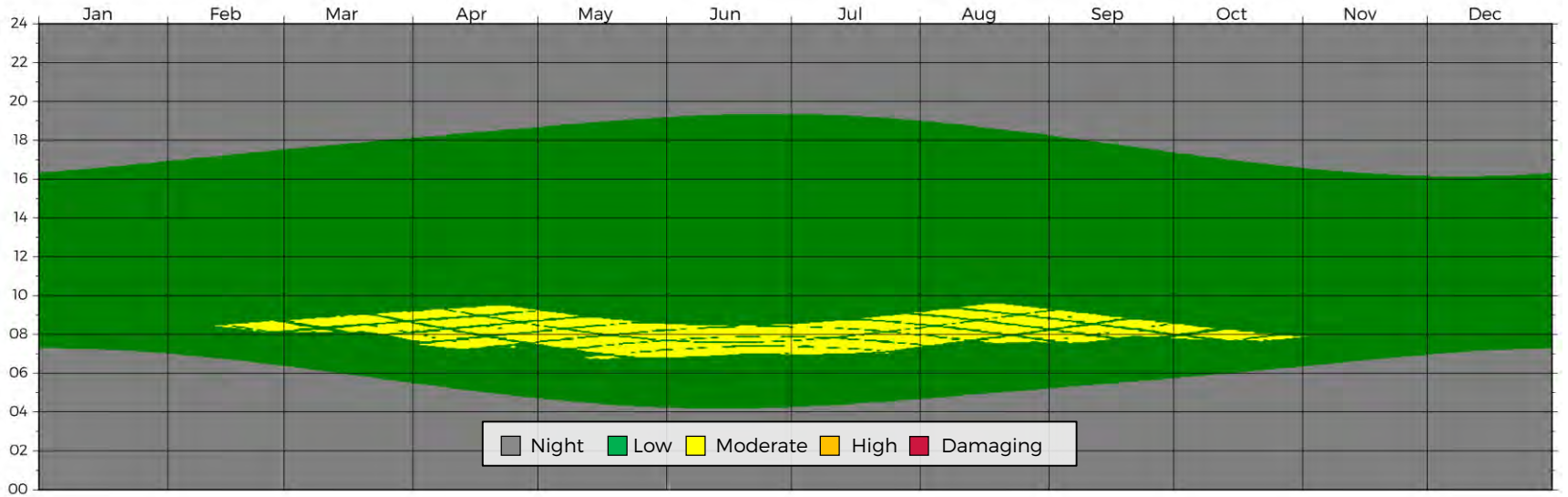
ANNUAL VISUAL IMPACT

Facade Receptor F17

Receptor F17 was chosen to assess the visual impact associated with solar reflections impacting the windows on the northwest facade of 180 Brookline Avenue.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



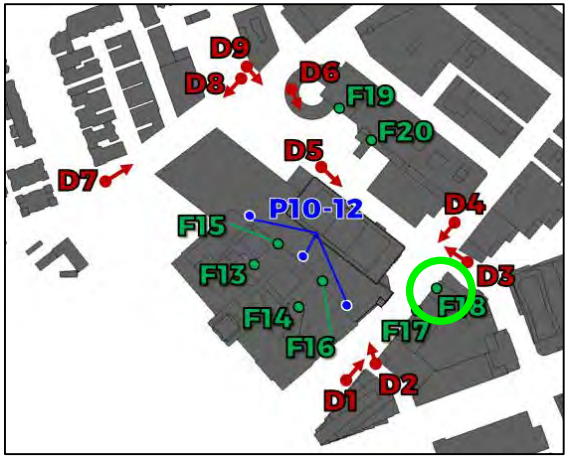


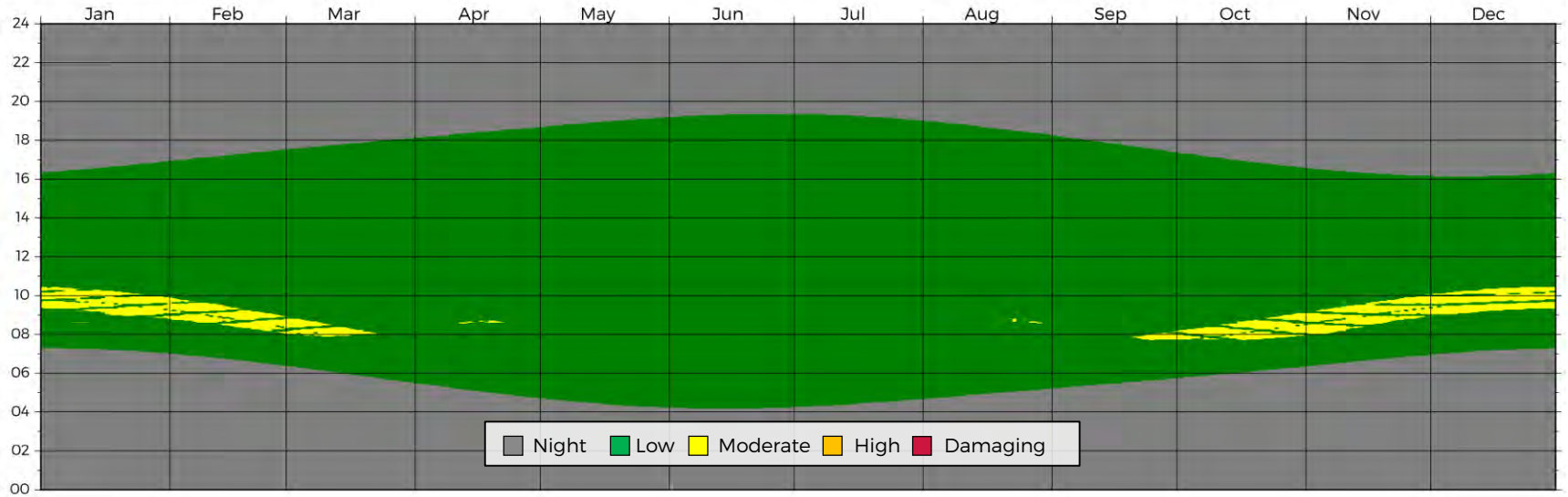
ANNUAL VISUAL IMPACT

Facade Receptor F18

Receptor F18 was chosen to assess the visual impact associated with solar reflections impacting the windows on the northwest facade of 180 Brookline Avenue.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



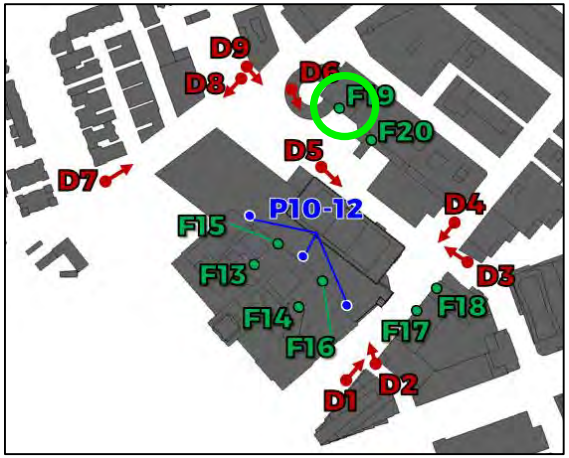


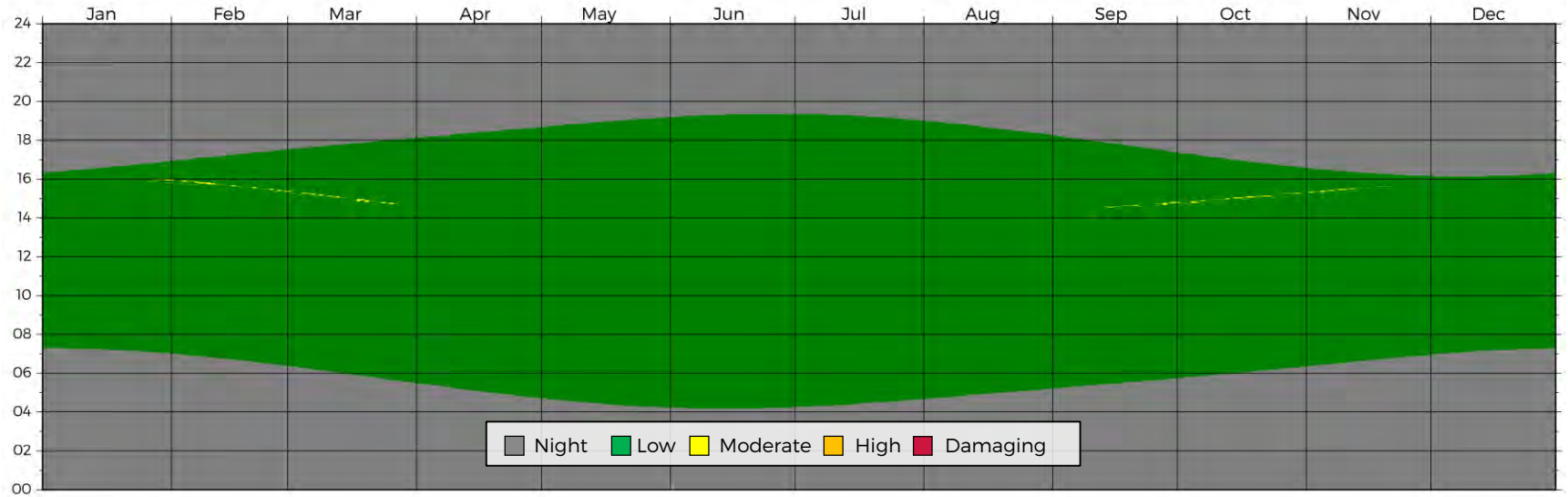
ANNUAL VISUAL IMPACT

Facade Receptor F19

Receptor F19 was chosen to assess the visual impact associated with solar reflections impacting the windows on the southwest facade of the Harvard Vanguard Medical Associates Building.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



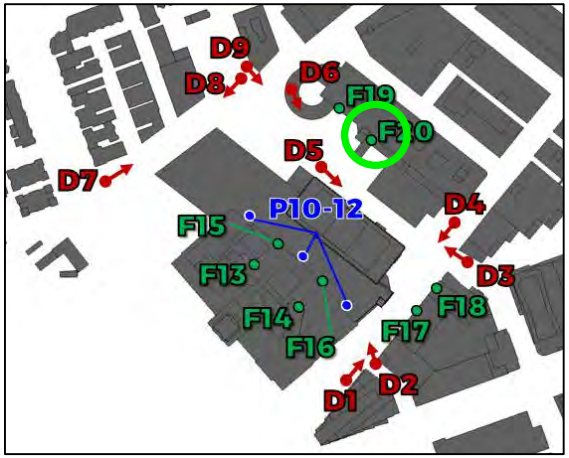


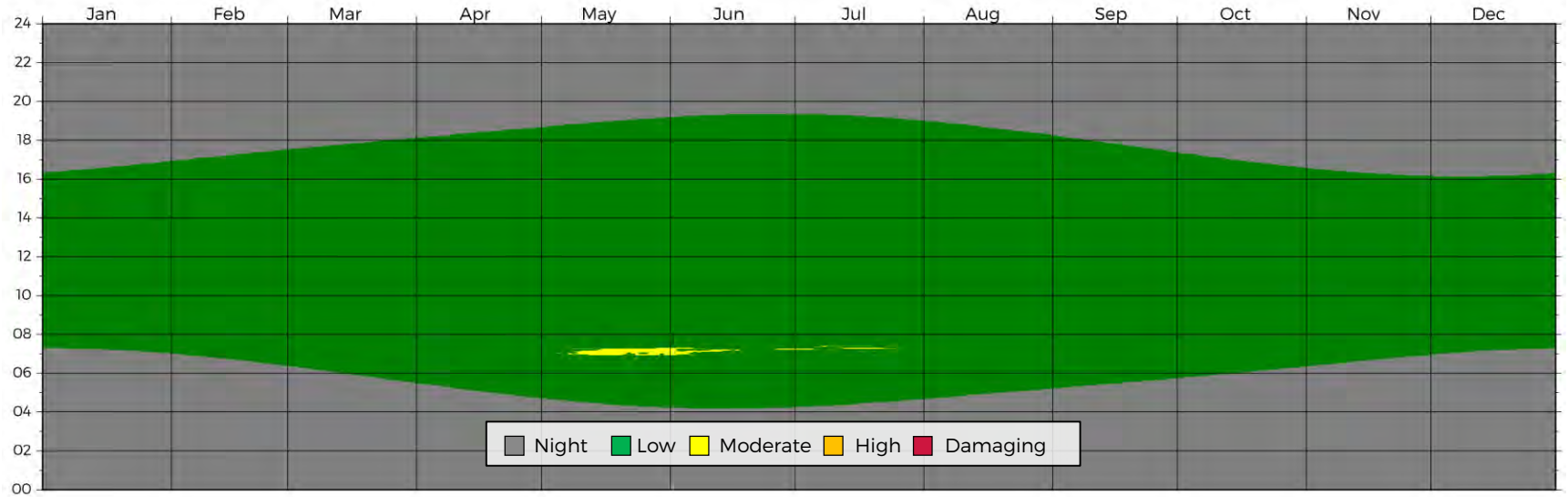
ANNUAL VISUAL IMPACT

Facade Receptor F20

Receptor F20 was chosen to assess the visual impact associated with solar reflections impacting the windows on the southwest facade of the Harvard Vanguard Medical Associates Building.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



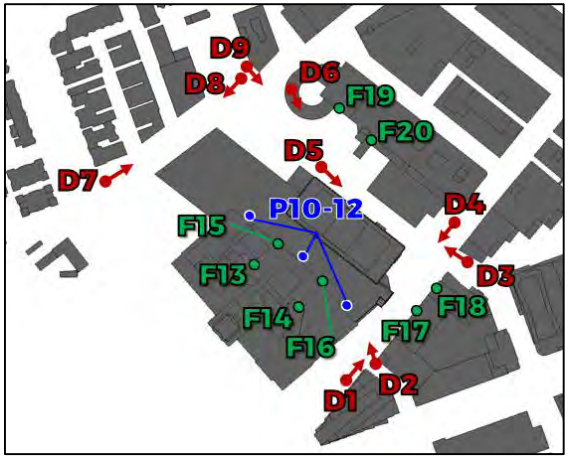


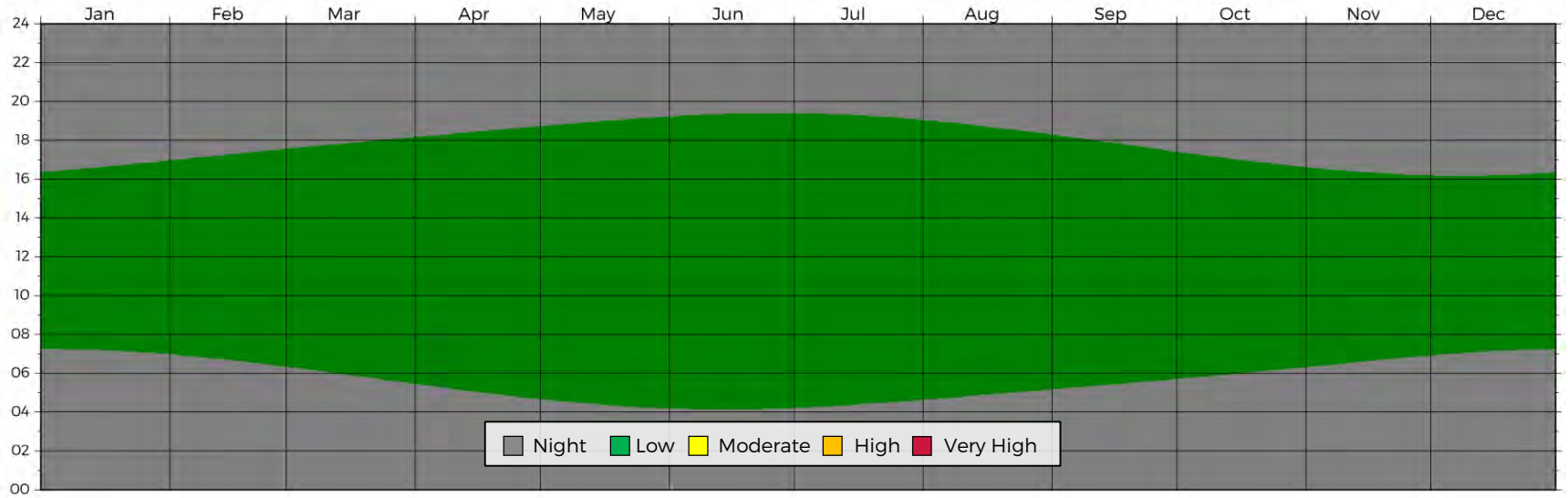
ANNUAL THERMAL IMPACT - PEOPLE

All Receptors

All reflection impacts at all receptors were found to have intensities below RWDI's short-term and human safety threshold values.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



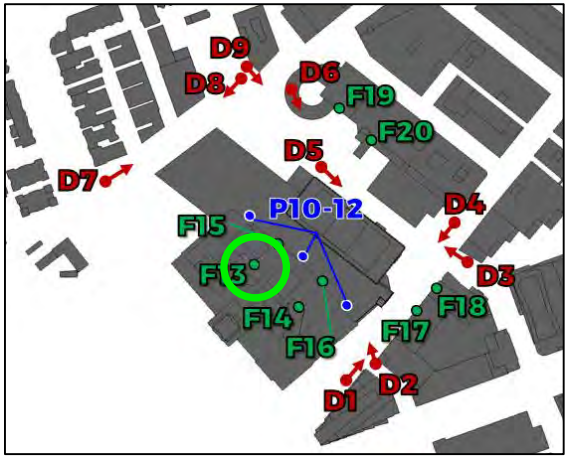


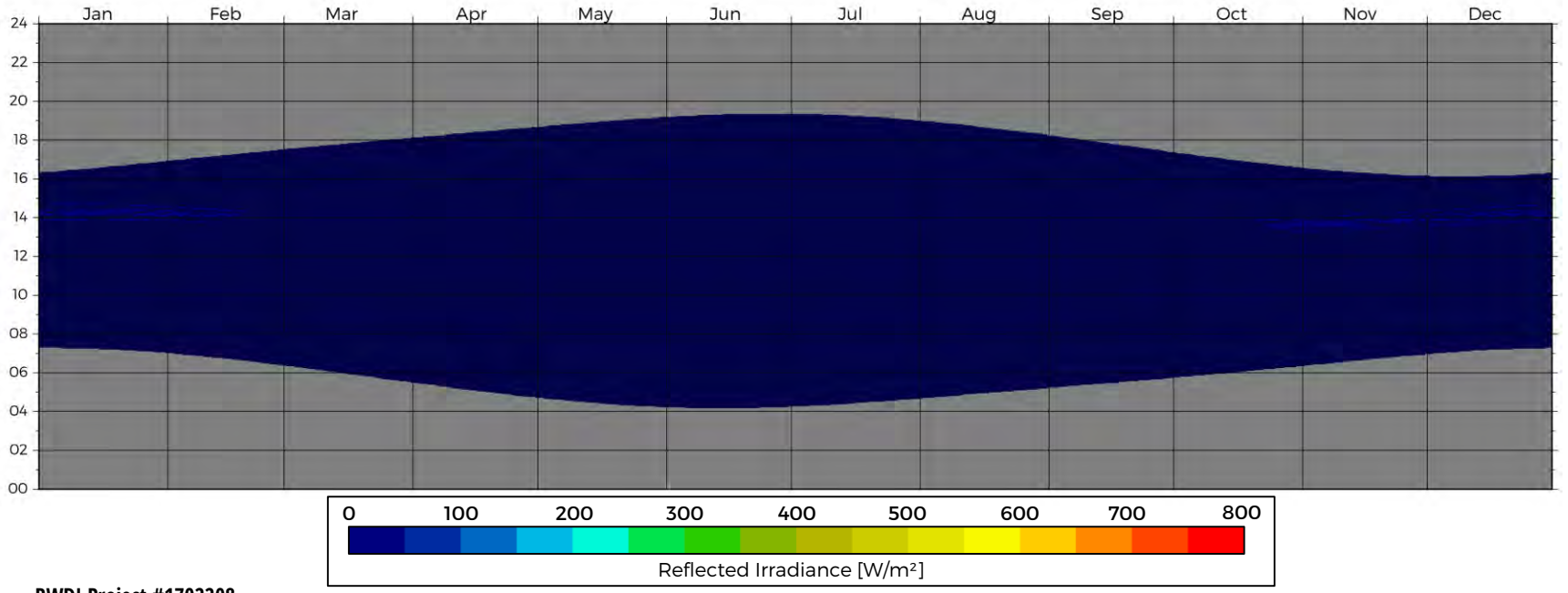
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F13

Receptor F13 was chosen to assess the thermal impact associated with solar reflections impacting the skylights of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



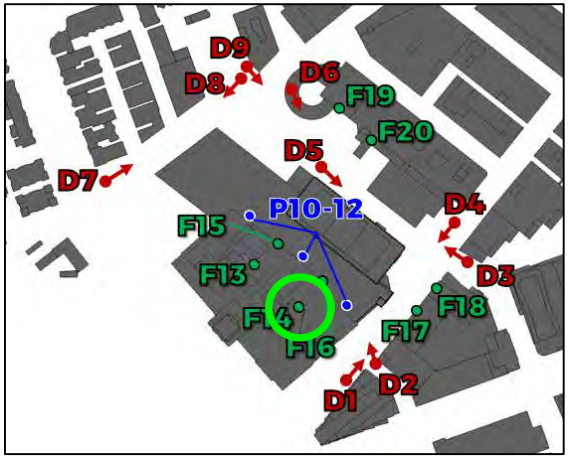


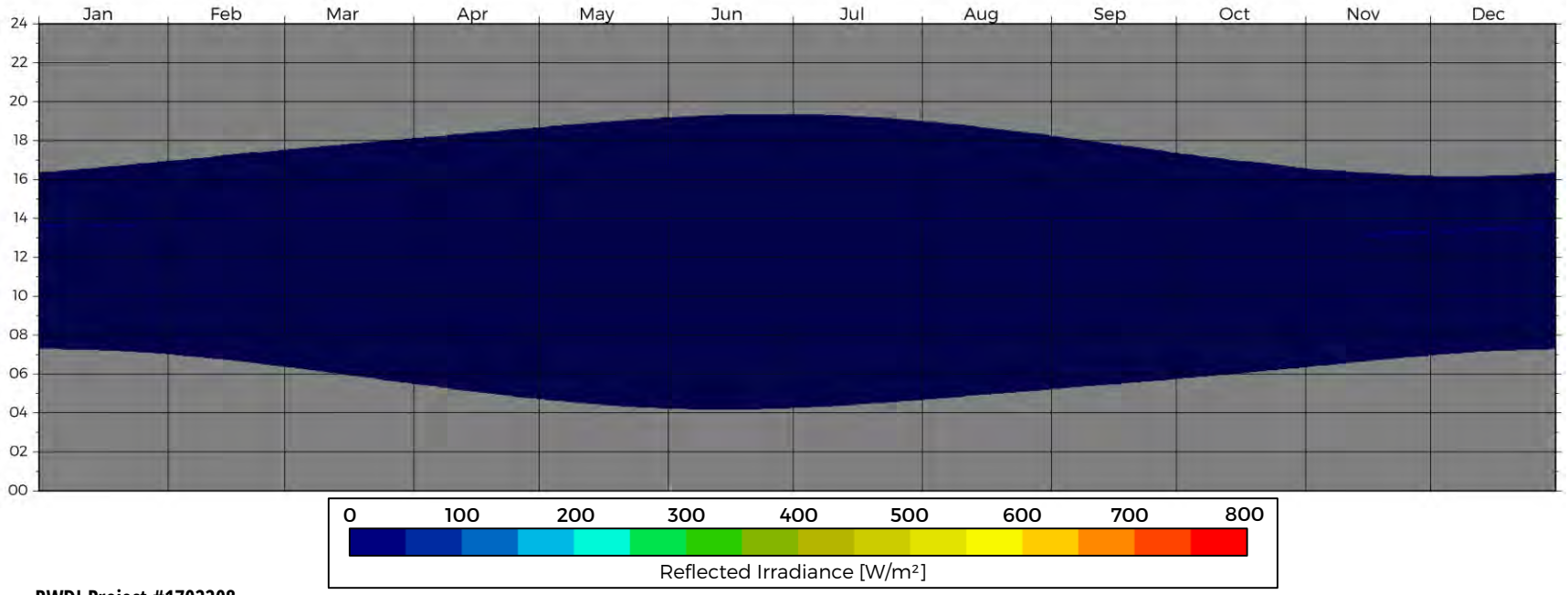
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F14

Receptor F14 was chosen to assess the thermal impact associated with solar reflections impacting the skylights of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



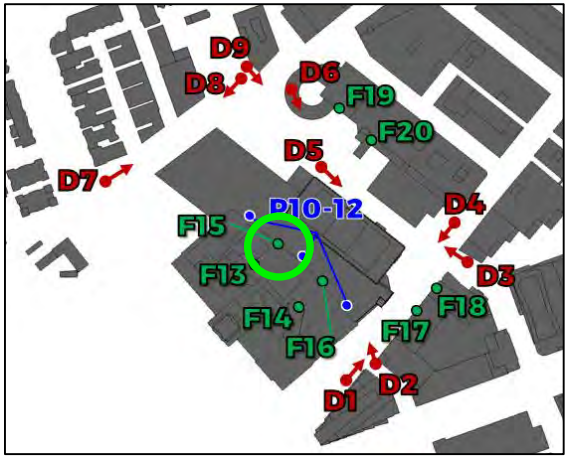


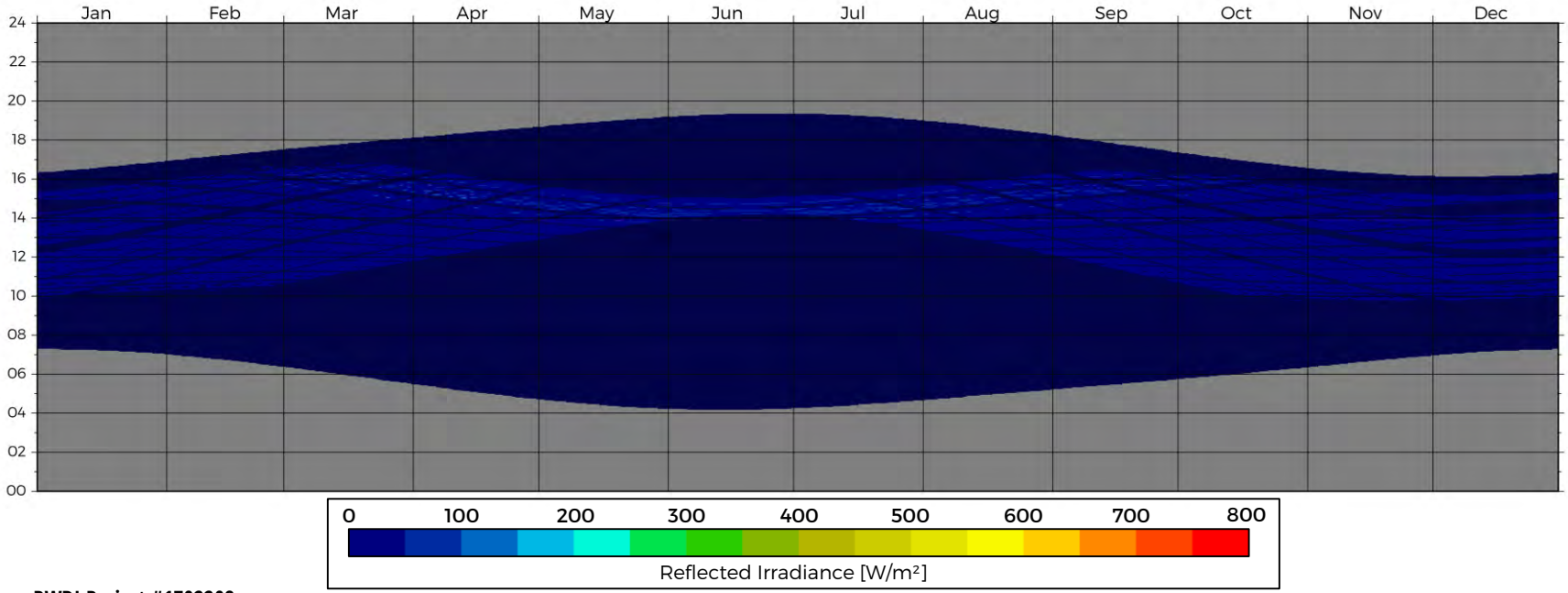
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F15

Receptor F15 was chosen to assess the thermal impact associated with solar reflections impacting the windows on the northeast facade of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



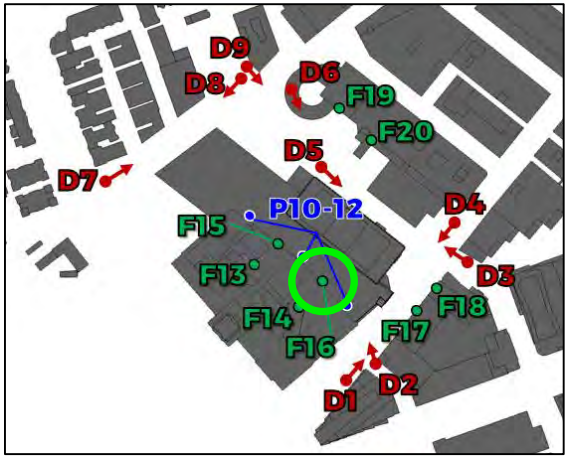


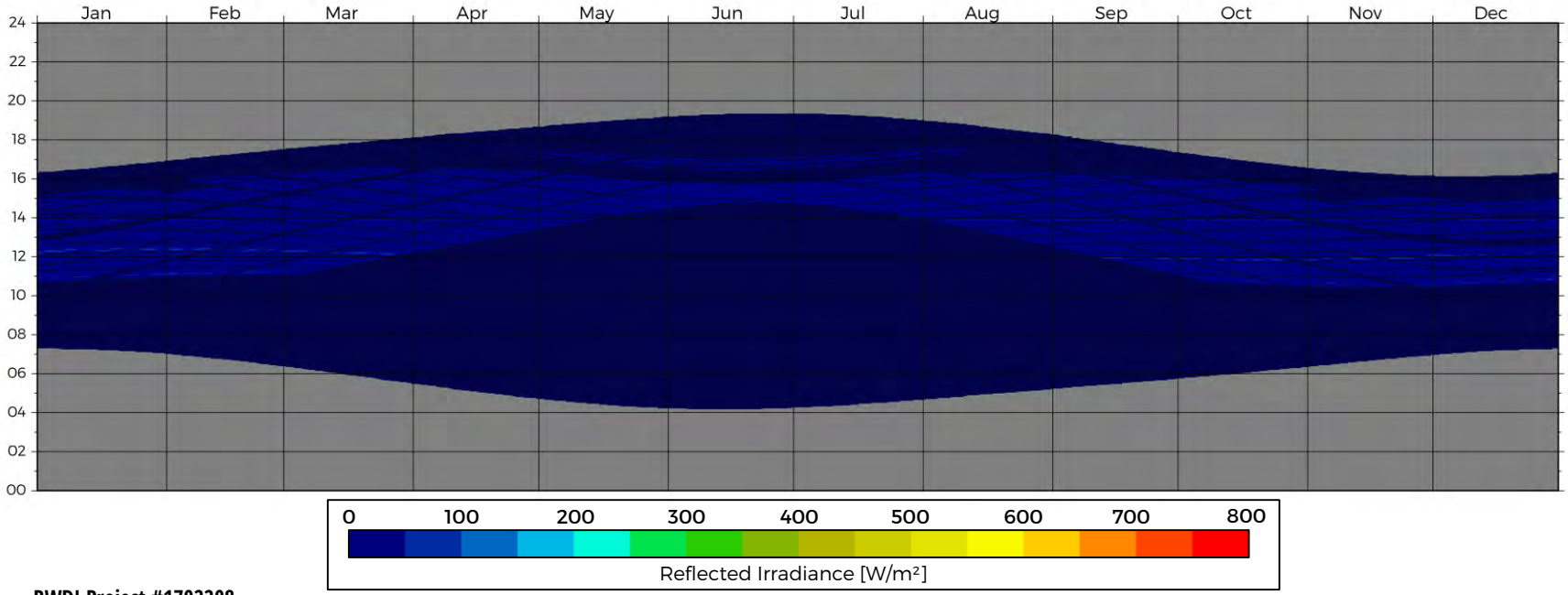
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F16

Receptor F16 was chosen to assess the thermal impact associated with solar reflections impacting the windows on the northeast facade of the existing Landmark Center.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



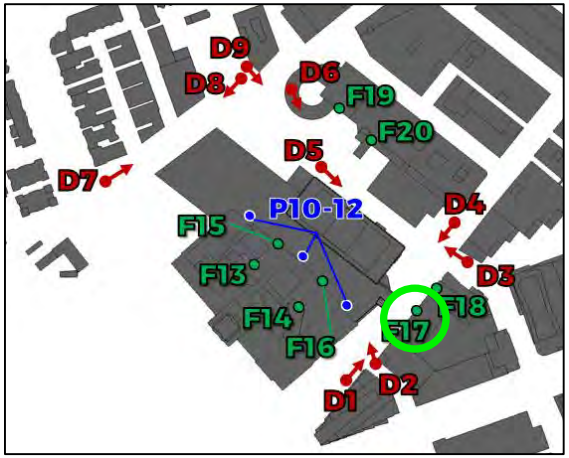


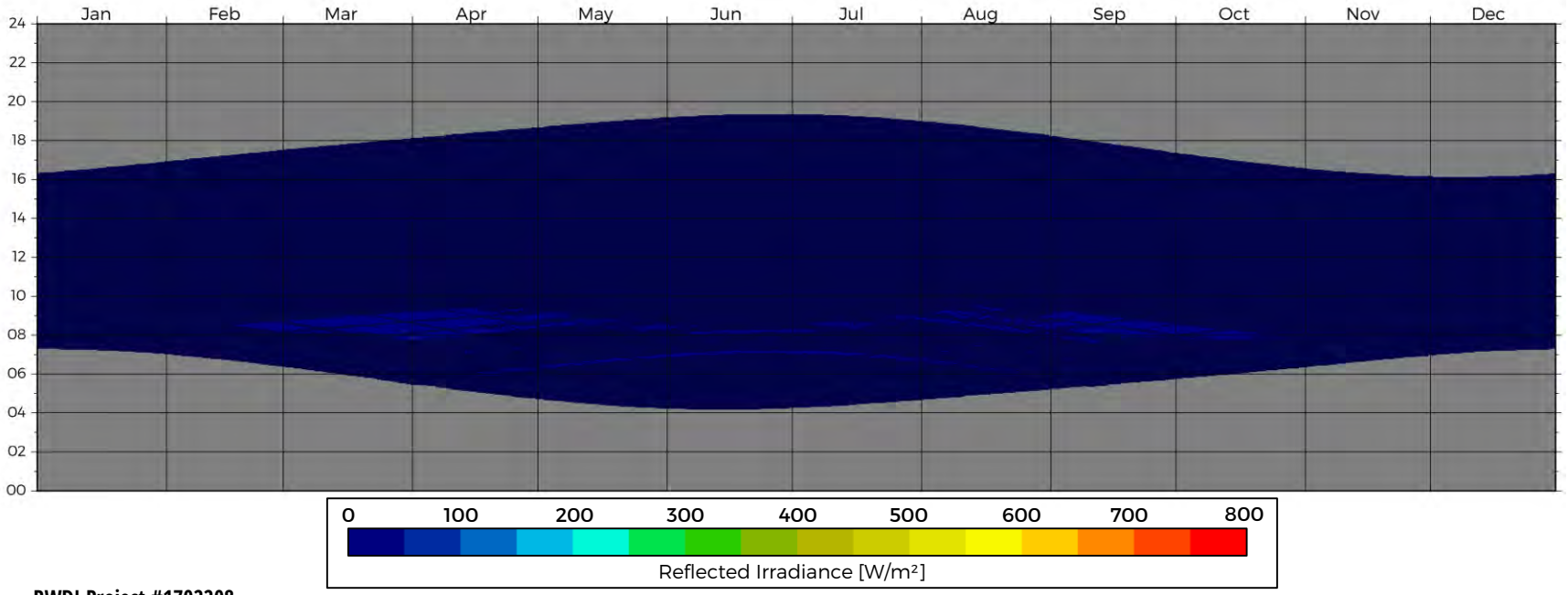
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F17

Receptor F17 was chosen to assess the thermal impact associated with solar reflections impacting the windows on the northwest facade of 180 Brookline Avenue.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



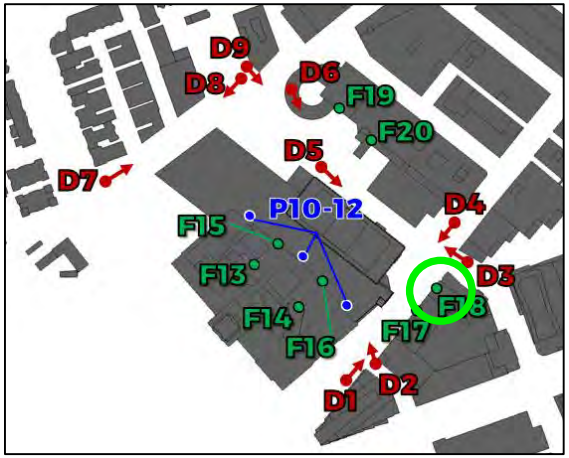


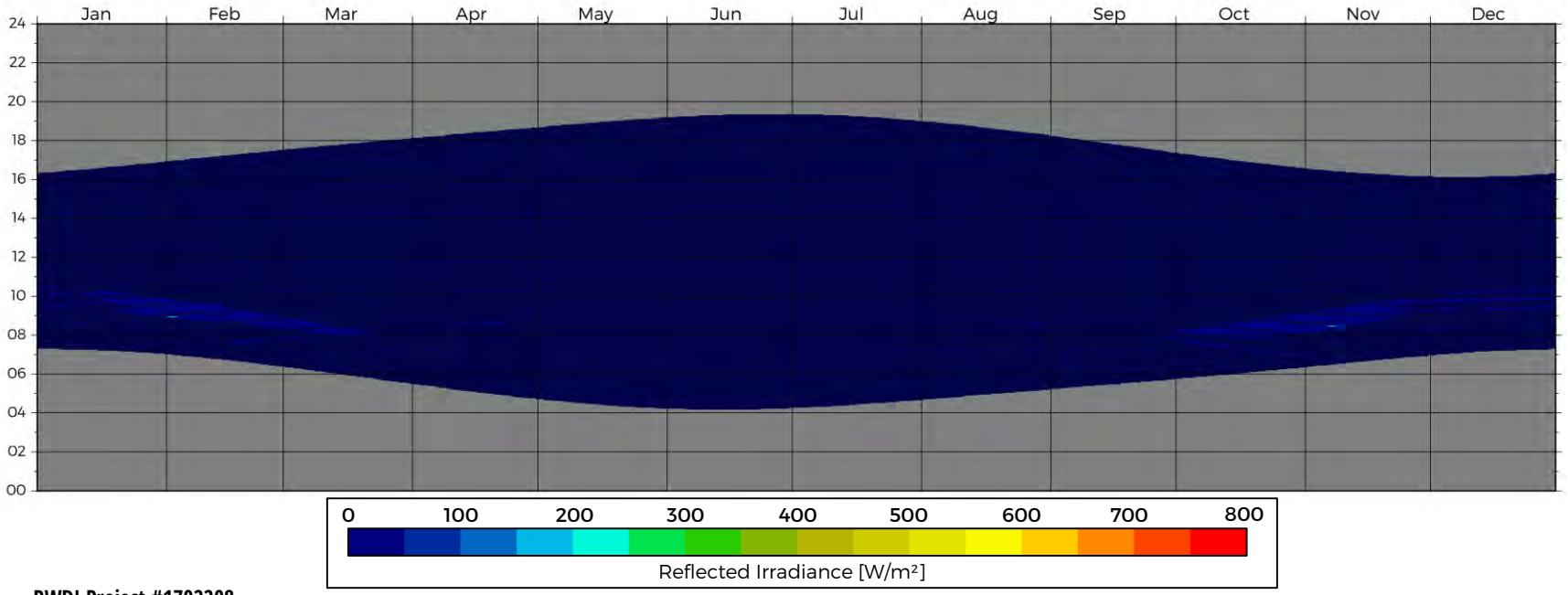
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F18

Receptor F18 was chosen to assess the thermal impact associated with solar reflections impacting the windows on the northwest facade of 180 Brookline Avenue.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



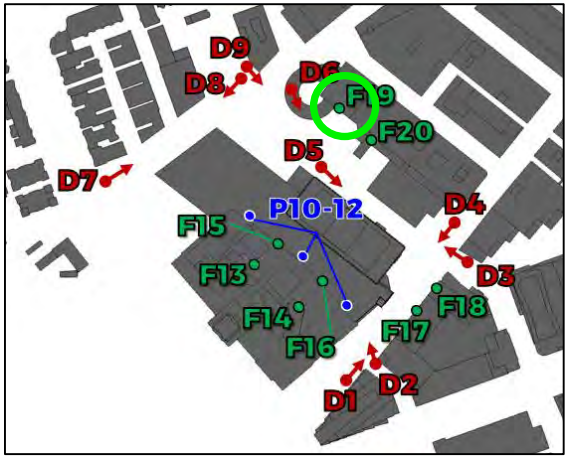


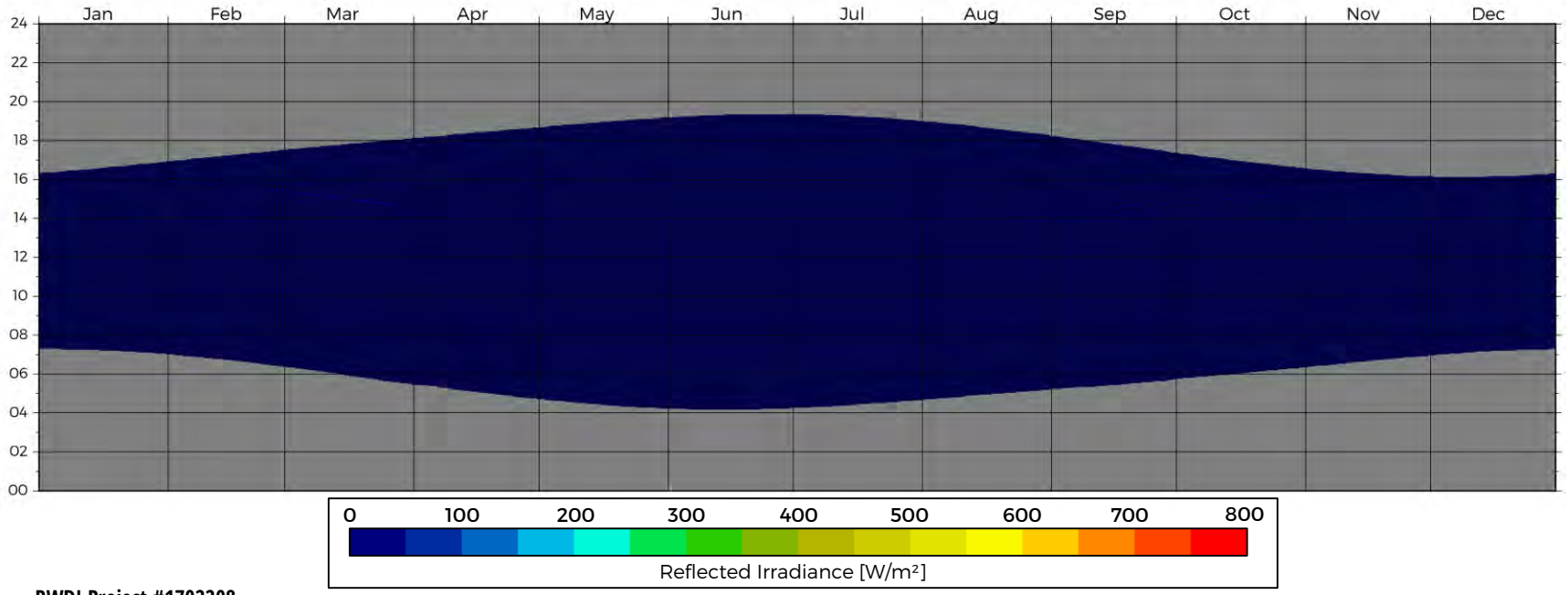
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F19

Receptor F19 was chosen to assess the thermal impact associated with solar reflections impacting the windows on the southwest facade of the Harvard Vanguard Medical Associates Building.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.



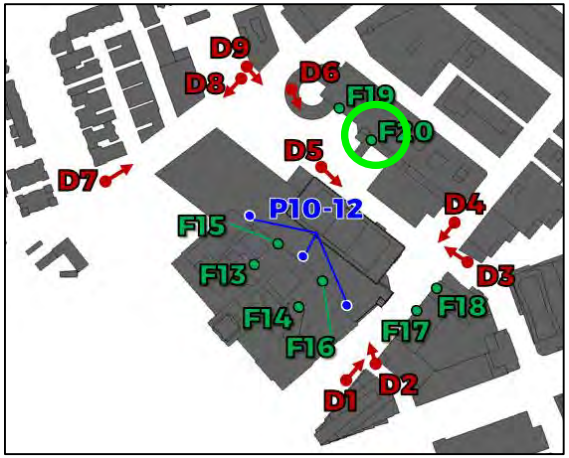


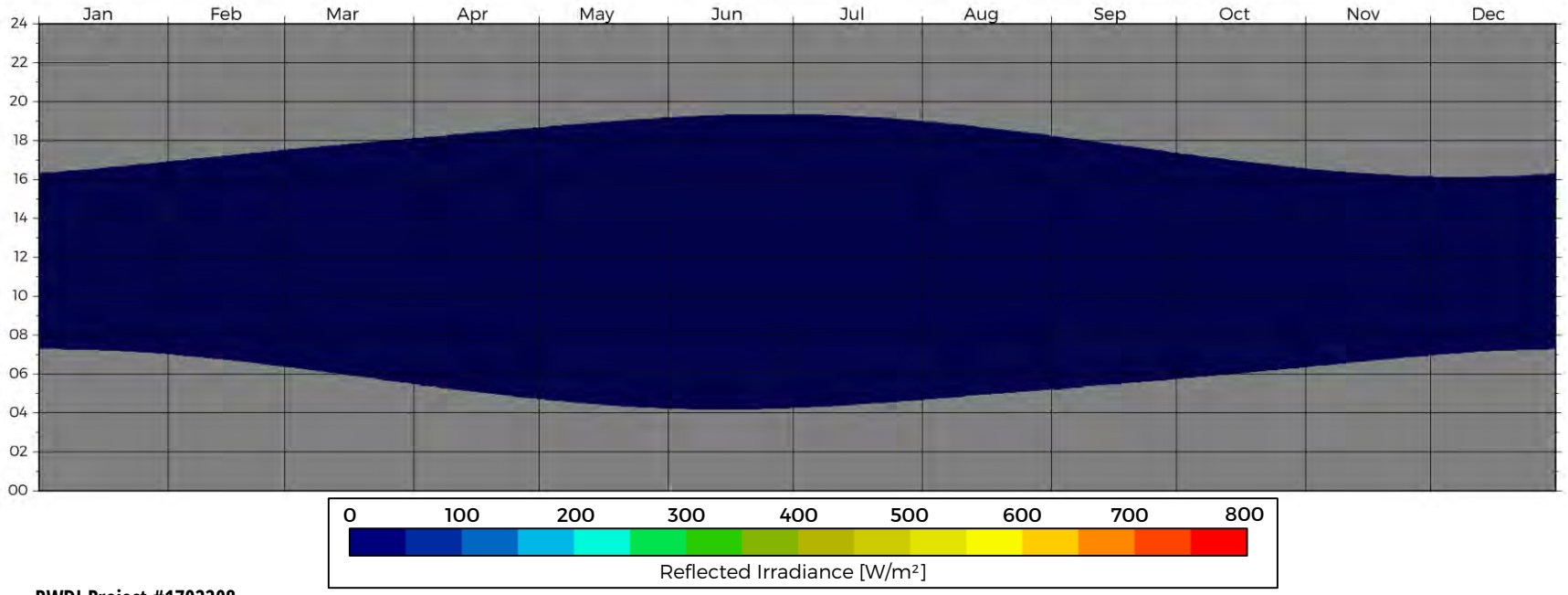
ANNUAL THERMAL IMPACT - FACADE

Facade Receptor F20

Receptor F20 was chosen to assess the thermal impact associated with solar reflections impacting the windows on the southwest facade of the Harvard Vanguard Medical Associates Building.

Please note that the referenced times are in local standard time, so in jurisdictions where Daylight Savings Time is used, the time should be shifted by an hour when appropriate.





APPENDIX B

RWDI REFLECTION CRITERIA

Visual Glare

There are currently no existing criteria or standards that define an "acceptable" level of reflected solar radiation from buildings. RWDI has conducted a literature review of available scientific sources[1] to determine levels of solar radiation that could be considered acceptable to individuals from a visual standpoint.

Many glare metrics are designed for interior use and have been found to not correlate well with the glare impact humans perceive from direct sun or in outdoor environments. RWDI uses the methodology of Ho et al[2], which defines glare impact based on a physical reaction rather than on a preference based correlation.

Based on the intensity of the glare source and the size of the source in the field of view (Figure A1), the risk of that source causing temporary flash blindness (i.e. the after images visible after one is exposed to a camera flash in a dark room) can be determined.

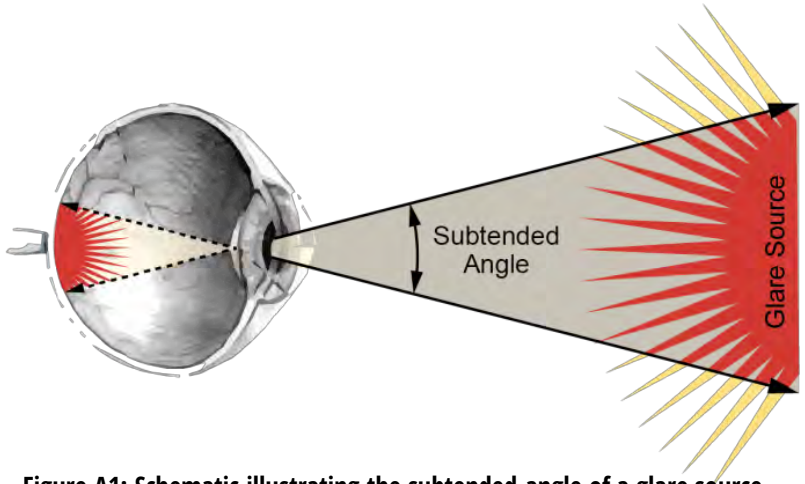


Figure A1: Schematic illustrating the subtended angle of a glare source

Visual Glare (cont'd)

At the screening level, we conservatively take any reflections at least 50% of the intensity required to cause after images as a "significant" reflection to be counted in the frequency analysis. In the detailed phase of work, we use the typical threshold level.

As a reference, point 1 on Figure A2 on the right illustrates where looking directly at the sun falls in terms of irradiance on the retina (on average about $8x10^4$ W/m^2), and the size of the angle that the sun subtends in the sky (about 9.8 milliradians). This puts it just at the border of causing serious damage. This methodology assumes that the exposure time is equivalent to the length of an average person's blink response.

The rest of the points in Figure A2 correspond to the following:

2. Direct viewing of high-intensity car headlamp from 50 ft
3. Direct viewing of typical camera flash from 7 ft
4. Direct viewing of high-intensity car headlamp from 5 ft
5. Direct viewing of frosted 60W light bulb from 5 ft
6. Direct viewing of average computer monitor from 2ft

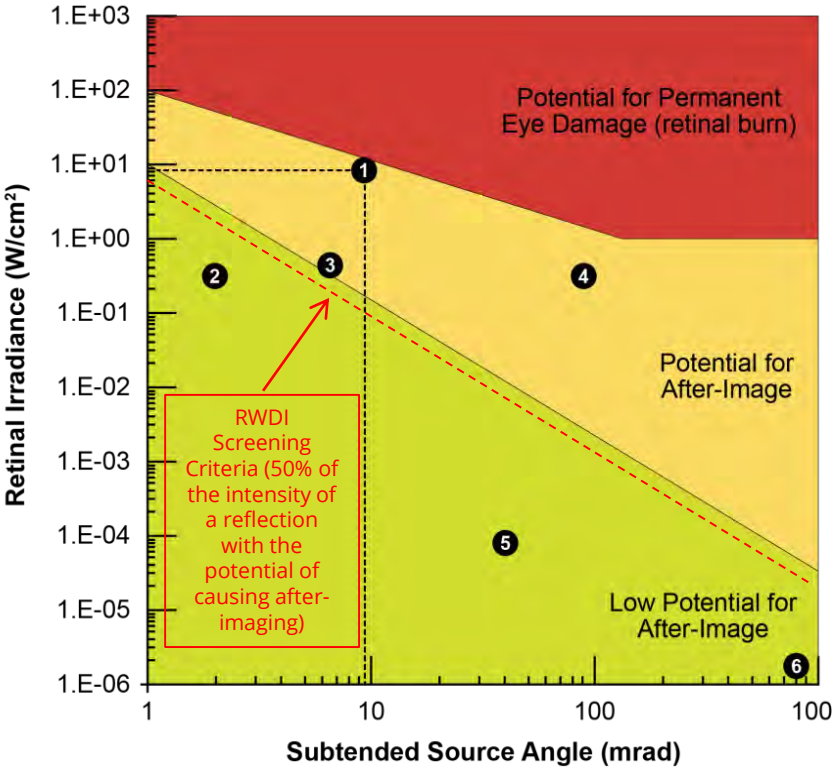


Figure A2: Plot showing the potential for glare sources of various sizes and intensities to cause after imaging

Thermal Impact (Heat Gain) on People

The primary sources for exposure limits to thermal radiation come from fire protection literature. The U.S. National Fire Protection Association (NFPA) defines 2,500 W/m² as an upper limit for a tenable egress environment[3]. That being said, while an individual could move through such an environment, they would not necessarily emerge unscathed. Both the British Standards Institution[4] and the U.S. Federal Energy Management Agency[5] indicate that individuals are likely to feel pain within 30 seconds at such exposure levels on bare skin. With second degree burns possible within minutes of exposure. Additionally, this level of additional heat flux can lead to rapid heating of exposed objects which could present a further risk to human safety.

It should be noted that these numbers are guideline values only, and that in reality many factors (skin color, age, clothing choice, etc.) influence how a person reacts to thermal radiation. **For our work RWDI has established 2,500 W/m² as a ceiling exposure limit which reflection intensity should not exceed for any length of time.**

Lower reflection intensities, while not posing as serious of a risk to human safety, can still negatively impact human comfort. There are no definitive guidelines or criteria with respect to this issue. We know this criterion should be less than 2,500 W/m² and greater than typical peak solar noon levels of 1,000 W/m² which people commonly experience. RWDI's opinion at this time is that a reasonable criterion is to limit reflected irradiance exposure to 1,500 W/m² or less. Based on our assessment, we believe at this level of irradiance most people would be able to tolerate it for several minutes before the onset of discomfort. Additionally reflections at this intensity level will heat surfaces more slowly.

Thus we feel reflections below 1,500 W/m² pose a reduced risk to people and should therefore be considered a short term exposure limit. We would conservatively define "short term" as 10 minutes or less which is slightly shorter than the standard 15 minute definition of short term used in the occupational safety context.

Thermal Impact (Heat Gain) on Property

The impact of solar irradiance on different materials is primarily based on the temperature gains to the material which can cause softening, deformation, melting, or in extreme cases, combustion. These temperature gains are difficult to predict as they are highly dependent on the convective heat transfer from air movement around the object and long-wave radiative heat transfer to the surroundings.

Generally, irradiance levels at or above 10,000 W/m² for more than 10 minutes are required to ignite common building and automotive materials in the presence of a pilot flame. That value increases to 25,000 W/m² when no pilot flame is present[6,7,8.] However, some materials like plastics and even some asphalts may begin to soften and deform at lower temperatures. For example, some plastics can deform at a temperature of 140°F (60°C), or lower if force is applied. The applied force typically comes from the thermal expansion of the material, the force of gravity acting on the material or an external mechanical force (i.e. someone or something pushing or pulling on it).

NASA[9] defines an upper limit of 111°F (44°C) for surfaces that require extended contact time with bare skin. Surface temperatures below this limit can be handled for any length of time without causing pain.

Because of the difficult nature of determining material temperatures, RWDI takes a conservative approach and uses a **threshold value of 1,000 W/m² which is approximately the peak intensity of natural sunlight that could be expected to occur over the course of a year**. Intensities beyond this value exceed the levels of irradiance that common exterior building materials are presumably designed for, and depending on the duration, may lead to deformation or damage. Though, as noted this would depend heavily on environmental conditions and the material properties of the exposed object or assembly.

References

1. Danks, R., Good, J., & Sinclair, R., “Assessing reflected sunlight from building facades: A literature review and proposed criteria.” Building and Environment, 103, 193-202, 2016.

2. Ho, C., Ghanbari, C. and Diver, R., "Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation," *J. Sol. Energy Eng.,* vol. 133, no. 3, 2011.

3. National Fire Protection Association. (2003). NFPA 130: standard for fixed guideway transit and passenger rail systems. NFPA.

4. The application of fire safety engineering principles to fire safety design of buildings – Part 6: Human Factors’ PD 7974-6:2004, British Standards Institution 2004.

5. Federal Emergency Management Agency, U.S. Department of Transportation, and U.S. Environmental Protection Agency. 1988. Handbook of Chemical Hazard Analysis Procedures. Washington, D.C.: Federal Emergency Management Agency Publications Office.

6. Building Research Establishment: ‘Fire spread in car parks’ BD2552, Department of Communities and Local Government 2010

7. SFPE Handbook of Fire Protection Engineering 4th Edition NFPA/SPFE 2008 USA

8. V. Babrauskas ‘Ignition Handbook’ Fire Science Publishers + SFP , 2003

9. E Ungar, K Stroud ‘A New Approach to Defining Human Touch Temperature Standards’ National Aeronautics and Space Agency , 2010

Appendix C – Energy Analysis Supporting Documentation

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ENERGY MODELING ANALYSIS

PROJECT NAME: 201 Brookline Ave (Landmark R&D Building)

PROJECT NUMBER: B1708024.000

DATE: June 23, 2017

The purpose of this memo is to present the modeled energy performance of 201 Brookline Ave with respect to the Massachusetts Stretch Energy code. Energy modeling has been performed using eQUEST v3.65 energy simulation software.

The project will consist of a new office and lab building located in Boston, MA. It will be a 14-story tower with a gross floor area of approximately 483,900 square feet, consisting of lab, office, and retail.

To comply with the minimum energy requirements of the Massachusetts Stretch Energy code, the design must achieve at least 10% energy savings relative to ASHRAE 90.1-2013 Appendix G. The results are based on the most current available design documentation as of 6/15/2017. As the design is in progress, these results are subject to change until the final models are complete at the 100% CD phase.

The design achieves a 10.4% site energy reduction relative to ASHRAE 90.1-2013 and meets the MA Stretch Code[1]. The results are summarized in the table below.

Table 1: Annual Energy Consumption and Cost

Proposed Design	Annual Energy Use (MMBtu)	Annual Energy Cost ($)	EUI (kBtu/SF)	Site Energy Savings vs ASHRAE 90.1-2013
Baseline (ASHRAE 90.1-2013)	55,620	$1,651,938	**114.9**	-
Proposed Design	49,792	$1,541,989	**102.9**	**10.4%**

[1] Energy Modeling Intent and Limitations: The energy modeling process is intended to provide a comparison of annual energy use and cost among multiple designs. These results are not predictive of actual utility bills. Actual energy use may differ from the simulation results due to variations in occupancy, controls and maintenance, weather, changes in energy rates, and the general precision of the simulation program.

WSP USA
88 Black Falcon Avenue, Suite 210
Boston, MA 02210

Tel.: +1 617 210-1600
Fax.: +1 617 210-1800
wsp.com

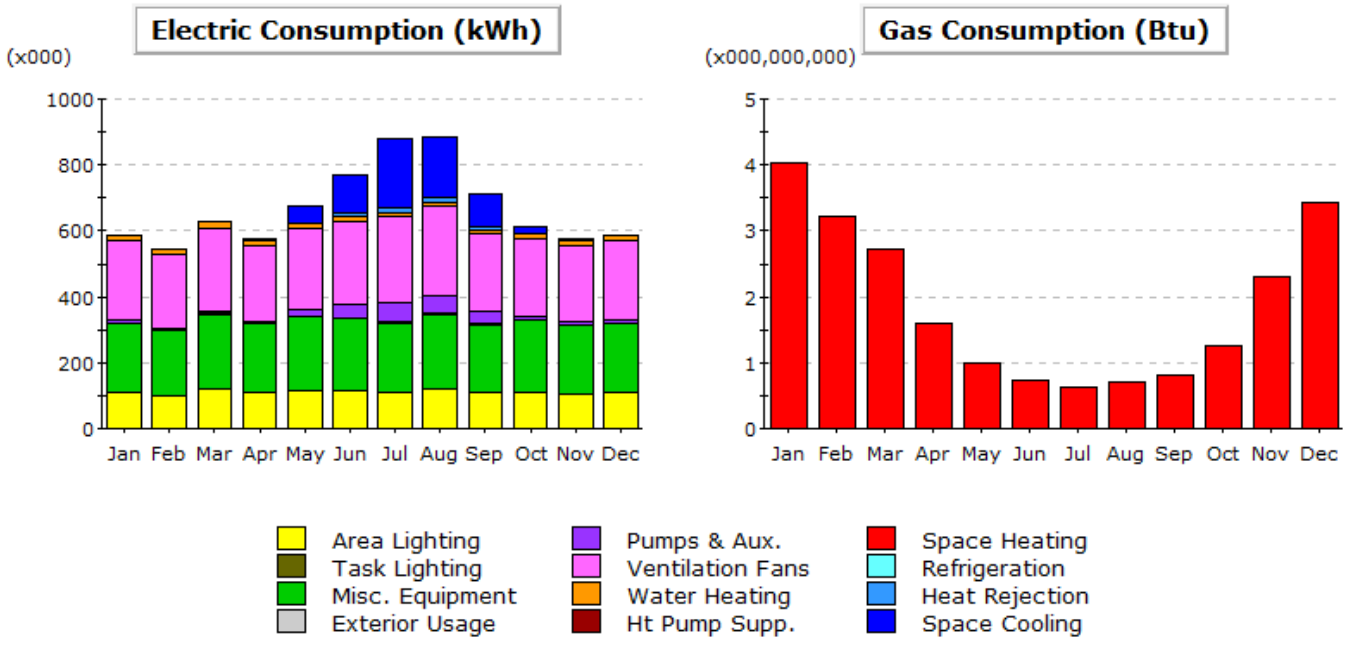
ENERGY MODEL SUMMARY OF INPUT ASSUMPTIONS

Summary of Assumptions	ASHRAE 90.1-2013 Baseline	Design
General Building Information		
Space use type	Office = 385,998 SF Lab = 79,992 SF	Office = 385,998 SF Lab = 79,992 SF
Conditioned Square Feet	483,990 SF	483,990 SF
Operating Schedule (HVAC Fans)	OFFICE: M-F: 7am-6pm ; Sat: None; Sun: None LAB: 24/7/365	OFFICE: M-F: 7am-6pm ; Sat: None; Sun: None LAB: 24/7/365
Temperature Setpoints	OFFICE: Cooling - Occupied : 75°F, Unoccupied : 82°F Heating - Occupied : 70°F, Unoccupied : 64°F LAB: Cooling - Occupied : 75°F, Unoccupied : 77°F Heating - Occupied : 70°F, Unoccupied : 68°F	OFFICE: Cooling - Occupied : 75°F, Unoccupied : 82°F Heating - Occupied : 70°F, Unoccupied : 64°F LAB: Cooling - Occupied : 75°F, Unoccupied : 77°F Heating - Occupied : 70°F, Unoccupied : 68°F
Building Envelope (Construction Assemblies)		
Roofs	R30ci Insulation Entirely Above Deck (U-0.032)	R30ci Insulation Entirely Above Deck (U-0.032)
Walls	Steel Framed R-18 (U-0.055)	Steel Framed R-18 (U-0.055)
Fenestration and Shading		
Vertical fenestration area (of Wall area)	Office = 40% maximum	North Elevation: 71% South Elevation: 76% East Elevation: 71% West Elevation: 71%
Vertical Glazing U-factor	Fixed = U-0.42	0.36
Vertical Glazing SHGC	0.4	0.39
HVAC (Air-side)		
HVAC System Type	System #7: VAV Rooftop Unit With HW Reheat - System per Floor	OFFICE: VAV Air Handling Units with hot water and chilled water, enthalpy recovery wheel, 288,700 CFM LAB: VAV Air Handling Units with hot water and chilled water, glycol heat recovery loop, 217,000 CFM
Unitary Efficiency	HW Unit Heaters serving mechanical room/penthouse System #3 Packaged Single Zone DX w/Gas furnace - serving Retail	HW Unit Heaters serving mechanical room/penthouse System #3 Packaged Single Zone DX w/Gas furnace - serving Retail
Fan System Operation	On continuously during occupied hours. Cycled to meet load during unoccupied hours.	On continuously during occupied hours. Cycled to meet load during unoccupied hours.
Outdoor Air Design Min. Ventilation	LAB = 288,700 CFM (Occupied), 144,350 CFM (unoccupied) Office = 65,100 CFM (Occupied), 0 CFM (unoccupied)	LAB = 288,700 CFM (Occupied), 144,350 CFM (unoccupied) Office = 65,100 CFM (Occupied), 0 CFM (unoccupied)
Economizer High-Limit Shutoff	System #7: Outdoor Air Temperature with 70°F shutoff limit	System #7: Dual Enthalpy Economizer
Design Airflow Rates (Conditioned Spaces)	Auto sized based on 20F supply air to room air delta-T	Auto sized based on 20F supply air to room air delta-T

Minimum Supply Flow	Per ASHRAE 90.1-2013 Section G3.1.3.13 OFFICE VAV - 30% Turndown Ratio LAB VAV - 50% Min Flow during unoccupied hours	Per ASHRAE 90.1-2013 Section G3.1.3.13 OFFICE VAV - 30% Turndown Ratio LAB VAV - 50% Min Flow during unoccupied hours
Total System Fan Power (Conditioned)	Per ASHRAE 90.1-2013 G3.1.2.9 Office: 0.0015 kW/CFM supply+exhaust Lab: 0.0015 kW/CFM supply, 0.0007 kW/CFM exhaust	Per ASHRAE 90.1-2013 G3.1.2.9 Office: 0.0015 kW/CFM supply+exhaust Lab: 0.0015 kW/CFM supply, 0.0007 kW/CFM exhaust
Pressure Drop Adjustments	-Particulate filtration Credit MERV 13 -Fully ducted return -Sound Attenuation -ERV in applicable systems	-Particulate filtration Credit MERV 13 -Fully ducted return -Sound Attenuation -ERV in applicable systems
Exhaust Air Energy Recovery	OFFICE: 50% effective enthalpy wheel on VAV Systems as required by ASHRAE 90.1-2013 Table 6.5.6.1 LAB: 50% effective sensible HX	OFFICE: 70% effective enthalpy wheel on VAV Systems LAB: 50% effective sensible HX
Supply Air Temperature Reset Parameters	Load Reset on VAV systems from 55F-60F	Load Reset on VAV systems from 55F-60F
HVAC (Water-side)		
Number of Chillers	3	4
Chiller Part-Load Controls	No VSD	VFD on all chillers
Chiller Capacity (Per Chiller)	>600 Tons	(2) magnetic bearing water-cooled centrifugal chillers @ 700 tons (1) water-cooled screw chiller @ 140 tons
Chiller Efficiency	0.56 kW/ton (full load)	0.58 kW/ton - 700-ton chiller 0.75 kW/ton - 140-ton chiller
Chilled Water Loop Supply Temperature	44	42
Chilled Water (CHW) Loop Delta-T	12	12
CHW Loop Temp Reset Parameters	54F @ 60F OA, 44F @ 80F OA	48F @ 60F OA, 42F @ 80F OA
CHW Loop Configuration	Primary/Secondary	Variable Primary
Number of Primary CHW Pumps	1 per chiller	2
Primary CHW Pump Power	11 W/GPM	22 W/GPM
Primary CHW Pump Speed Control	Variable Speed	Variable Speed
Secondary CHW Pump Power	11 W/GPM	N/A
Secondary CHW Pump Speed Control	Variable Speed	N/A
Number of Cooling Towers / Fluid Coolers	1	2
Cooling Tower Fan Control	Variable Speed	Variable Speed
Condenser Water Leaving Temperature	85	85
Condenser Water (CW) Loop Delta-T	10	10
CW Loop Temp Reset Parameters	Maintain 70°F when weather permits, floating up to leaving water temperature at design conditions	Maintain 70°F when weather permits, floating up to leaving water temperature at design conditions
CW Loop Configuration	Primary Only	Primary Only
Number of CW Pumps	1 per chiller	1 per chiller
CW Pump Power	19 W/GPM	19 W/GPM
CW Pump Speed Control	One Speed	One Speed
Water-side Economizer for Free Cooling	No	No
Number of Boilers	2	3 Condensing Boilers @ 6,000 MBH each
Boiler Part-Load Controls	Staged	Staged
Boiler Capacity (Per Boiler)	N/A	N/A
Boiler Efficiency	82% Natural Draft	95% Condensing
Boiler Water Loop Supply Temperature	180°F	140°F
Hot Water or Steam (HW) Loop Delta-T	50°F	20°F

HW Loop Reset Parameters	150°F @ 50°F OA, 180°F @ 20°F OA	110°F @ 60°F OA, 140 @ 20°F OA
Number of Primary HW Pumps	1	2
Primary HW Pump Power	19W/GPM	19W/GPM
Primary HW Pump Speed Control	Variable Speed	Variable Speed
Domestic Water Heating		
DHW Equipment Type	Electric Resistance Storage Water Heater	Electric Resistance Storage Water Heater
Equipment Efficiency	Energy Factor = 0.963 per ASHRAE 90.1-2013 Table 7.8	Energy Factor = 0.963 per ASHRAE 90.1-2013 Table 7.8
Temperature Controls	120°F Constant	120°F Constant
DHW Flow	Standard Flow Fixtures	Standard Flow Fixtures
Lighting		
Automatic Lighting Shutoff Method	Scheduled off during unoccupied hours	Scheduled off during unoccupied hours
Gross Lighted Floor Area	483,990 SF	483,990 SF
Interior Lighting Power Calc Method	Building Area	Building Area
Interior LPD by Building Area (W/SF)	Loading Dock: 0.47 Electrical/Mechanical: 0.42 Enclosed Office: 1.11 Office/Lab: 1.48 Open Office: 0.98 Corridor: 0.66 Elevator: 0.64 Lobby: 0.9 Restroom: 0.98 Retail: 1.68	20% Reduction in all spaces
Miscellaneous		
Receptacle Equipment	Office = 1.00 W/sf Lab = 5.00 W/sf (average operating)	Office = 1.00 W/sf Lab = 5.00 W/sf (average operating)
Escalators and Elevators	Average load = 75 kW per building	Average load = 75 kW per building
Utility Rates		
Electricity	$0.16/kWh	$0.16/kWh
Natural Gas	$1.15/therm	$1.15/therm

PROPOSED ENERGY MODEL OUTPUT



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.2	0.3	1.2	6.3	48.6	118.2	213.0	182.6	99.1	19.5	4.6	1.4	694.9
Heat Reject.	-	-	0.0	0.3	2.8	8.0	14.7	12.9	7.2	0.7	0.3	0.0	46.9
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	15.3	14.9	17.7	15.7	15.6	14.3	12.5	13.2	11.9	12.8	13.2	14.5	171.5
Vent. Fans	245.4	224.8	254.1	228.7	244.9	255.1	259.7	270.8	237.6	235.0	232.5	242.8	2,931.3
Pumps & Aux.	6.8	5.8	6.0	6.6	22.1	40.1	59.9	53.9	36.4	12.7	6.7	6.9	263.8
Ext. Usage	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	13.1
Misc. Equip.	211.7	196.6	228.4	209.1	222.8	219.7	212.3	228.4	209.1	217.3	208.5	212.3	2,576.3
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	108.0	101.4	119.5	107.7	115.7	114.7	108.6	119.5	107.6	111.9	107.0	108.6	1,330.0
Total	588.5	544.9	628.0	575.4	673.5	771.1	881.8	882.3	710.0	611.0	573.9	587.6	8,028.0

Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	4.02	3.23	2.73	1.59	0.99	0.74	0.62	0.70	0.81	1.25	2.29	3.42	22.39
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	4.02	3.23	2.73	1.59	0.99	0.74	0.62	0.70	0.81	1.25	2.29	3.42	22.39

PROPOSED BEPS OUTPUT

REPORT- BEPS Building Energy Performance WEATHER FILE- Boston MA TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	4539.0	0.0	8793.0	0.0	2372.0	160.0	900.4	10000.0	0.0	0.0	585.4	44.8	27399.0
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	22390.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22393.0
MBTU	4539.0	0.0	8793.0	22390.0	2372.0	160.0	900.4	10000.0	0.0	0.0	585.4	44.8	49792.0

TOTAL SITE ENERGY 49791.80 MBTU 102.9 KBTU/SQFT-YR GROSS-AREA 102.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 104590.00 MBTU 216.1 KBTU/SQFT-YR GROSS-AREA 216.1 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.35
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 15
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 16

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

PROPOSED BEPU OUTPUT

REPORT- BEPU Building Utility Performance WEATHER FILE- Boston MA TMY2

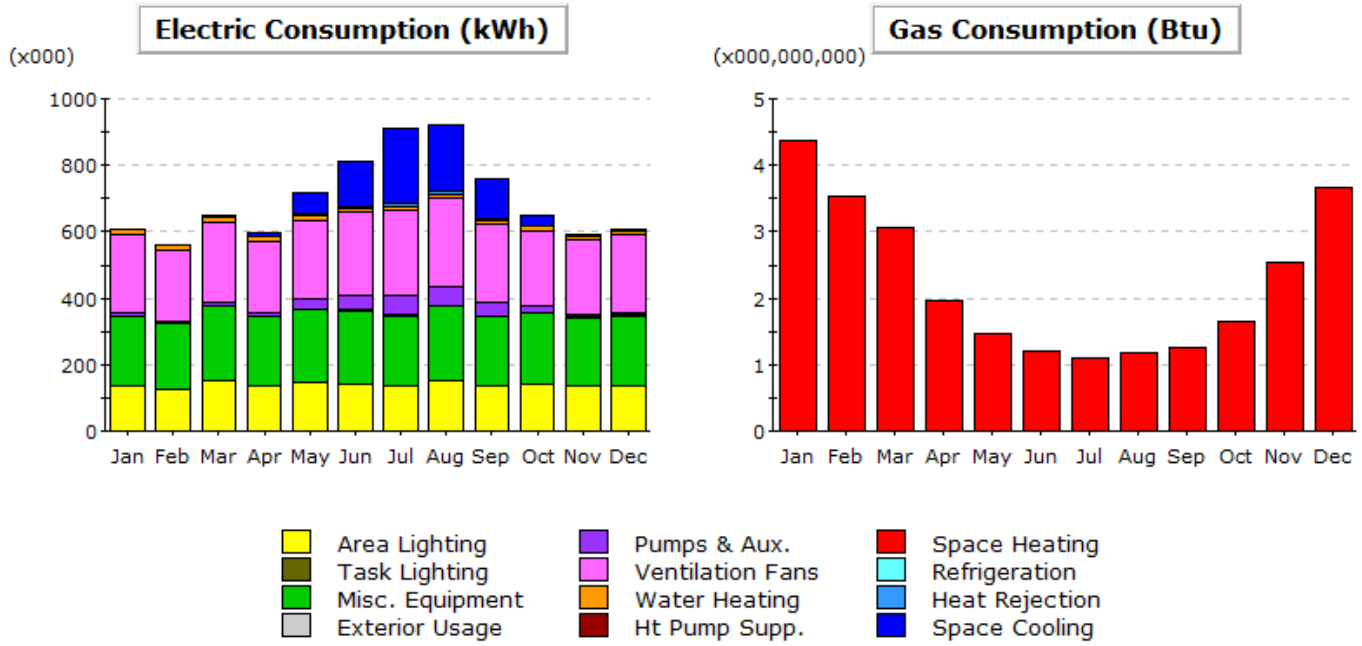
	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	1330010.	0.	2576344.	0.	694937.	46875.	263804.	2931329.	0.	0.	171521.	13140.	8027960.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	223926.	0.	0.	0.	0.	0.	0.	0.	0.	223926.

TOTAL ELECTRICITY	8027960. KWH	16.587 KWH	/SQFT-YR GROSS-AREA	16.587 KWH	/SQFT-YR NET-AREA
TOTAL NATURAL-GAS	223926. THERM	0.463 THERM	/SQFT-YR GROSS-AREA	0.463 THERM	/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.35
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 15
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 16

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

BASELINE ENERGY MODEL OUTPUT



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.2	0.3	1.8	8.2	63.2	136.1	224.6	198.3	122.5	30.9	6.2	2.6	794.9
Heat Reject.	-	-	-	0.1	1.7	5.3	12.0	9.2	4.4	0.4	0.2	0.0	33.2
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	15.3	14.9	17.7	15.7	15.6	14.3	12.5	13.2	11.9	12.8	13.2	14.5	171.5
Vent. Fans	236.2	214.2	241.5	217.3	237.7	248.1	254.8	265.4	232.6	226.6	221.0	231.2	2,826.4
Pumps & Aux.	8.1	7.3	8.4	9.4	29.1	45.7	59.8	56.4	43.7	19.5	9.1	9.0	305.4
Ext. Usage	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	13.1
Misc. Equip.	211.7	196.6	228.4	209.1	222.8	219.7	212.3	228.4	209.1	217.3	208.5	212.3	2,576.3
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	135.0	126.7	149.4	134.6	144.6	143.4	135.8	149.4	134.5	139.8	133.8	135.7	1,662.5
Total	607.6	560.9	648.2	595.5	715.9	813.6	912.8	921.4	759.6	648.4	593.0	606.5	8,383.4

Gas Consumption (Btu x000,000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	4.37	3.54	3.06	1.95	1.47	1.21	1.10	1.19	1.26	1.66	2.54	3.67	27.01
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	4.37	3.54	3.06	1.95	1.47	1.21	1.10	1.19	1.26	1.66	2.54	3.67	27.01

BASELINE BEPS OUTPUT

REPORT- BEPS Building Energy Performance WEATHER FILE- Boston MA TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
MBTU	5674.0	0.0	8793.0	0.0	2713.0	113.4	1042.0	9647.0	0.0	0.0	585.2	44.8	28612.0
FM1 NATURAL-GAS													
MBTU	0.0	0.0	0.0	27010.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27008.0
MBTU	5674.0	0.0	8793.0	27010.0	2713.0	113.4	1042.0	9647.0	0.0	0.0	585.2	44.8	55620.0

TOTAL SITE ENERGY 55620.10 MBTU 114.9 KBTU/SQFT-YR GROSS-AREA 114.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 112845.00 MBTU 233.2 KBTU/SQFT-YR GROSS-AREA 233.2 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.28
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 15
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 97

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

BASELINE BEPU OUTPUT

REPORT- BEPU Building Utility Performance WEATHER FILE- Boston MA TMY2

	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1 ELECTRICITY													
KWH	1662514.	0.	2576344.	0.	794945.	33238.	305372.	2826434.	0.	0.	171455.	13140.	8383440.
FM1 NATURAL-GAS													
THERM	0.	0.	0.	270076.	0.	0.	0.	0.	0.	0.	0.	0.	270076.

TOTAL ELECTRICITY	8383440. KWH	17.322 KWH	/SQFT-YR GROSS-AREA	17.322 KWH	/SQFT-YR NET-AREA
TOTAL NATURAL-GAS	270076. THERM	0.558 THERM	/SQFT-YR GROSS-AREA	0.558 THERM	/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.28
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 15
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 97

NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.

Appendix D – BPDA Checklists

- Accessibility Checklist
- Climate Change Resiliency and Preparedness Checklist

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Accessibility Checklist

(to be added to the BRA Development Review Guidelines)

In 2009, a nine-member Advisory Board was appointed to the Commission for Persons with Disabilities in an effort to reduce architectural, procedural, attitudinal, and communication barriers affecting persons with disabilities in the City of Boston. These efforts were instituted to work toward creating universal access in the built environment.

In line with these priorities, the Accessibility Checklist aims to support the inclusion of people with disabilities. In order to complete the Checklist, you must provide specific detail, including descriptions, diagrams and data, of the universal access elements that will ensure all individuals have an equal experience that includes full participation in the built environment throughout the proposed buildings and open space.

In conformance with this directive, all development projects subject to Boston Zoning Article 80 Small and Large Project Review, including all Institutional Master Plan modifications and updates, are to complete the following checklist and provide any necessary responses regarding the following:

- improvements for pedestrian and vehicular circulation and access;
- encourage new buildings and public spaces to be designed to enhance and preserve Boston's system of parks, squares, walkways, and active shopping streets;
- ensure that persons with disabilities have full access to buildings open to the public;
- afford such persons the educational, employment, and recreational opportunities available to all citizens; and
- preserve and increase the supply of living space accessible to persons with disabilities.

We would like to thank you in advance for your time and effort in advancing best practices and progressive approaches to expand accessibility throughout Boston's built environment.

Accessibility Analysis Information Sources:

1. Americans with Disabilities Act – 2010 ADA Standards for Accessible Design
    a. http://www.ada.gov/2010ADAstandards_index.htm
2. Massachusetts Architectural Access Board 521 CMR
    a. http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/aab/aab-rules-and-regulations-pdf.html
3. Boston Complete Street Guidelines
    a. http://bostoncompletestreets.org/
4. City of Boston Mayors Commission for Persons with Disabilities Advisory Board
    a. http://www.cityofboston.gov/Disability
5. City of Boston – Public Works Sidewalk Reconstruction Policy
    a. http://www.cityofboston.gov/images_documents/sidewalk%20policy%200114_tcm3-41668.pdf
6. Massachusetts Office On Disability Accessible Parking Requirements
    a. www.mass.gov/anf/docs/mod/hp-parking-regulations-mod.doc
7. MBTA Fixed Route Accessible Transit Stations
    a. http://www.mbta.com/about_the_mbta/accessibility/

Article 80 | ACCESSIBILTY CHECKLIST

Project Information

Project Name:	Landmark Center Redevelopment
Project Address Primary:	201 Brookline Avenue
Project Address Additional:	
Project Contact (name / Title / Company / email / phone):	Abe Menzin / Senior Vice President Development / Samuels & Associates / amenzin@samuelsre.com / 617-247-3434

Team Description

Owner / Developer:	Fenway Enterprises LLC, A Samuels & Associates entity
Architect:	Elkus Manfredi Architects
Engineer (building systems):	WSP
Sustainability / LEED:	The Green Engineer, Inc.
Permitting:	VHB
Construction Management:	Suffolk Construction

Project Permitting and Phase

At what phase is the project – at time of this questionnaire?

PNF / Expanded PNF Submitted	**Conceptual Design – Pre BCDC and BPDA design review**	
		:

Building Classification and Description

What are the principal Building Uses - select all appropriate uses?

Residential – One to Three Unit	Residential - Multi-unit, Four +	Institutional	Education
Commercial	**Office**	**Retail**	Assembly
Laboratory / Medical	Manufacturing / Industrial	Mercantile	**Storage, Utility and Other**
First Floor Uses (List)	***Retail and Building Services***		

What is the Construction Type – select most appropriate type?

Wood Frame	Masonry	**Steel Frame**	**Concrete**

Describe the building?

Site Area:	*383,079 SF*	Building Area:	*506,000 SF*
Building Height:	*208' 6" Ft.*	Number of Stories:	*14 Flrs.*
First Floor Elevation:	*16 -6" Elev.*	Are there below grade spaces:	***Yes** / No*

Assessment of Existing Infrastructure for Accessibility:

This section explores the proximity to accessible transit lines and proximate institutions such as, but not limited to hospitals, elderly and disabled housing, and general neighborhood information. The proponent should identify how the area surrounding the development is accessible for people with mobility impairments and should analyze the existing condition of the accessible routes through sidewalk and pedestrian ramp reports.

Provide a description of the development neighborhood and identifying characteristics.	The Fenway neighborhood is a diverse urban neighborhood with great residential neighborhoods, retail amenities, institutions of higher learning and a rich supply of public open space and cultural institutions.
List the surrounding ADA compliant MBTA transit lines and the proximity to the development site: Commuter rail, subway, bus, etc.	**ADA compliant transit lines** Commuter Rail: • Framingham/Worcester Line (Yawkey Station): 0.3 miles Light Rail: • B Line (Kenmore Station): 0.4 miles • D Line (Fenway Station): 0.2 miles • C Line (Saint Mary's Street): 0.4 miles Bus: • 47, 57, CT2 (Fenway Station): 0.2 miles • 8, 9, 19, 60, 65 (Brookline Ave): 82' • 55 (Boylston Street): 0.2 miles
List the surrounding institutions: hospitals, public housing and elderly and disabled housing developments, educational facilities, etc.	Hospitals: • Beth Israel Deaconess Medical Center: 0.4 miles • Boston Children's Hospital: 0.7 miles • Brigham & Women's Hospital: 0.7 miles • Mass General Hospital Back Bay: 0.7 miles Public, elderly, and disabled housing: • West Fenway Apartments: 0.2 miles • St. Cecilia's House: 0.3 miles • West Fenway Elderly Housing: 0.2 miles • Peterborough Senior Center: 0.3 miles Educational Facilities: • Boston University: 0.5 miles • Harvard Medical School: 0.3 miles • Emmanuel College: 0.4 miles • Wheelock College: 0.4 miles • Simmons College: 0.5 miles • Berklee College of Music: 0.7 miles • Massachusetts College of Art and Design: 0.8 miles • Bright Horizons: 0.8 miles • Northeastern University: 1.1 miles • Wentworth Institute of Technology: 1.2 miles
Is the proposed development on a priority accessible route to a	Libraries: • The Mary Baker Eddy Library: 1.0 mile

key public use facility? List the surrounding: government buildings, libraries, community centers and recreational facilities and other related facilities.	• Parker Hill Branch of the Boston Public Library: 1.1 miles • Coolidge Corner Branch Library: 1.2 miles Community Centers: • Fenway Community Center: 0.2 miles • Tobin Community Center: 1.5 miles • Fenway Community Development Corporation: 1.6 miles Museums: • Isabella Stewart Gardner Museum: 0.6 miles • Museum of Fine Arts: 0.7 miles Recreational Facilities: • BCYF Recreation Center at Madison Park: 1.4 miles • Brookline Quest: 1.4 miles

Surrounding Site Conditions – Existing:

This section identifies the current condition of the sidewalks and pedestrian ramps around the development site.

Are there sidewalks and pedestrian ramps existing at the development site?	Yes
If yes above, list the existing sidewalk and pedestrian ramp materials and physical condition at the development site.	The Project includes replacement of all adjacent sidewalks. Sidewalks are anticipated to be concrete per City Standards.
Are the sidewalks and pedestrian ramps existing-to-remain? **If yes,** have the sidewalks and pedestrian ramps been verified as compliant? **If yes,** please provide surveyors report.	No
Is the development site within a historic district? **If yes,** please identify.	No

Surrounding Site Conditions – Proposed

This section identifies the proposed condition of the walkways and pedestrian ramps in and around the development site. The width of the sidewalk contributes to the degree of comfort and enjoyment of walking along a street. Narrow sidewalks do not support lively pedestrian activity, and may create dangerous conditions that force people to walk in the street. Typically, a five foot wide Pedestrian Zone supports two people walking side by side or two wheelchairs passing each other. An eight foot wide Pedestrian Zone allows two pairs of people to comfortable pass each other, and a ten foot or wider Pedestrian Zone can support high volumes of pedestrians.

Are the proposed sidewalks consistent with the Boston Complete Street Guidelines? See: www.bostoncompletestreets.org	Yes

If yes above, choose which Street Type was applied: Downtown Commercial, Downtown Mixed-use, Neighborhood Main, Connector, Residential, Industrial, Shared Street, Parkway, Boulevard.	Downtown Mixed Use | Modified
What is the total width of the proposed sidewalk? List the widths of the proposed zones: Frontage, Pedestrian and Furnishing Zone.	Width Varies from 12 to 25 feet. Refer to site plan
List the proposed materials for each Zone. Will the proposed materials be on private property or will the proposed materials be on the City of Boston pedestrian right-of-way?	Concrete, Concrete pavers and Granite. Final materials to be determined.
If the pedestrian right-of-way is on private property, will the proponent seek a pedestrian easement with the City of Boston Public Improvement Commission?	TBD
Will sidewalk cafes or other furnishings be programmed for the pedestrian right-of-way?	Potentially
If yes above, what are the proposed dimensions of the sidewalk café or furnishings and what will the right-of-way clearance be?	TBD

Proposed Accessible Parking:

See Massachusetts Architectural Access Board Rules and Regulations 521 CMR Section 23.00 regarding accessible parking requirement counts and the Massachusetts Office of Disability Handicap Parking Regulations.

What is the total number of parking spaces provided at the development site parking lot or garage?	Parking spaces are existing to remain within the existing Landmark Center Garage.
What is the total number of accessible spaces provided at the development site?	The total accessible parking spaces are existing to remain. The final design will relocate accessible spaces to be adjacent to the proposed new building lobby elevator entrance via an accessible route.
Will any on street accessible parking spaces be required? If yes, has the proponent contacted the Commission for Persons with Disabilities and City of Boston Transportation Department regarding this need?	No
Where is accessible visitor parking located?	In the existing Garage
Has a drop-off area been identified? If yes, will it be accessible?	No
Include a diagram of the accessible routes to and from the accessible parking lot/garage and drop-off areas to the development entry locations. Please include route distances.	Refer to figures provided

Article 80 | ACCESSIBILTY CHECKLIST

Circulation and Accessible Routes:

The primary objective in designing smooth and continuous paths of travel is to accommodate persons of all abilities that allow for universal access to entryways, common spaces and the visit-ability* of neighbors.

**Visit-ability – Neighbors ability to access and visit with neighbors without architectural barrier limitations*

Provide a diagram of the accessible route connections through the site.	Refer to figures provided
Describe accessibility at each entryway: Flush Condition, Stairs, Ramp Elevator.	Flush Condition
Are the accessible entrance and the standard entrance integrated?	Yes
If no above, what is the reason?	
Will there be a roof deck or outdoor courtyard space? If yes, include diagram of the accessible route.	Refer to figures provided
Has an accessible routes way-finding and signage package been developed? If yes, please describe.	No

Accessible Units: (If applicable)

In order to facilitate access to housing opportunities this section addresses the number of accessible units that are proposed for the development site that remove barriers to housing choice.

What is the total number of proposed units for the development?	NA
How many units are for sale; how many are for rent? What is the market value vs. affordable breakdown?	NA
How many accessible units are being proposed?	NA
Please provide plan and diagram of the accessible units.	NA
How many accessible units will also be affordable? If none, please describe reason.	NA
Do standard units have architectural barriers that would prevent entry or use of common space for persons with mobility impairments? Example: stairs at entry or step to balcony. If yes, please provide reason.	NA
Has the proponent reviewed or presented the proposed plan to the City of Boston Mayor's Commission for Persons with Disabilities Advisory Board?	No
Did the Advisory Board vote to support this project? If no, what recommendations did the Advisory Board give to make this project more accessible?	NA

Thank you for completing the Accessibility Checklist!
For questions or comments about this checklist or accessibility practices, please contact:
kathryn.quigley@boston.gov | Mayors Commission for Persons with Disabilities

Climate Change Preparedness and Resiliency Checklist for New Construction

In November 2013, in conformance with the Mayor's 2011 Climate Action Leadership Committee's recommendations, the Boston Redevelopment Authority adopted policy for all development projects subject to Boston Zoning Article 80 Small and Large Project Review, including all Institutional Master Plan modifications and updates, are to complete the following checklist and provide any necessary responses regarding project resiliency, preparedness, and to mitigate any identified adverse impacts that might arise under future climate conditions.

For more information about the City of Boston's climate policies and practices, and the 2011 update of the climate action plan, *A Climate of Progress*, please see the City's climate action web pages at http://www.cityofboston.gov/climate

In advance we thank you for your time and assistance in advancing best practices in Boston.

Climate Change Analysis and Information Sources:

1. Northeast Climate Impacts Assessment (www.climatechoices.org/ne/)
2. USGCRP 2009 (http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/)
3. Army Corps of Engineers guidance on sea level rise (http://planning.usace.army.mil/toolbox/library/ECs/EC11652212Nov2011.pdf)
4. Proceeding of the National Academy of Science, "Global sea level rise linked to global temperature", Vermeer and Rahmstorf, 2009 (http://www.pnas.org/content/early/2009/12/04/0907765106.full.pdf)
5. "Hotspot of accelerated sea-level rise on the Atlantic coast of North America", Asbury H. Sallenger Jr*, Kara S. Doran and Peter A. Howd, 2012 (http://www.bostonredevelopmentauthority.org/planning/Hotspot of Accelerated Sea-level Rise 2012.pdf)
6. "Building Resilience in Boston": Best Practices for Climate Change Adaptation and Resilience for Existing Buildings, Linnean Solutions, The Built Environment Coalition, The Resilient Design Institute, 2103 (http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf)

Checklist

Please respond to all of the checklist questions to the fullest extent possible. For projects that respond "Yes" to any of the D.1 – Sea-Level Rise and Storms, Location Description and Classification questions, please respond to all of the remaining Section D questions.

Checklist responses are due at the time of initial project filing or Notice of Project Change and final filings just prior seeking Final BRA Approval. A PDF of your response to the Checklist should be submitted to the Boston Redevelopment Authority via your project manager.

Please Note: When initiating a new project, please visit the BRA web site for the most current Climate Change Preparedness & Resiliency Checklist.

A.1 - Project Information

Project Name:	Landmark Center Redevelopment
Project Address Primary:	201 Brookline Avenue
Project Address Additional:	
Project Contact (name / Title / Company / email / phone):	Abe Menzin / Senior Vice President Development / Samuels & Associates / amenzin@samuelsre.com / 617-247-3434

A.2 - Team Description

Owner / Developer:	Fenway Enterprises LLC, A Samuels & Associates entity
Architect:	Elkus Manfredi Architects
Engineer (building systems):	WSP
Sustainability / LEED:	The Green Engineer, Inc.
Permitting:	VHB
Construction Management:	Suffolk Construction
Climate Change Expert:	WSP / VHB

A.3 - Project Permitting and Phase

At what phase is the project – most recent completed submission at the time of this response?

PNF / Expanded PNF Submission	Draft / Final Project Impact Report Submission	BRA Board Approved	**Notice of Project Change**
Planned Development Area	BRA Final Design Approved	Under Construction	Construction just completed:

A.4 - Building Classification and Description

List the principal Building Uses:	Office, Retail, Cinema, Building Services, Parking
List the First Floor Uses:	Office, Retail, Cinema, Building Services, Parking

What is the principal Construction Type – select most appropriate type?

Wood Frame	Masonry	**Steel Frame**	Concrete

Describe the building?

Site Area:	*383,079 SF*	Building Area:	*506,000 SF*
Building Height:	*208' 6" Ft.*	Number of Stories:	*14 Flrs.*
First Floor Elevation (reference Boston City Base):	*16' 6" Elev.*	Are there below grade spaces/levels, if yes how many:	*No / **Yes 1** Number of Levels*

A.5 - Green Building

Which LEED Rating System(s) and version has or will your project use (by area for multiple rating systems)?

Select by Primary Use:	New Construction	**Core & Shell**	Healthcare	Schools
	Retail	Homes Midrise	Homes	Other
Select LEED Outcome:	Certified	Silver	**Gold**	Platinum

Will the project be USGBC Registered and / or USGBC Certified?

Registered:	*Yes* / No	Certified:	Yes / *No*
	LEED-CSv09 USGBC Project ID: 1000040807		

A.6 - Building Energy

What are the base and peak operating energy loads for the building?

Electric:	*8,169 (kW)*	Heating:	*18.0 (MMBtu/hr)*
What is the planned building Energy Use Intensity:	*102.9 (kbut/SF or kWh/SF)*	Cooling:	*1,540 (Tons)*

What are the peak energy demands of your critical systems in the event of a service interruption?

Electric:	*1,191(kW)*	Heating:	*0 (MMBtu/hr)*
		Cooling:	*15 (Tons/hr)*

What is nature and source of your back-up / emergency generators?

Electrical Generation:	*(1)-800KW & (1)-600(kW)*		Fuel Source:	*Diesel*
System Type and Number of Units:	**Combustion Engine**	Gas Turbine	Combine Heat and Power	*(Units)*

B - Extreme Weather and Heat Events

Climate change will result in more extreme weather events including higher year round average temperatures, higher peak temperatures, and more periods of extended peak temperatures. The section explores how a project responds to higher temperatures and heat waves.

B.1 - Analysis

What is the full expected life of the project?

Select most appropriate:	10 Years	25 Years	50 Years	**75 Years**

What is the full expected operational life of key building systems (e.g. heating, cooling, ventilation)?

Select most appropriate:	10 Years	**25 Years**	50 Years	75 Years

What time span of future Climate Conditions was considered?

Select most appropriate:	10 Years	25 Years	50 Years	**75 Years**

Analysis Conditions - What range of temperatures will be used for project planning – Low/High?

91/73 Summer DB/WB 7 Degree Winter

What Extreme Heat Event characteristics will be used for project planning – Peak High, Duration, and Frequency?

87.6 Deg.	*1 Days*	*4 Events / yr.*

What Drought characteristics will be used for project planning – Duration and Frequency?

5 Days	*2 Events / yr.*

What Extreme Rain Event characteristics will be used for project planning – Seasonal Rain Fall, Peak Rain Fall, and Frequency of Events per year?

41.51 Inches / yr.	*4.9 Inches*	*127 Events / yr.*

What Extreme Wind Storm Event characteristics will be used for project planning – Peak Wind Speed, Duration of Storm Event, and Frequency of Events per year?

Peak Wind	*Hours*	*Events / yr.*

B.2 - Mitigation Strategies

What will be the overall energy performance, based on use, of the project and how will performance be determined?

Building energy use below code:	*10.4 %*
How is performance determined:	Energy Model

What specific measures will the project employ to reduce building energy consumption?

Select all appropriate:	**High performance building envelope**	**High performance lighting & controls**	Building day lighting	EnergyStar equip. / appliances
	High performance HVAC equipment	**Energy recovery ventilation**	No active cooling	No active heating
Describe any added measures:				

What are the insulation (R) values for building envelop elements?

Roof:	*R = 30*	Walls / Curtain Wall Assembly:	*R = 18*
Foundation:	*R =*	Basement / Slab:	*R =*
Windows:	*R = / U =*	Doors:	*R = / U =*

What specific measures will the project employ to reduce building energy demands on the utilities and infrastructure?

	On-site clean energy / CHP system(s)	Building-wide power dimming	Thermal energy storage systems	Ground source heat pump
	On-site Solar PV	On-site Solar Thermal	Wind power	None
Describe any added measures:	**CHP to be Studied as the design progresses.**			

Will the project employ Distributed Energy / Smart Grid Infrastructure and /or Systems?

Select all appropriate:	Connected to local distributed electrical	Building will be Smart Grid ready	Connected to distributed steam, hot, chilled water	Distributed thermal energy ready

Will the building remain operable without utility power for an extended period?

	*Yes / **No***	If yes, for how long:	*Days*
If Yes, is building "Islandable?			
If Yes, describe strategies:			

Describe any non-mechanical strategies that will support building functionality and use during an extended interruption(s) of utility services and infrastructure:

Select all appropriate:	Solar oriented –	Prevailing winds	External shading	Tuned glazing,

	longer south walls	oriented	devices	
	Building cool zones	Operable windows	Natural ventilation	Building shading
	Potable water for drinking / food preparation	Potable water for sinks / sanitary systems	Waste water storage capacity	High Performance Building Envelope
Describe any added measures:				

What measures will the project employ to reduce urban heat-island effect?

Select all appropriate:	High reflective paving materials	Shade trees & shrubs	High reflective roof materials	**Vegetated roofs**
Describe other strategies:				

What measures will the project employ to accommodate rain events and more rain fall?

Select all appropriate:	On-site retention systems & ponds	Infiltration galleries & areas	vegetated water capture systems	**Vegetated roofs**
Describe other strategies:				

What measures will the project employ to accommodate extreme storm events and high winds?

Select all appropriate:	Hardened building structure & elements	**Buried utilities & hardened infrastructure**	Hazard removal & protective landscapes	Soft & permeable surfaces (water infiltration)
Describe other strategies:				

C - Sea-Level Rise and Storms

Rising Sea-Levels and more frequent Extreme Storms increase the probability of coastal and river flooding and enlarging the extent of the 100 Year Flood Plain. This section explores if a project is or might be subject to Sea-Level Rise and Storm impacts.

C.1 - Location Description and Classification:

Do you believe the building to susceptible to flooding now or during the full expected life of the building?

*Yes / **No***

Describe site conditions?

Site Elevation – Low/High Points:	*14' – 21'' Boston City Base Elev.*
Building Proximity to Water:	*260 Ft.*

Is the site or building located in any of the following?

Coastal Zone:	*Yes / **No***	Velocity Zone:	*Yes / **No***
Flood Zone:	***Yes**** / *No*	Area Prone to Flooding:	*Yes / **No***

* While the property is depicted as containing portions of the SFHA on FIRM Panels 0076G and 0078G, there is in fact no hydraulic connection at or below the base flood elevation (BFE) between the Muddy River corridor and the Site as confirmed by a Negative Determination of Applicability issued by the Boston Conservation Commission on April 17, 2014.

Will the 2013 Preliminary FEMA Flood Insurance Rate Maps or future floodplain delineation updates due to Climate Change result in a change of the classification of the site or building location?

2013 FEMA Prelim. FIRMs:	*Yes / **No***	Future floodplain delineation updates:	*Yes / **No***

What is the project or building proximity to nearest Coastal, Velocity or Flood Zone or Area Prone to Flooding?

225 Ft.

***If you answered YES to any of the above Location Description and Classification questions, please complete the following questions.** Otherwise you have completed the questionnaire; thank you!*

C - Sea-Level Rise and Storms

This section explores how a project responds to Sea-Level Rise and / or increase in storm frequency or severity.

C.2 - Analysis

How were impacts from higher sea levels and more frequent and extreme storm events analyzed:

Sea Level Rise:	*Ft.*	Frequency of storms:	*per year*

C.3 - Building Flood Proofing

Describe any strategies to limit storm and flood damage and to maintain functionality during an extended periods of disruption.

What will be the Building Flood Proof Elevation and First Floor Elevation:

Flood Proof Elevation:	*Boston City Base Elev.(Ft.)*	First Floor Elevation:	*Boston City Base Elev. (Ft.)*

Will the project employ temporary measures to prevent building flooding (e.g. barricades, flood gates):

	Yes / No	If Yes, to what elevation	*Boston City Base Elev. (Ft.)*
If Yes, describe:			

What measures will be taken to ensure the integrity of critical building systems during a flood or severe storm event:

Systems located above 1st Floor.	Water tight utility conduits	Waste water back flow prevention	Storm water back flow prevention

Were the differing effects of fresh water and salt water flooding considered:

Yes / No

Will the project site / building(s) be accessible during periods of inundation or limited access to transportation:

Yes / No	If yes, to what height above 100 Year Floodplain:	*Boston City Base Elev. (Ft.)*

Will the project employ hard and / or soft landscape elements as velocity barriers to reduce wind or wave impacts?

Yes / No	
If Yes, describe:	

Will the building remain occupiable without utility power during an extended period of inundation:

Yes / No	If Yes, for how long:	*days*

Describe any additional strategies to addressing sea level rise and or sever storm impacts:

C.4 - Building Resilience and Adaptability

Describe any strategies that would support rapid recovery after a weather event and accommodate future building changes that respond to climate change:

Will the building be able to withstand severe storm impacts and endure temporary inundation?

Select appropriate:	*Yes / No*	Hardened / Resilient Ground Floor Construction	Temporary shutters and or barricades	Resilient site design, materials and construction

Can the site and building be reasonably modified to increase Building Flood Proof Elevation?

Select appropriate:	*Yes / No*	Surrounding site elevation can be raised	Building ground floor can be raised	Construction been engineered
Describe additional strategies:				

Has the building been planned and designed to accommodate future resiliency enhancements?

Select appropriate:	*Yes / No*	Solar PV	Solar Thermal	Clean Energy / CHP System(s)
		Potable water storage	Wastewater storage	Back up energy systems & fuel
Describe any specific or additional strategies:				

Thank you for completing the Boston Climate Change Resilience and Preparedness Checklist!

For questions or comments about this checklist or Climate Change Resiliency and Preparedness best practices, please contact: John.Dalzell.BRA@cityofboston.gov