

2. SUSTAINABILITY

2.1 SUSTAINABILITY

NARRATIVE



The Green Engineer, Inc.
Sustainable Design Consulting

Article 22: Green Building Report

Submitted for Review: August 9, 2016

Commercial Building A
145 Broadway Street



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LEED 2009 Core & Shell Project Scorecard (target)

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I. PROJECT DESCRIPTION

Commercial Building A at 145 Broadway, part of the MxD Infill Development Concept Plan within the Kendall Square Urban Renewal Plan (KSURP), is meeting the Special Permit application requirement with a minimum of LEED Gold certification under the LEED 2009 Core and Shell rating system. The project will develop over the course of design development, possible points may be achieved, and any updates to this report will be included in the Building Permit application.

Commercial Building A at 145 Broadway is part of the infill development concept plan, a major urban mixed-use project set within a 24-acre area in the 43-acre KSURP. Phase 1 will include demolition of the existing 145 Broadway commercial office building totaling 78,636 gross square feet to be replaced with the new construction of Commercial Building A at 145 Broadway—an approximately 453,768 gross square foot, 19-story commercial office or research laboratory building.

II. AFFIDAVIT

I, Allison Zuchman, do hereby affirm that I have thoroughly reviewed the supporting documents for LEED 2009 Core and Shell rating system and confirm that Commercial Building A at 145 Broadway meets the requirement for Gold with 62 points and 25 possible ('maybe') points. Commercial Building A at 145 Broadway, Cambridge, MA has been designed to meet the green building requirement under Article 22.20 of the Cambridge Zoning Ordinance.

Allison Zuchman, The Green Engineer, Inc.
LEED Administrator and Sustainability Consultant
Registered 12/22/2009



III. LEED 2009 CORE AND SHELL SCORECARD SUMMARY

- A. Please refer to the LEED credit summary below and the attached LEED 2009 Core and Shell (CS) Project Scorecard in Appendix B.
- B. The Project anticipates exceeding the Gold Certification threshold of 60 credit points by attempting **62** credit points. Additionally the project has earmarked and additional **25** possible 'maybe' credit points that require further research; these credits will remain under consideration as the design continues to evolve.

LEED CREDIT SUMMARY	Yes	Maybe
Sustainable Sites (SS)	24 points	4 possible points
Water Efficiency (WE)	5 points	2 possible points
Energy & Atmosphere (EA)	13 points	12 possible points
Materials & Resources (MR)	5 points	2 possible point
Indoor Environmental Quality (EQ)	7 points	3 possible points
Innovation in Design (ID)	4 points	2 possible points
Regional Priority (RP)	4 points	0 possible points
Total Points	62 points	25 possible points

IV. LEED Credit Narrative

The project meets the LEED 2009 Core and Shell Minimum Program Requirements and each of the required Prerequisites.

General Project Information

SITE AND BUILDING AREA	
Total Site Area within the LEED Project Boundary (LPB)	56,760 sf
Total Gross Square Feet ¹	453,768 sf
Commercial	443,731 sf
Retail	10,037 sf
Building Footprint:	22,434 sf
TRANSPORTATION	
Parking Spaces	Up to 374 space underground parking garage
Bike Racks (42 required)	Up to 112 long-term bike racks
	Up to 33 short-term bike racks at grade
OCCUPANCY (Per LEED BD+C Reference Guide, Core & Shell Appendix 1)	
Commercial FTE (250/sf)	1,775
Commercial Transients (0/sf)	0
Retail FTE (550/sf)	19
Retail Transients (130/sf)	78

1. Gross Square Feet excludes accessory and support spaces, such as vertical transportation, core and mechanical space, as defined under Article 2 of the Cambridge Zoning Ordinance. For LEED calculations, gross square feet will be adjusted during the design process to meet ASHRAE requirements, which includes total building area measured from the exterior face of the exterior wall.

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A. Sustainable Sites

The project site is in an urban neighborhood close to public transportation including multiple bus routes and the MBTA Red Line Kendall Station. Immediately adjacent to the site are pedestrian sidewalks and designated bikeways. Below grade parking is provided on site.

Prerequisite 1: Construction Activity Pollution Prevention Required

The Construction Manager will be required to submit and implement an appropriate SWPPP/Erosion and Sedimentation Control (ESC) Plan for construction activities related to the construction of the project. The ESC Plan will conform to the erosion and sedimentation requirements of the applicable NPDES regulations and specific municipal requirements for the City of Cambridge. Additionally, the ESC Plan will address management/containment of dust and/or particulate matter generated by on site demolition and construction activities. Civil design drawings will include measures for the implementation of the ESC plan.

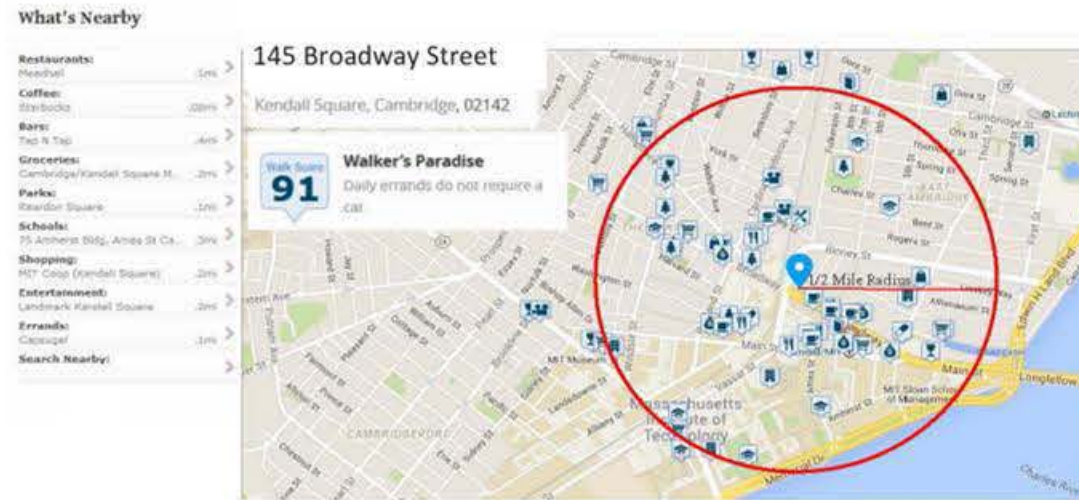
Credit 1 Site Selection 1 credit point

The project has not been developed on any of the following prohibited sites:

- Prime farmland as defined citation in 7CFR657.5
- Previously undeveloped land lower than 5 feet above the elevation of the 100 year flood as per FEMA
- Land specifically identified as habitat for any threatened or endangered species
- Within 100 feet of wetlands as defined by local, state or federal regulations
- Previously undeveloped land within 50 feet of a water body that supports fish or provides recreations or industrial uses as per the Clean Water Act
- Land that prior to acquisition was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner.

Credit 2 Development Density and Community Connectivity 5 credit points

The project is compliant with the credit requirements for Option 2, Community Connectivity; it is on a previously developed parcel with pedestrian access to a minimum of 10 basic services within a ½ mile. The project is also within ½ mile of a residential area with an average density of 10 units per acre – for instance, Ames Street Residences fulfills this requirement with 280 units.



The project is located within ½ mile of the following 10 basic services:

- Coffee Shop: Starbucks
- Entertainment: Landmark Cinema
- Groceries: Fresh Mart
- Museum: MIT Museum
- Place of Worship: Cambridge Community Fellowship Church
- Bank: Bank of America
- Restaurant: Cambridge Brewing Co
- Hardware Store: Economy True Value
- Park: Reardon Square
- School: Fletcher/Maynard Academy
- Fitness Club: Cambridge Athletic Club
- Daycare: Bright Horizons

Credit 3 Brownfield Redevelopment 1 credit point

Remediation will be conducted in conjunction with new construction including management of contaminated soil and treatment of water.

Credit 4.1 Alternative Transportation, Public Transportation Access 6 credit points

The project meets Option 1, Rail Station Proximity. The Red line MBTA Kendall Square subway station is located 0.2 miles from the project site. There are bus routes that pass by in close proximity to the site and/or originate at the subway station.



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Line Designation	Transit Type	Stop Name	Lines Served	Distance from Project (mi)	# of Transit Stops Per Weekday
1	Subway	Kendall/MIT	Redline	0.2	224
2	MBTA Bus	Kendall/MIT	64	0.2	30
3	MBTA Bus	Kendall/MIT	68	0.2	46
4	MBTA Bus	Kendall/MIT	85	0.2	45
5	MBTA Bus	Kendall/MIT	CT2	0.2	62
Total:					407

Credit 4.2 Alternative Transportation, Bicycle Storage 2 credit points
 A minimum of 42 secure bicycle racks within 200 yards of the building entrance will be provided, serving 3% or more of all building occupants. 10 shower and changing facilities within 200 yards of the building entrance will be provided, serving 0.5% of building employees (FTE occupants). (Refer to page 4 of this report for occupant count.)

Commercial Building A at 145 Broadway			
Bike Racks	Office	Retail	Total
3% occupants <300,000 sf	36	3	39
0.5% occupants >300,000 sf	3	0	3
TOTAL			42

Commercial Building A at 145 Broadway	
Showers/Changing Rooms (0.5% FTE)	
General Office	9
Retail, general	1
TOTAL	10

Credit 4.3 Alternative Transportation, Low-Emitting & Fuel-Efficient Vehicles 3 credit points
 A maximum of 374 parking spaces will be provided within the below grade parking garage. One of the following three options will be provided by the project:

- Up to 19 LEFE spaces (5% of total parking capacity) located close to a main building entrance
- Up to 12 electric vehicle charging stations (3% of total parking capacity)
- A combination of LEFE spaces and electric vehicle charging stations meeting the LEED requirements through a weighted average calculation

Commercial Building A at 145 Broadway	# Parking Spaces	5% LEFE	OR 3% EVCS
Commercial Building A at 145 Broadway new underground parking garage	374	19	12



Credit 4.4 Alternative Transportation Parking Capacity 2 credit points
 The total existing off-street parking capacity for the master site is 3,507 parking spaces, which meets Option 1 credit requirements by not exceeding the quantity required by the local zoning regulations (3,545 maximum allowable). Up to 374 spaces of the total 3,507 spaces are located in Commercial Building A parking garage. (Preferred parking for carpools or vanpools is not required for Core and Shell projects and is therefore not included for this project.)

Credit 5.1 Site Development, Protect or Restore Habitat 1 maybe credit point
 The project may protect or restore 50% of the site area (excluding the building footprint) with native and adaptive vegetation. Approximately, 9,450 sf would need to be restored or protected in order to meet the intent of the credit. Further clarification on credit feasibility will be determined once the site landscaping has been further developed.

Credit 5.2 Site Development, Maximize Open Space 1 maybe credit point
 The Kendall Square Urban Renewal Project may provide over 150,000 square feet of public open space, which consists of vegetated areas, parks, plazas and other pedestrian-oriented hardscape. The amount of open space that is allocated to 145 Broadway will be considered during design development to determine if credit requirements can be met (at least 25% vegetated and exceed local zoning requirements by at least 25%).

Credit 6.1/6.2 Stormwater Design, Quantity Control/Quality Control 1 credit point, 1 maybe credit point
 The project will implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the 2-year 24-hour storm (SSc6.1, Case 2, existing imperviousness greater than 50%). To meet SSc6.2 requirements, the project will implement a stormwater management plan that may capture and treat runoff from 90% of the average annual rainfall using acceptable best management practices (BMP's). BMP's may be capable of removing 80% of the average annual post-development total suspended solids (TSS).

A combination of natural and structural BMP measures may be designed for the site. Stormwater control measures will be investigated, engineered and refined as the project undergoes the design development process. Measures that will be considered include, but are not limited to, the following:

- Subsurface infiltration systems
- Green roofs
- Rainwater harvesting
- Permeable pavements
- Proprietary treatment devices for Phosphorus and Nutrient removal
- Bioretention landscaped areas and streetscape design
- Deep sump, hooded catch basins

The Project will comply with the Mass DEP Stormwater Management Policy, as well as reduce the peak rate and total volume of runoff for the 25-year design storm in the post-development condition to meet the two-year predevelopment condition, as required by Cambridge Department of Public Works (CDPW). The Project will also improve the quality of stormwater runoff Kendall Square Urban Renewal Plan Amendment No. 10 Notice of Project Change Assessment of Project Change Impacts 2-9 from the Project area, which discharges to the Lower Charles River Basins, which has a Total Phosphorus Total Maximum Daily Load (TMDL) in place. – Source: Kendall Square Urban Renewal Plan Amendment No. 10, Section 3.5 of Chapter 3, Summary of Mitigation Measures and Draft Section 61 Findings.

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Credit 7.1 Heat Island Effect, Non-Roof 1 credit point
100% of the parking provided for the project is located undercover in the underground parking garage.

Credit 7.2 Heat Island Effect, Roof 1 credit point
The roof membrane will be a high albedo roof product with an SRI value of 78 minimum. The high albedo roof will cover a minimum of 75% of the total roof area.

Credit 8 Light Pollution Reduction 1 maybe credit point
The project is considering pursuing this credit by complying with the LEED v4 BUG Rating method. This approach is an accepted alternative compliance path for LEEDv3 projects and is aligned with the new proposed Cambridge Outdoor Lighting Ordinance.

The project site is classified under Lighting Zone 3 as per the Illuminating Engineering Society and International Dark Sky Association (IES/IDA) Model Lighting Ordinance User Guide. To meet credit requirements, the site lighting will need to not exceed the allowable luminaire backlight, uplight and glare ratings for this lighting zone.

Credit 9 Tenant Design and Construction Guidelines 1 credit point
The project will draft a set of Tenant Design and Construction Guidelines that outline the sustainable design and energy efficiency measures in the project and provide detailed guidance for the Tenants to design and build in alignment with the project sustainability goals.

B. Water Efficiency

The project will specify low flow and high efficiency plumbing fixtures for the base building core public restrooms to reduce the amount of potable water used for sewage conveyance. There will be a high efficiency irrigation system for the landscaped areas.

Prerequisite 1 Water Use Reduction, 20% Reduction Required
Through the specification of low flow and high efficiency plumbing fixtures, the project will implement water use reduction strategies that use, at a minimum, 20% less potable water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements. Preliminary water use calculations are provided below.

Flush Fixture Type	Baseline GPF	Design GPF	Uses/Day	Baseline Annual Use/kGallons	Design Annual Use/kGallons	% Savings
Water Closet	1.6	1.28	3,550	1,476.8	1,181.44	
Urinal	1	.125	1,775	461.5	60.0	
Sub-TOTAL annual water savings				1,938.3	1,241.44	35.95%
Flow Fixture Type	Baseline GPM/GP C	Design GPM/GP C	Uses/Day	Baseline Annual Use/kGallons	Design Annual Use/kGallons	% Savings
Public Lavatory	.25gpc	.1gpc	5325	346.13	138.45	
Shower for FTEs	2.5gpm	1.8gpm	178	578.5	347.1	
FTE Kitchen Sink	2.2gpm	2.2gpm	1,775	253.83	253.83	
Sub-TOTAL annual water savings				1,178.46	739.38	37.26%
TOTAL annual water savings				3,116.76	1,980.82	36.45%



Credit 1.1 Water Efficient Landscaping, Reduce by 50% 2 credit points
The project includes an irrigation system that serves the landscaped areas throughout the entirety of the Master Site. The landscape design will incorporate native and adaptive plant materials and the design of the irrigation system will target a 50% reduction in potable water use when compared to a mid-summer baseline through the use of high controller efficiency and moisture sensors.

Credit 1.2 Water Efficient Landscaping, No Potable Water Use or No Irrigation 2 maybe credit points
In addition to the use of native/indigenous planting, the project is evaluating options for capturing and reusing rainwater to eliminate the need for permanent irrigation systems.

Credit 3 Water Use Reduction, 35% (3 points) 3 credit points
Through the specification of low flow and high efficiency plumbing fixtures, the project will implement water use reduction strategies that target 35% less potable water use annually when compared to EPA baseline fixtures for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements. Refer to the summary water use calculations provided with WEp1.

C. Energy and Atmosphere

The building envelope and systems will be designed to optimize energy performance and will not use refrigerants that are harmful to the environment. The Building Owner will engage a Commissioning Agent to review the proposed design documents and to confirm the building systems are installed and function as intended.

Prerequisite 1 Fundamental Commissioning of the Building Energy Systems Required
A third party Commissioning Agent, (CxA) will be engaged by the owner for purposes of providing basic commissioning services for the building energy related systems including HVAC, lighting and domestic hot water systems. The CxA will verify the building systems are installed, calibrated and perform to the building owners project requirements.

Prerequisite 2 Minimum Energy Performance Required
The building performance rating will demonstrate at a minimum, a 10% improvement in energy use by cost when compared to a baseline building performance as calculated using the rating method in Appendix G of ANSI/ASHREA/IESNA Standard 90.1-2007. This requirement is met by the selection of efficient building systems equipment and a lighting power density that is below code. Additionally, an improved building envelope design is required to achieve this minimum. The design team will develop a whole building energy model to demonstrate the expected performance rating of the designed building systems. Additionally, lighting power density requirements will be included in the tenant lease agreement.

Energy conservation measures (ECMs) that will be considered/evaluated as the design progresses includes but are not limited to the following:

- Improved glazing properties
- Improved roof insulation
- Improved exterior wall insulation
- Improved interior lighting power density
- Low-flow water fixtures and high-efficiency domestic water heater
- Variable volume condensing water pump
- High-efficiency centrifugal chillers
- VFD on cooling tower fans

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- High-efficiency condensing gas-fired hot water boilers
- Differential CO2 based demand control ventilation for offices
- CO control and VFD for underground garage fans
- Solar panels
- Consideration and evaluation for more innovative building systems, such as chilled beams, energy demand response, and smart grid compatible technologies

Prerequisite 3 Fundamental Refrigerant Management Required
CFC based refrigerants will not be used in the building HVAC & R systems. Additionally, depending on use of leasable space, equipment such as walk in freezers and coolers installed by future tenants will be required to meet credit requirements.

Credit 1 Optimize Energy Performance 5 credit points, 4 maybe credit points
The building is targeted to achieve a minimum of 16% annual energy cost savings (5 LEED points) when compared to a baseline building performance as calculated using the rating method in Appendix G of ANSI/ASHREA/IESNA Standard 90.1-2007. (Refer to EAp2 for additional information.)

Credit 2 Onsite Renewable Energy 4 maybe credit points
The project team is evaluating on-site renewable/clean energy opportunities including the use of building-mounted solar panels.

Credit 3 Enhanced Commissioning 2 credit points
A Commissioning Agent, (CxA) will be engaged and the scope of work includes enhanced commissioning requirements. The CxA's role will include reviewing the owner's project requirements, and the basis of design, creating, distributing and implementing a commissioning plan, performing a design review of the project documents, witnessing on-site installations and testing and performing commissioning of installed HVAC, lighting, lighting controls and domestic hot water systems.

Credit 4 Enhanced Refrigerant Management 2 maybe credit points
The HVAC equipment installed in the base building will use refrigerants that have low global warming and ozone depletion potential. Additionally, depending on use of leasable space, equipment installed by future tenants will be required to meet credit requirements.

Credit 5.1 Measurement and Verification: Base Building 3 credit points
The project will develop and implement a measurement and verification (M&V) plan consistent with Option D: Calibrated Simulation (Savings Estimation Method 2) as specified by the International Performance Measurement & Verification Protocol (IPMVP), Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003 for the base Core and Shell building. Refer to the building systems overview provided with EAp2.

The project will implement a measurement and verification plan that will utilize the base building DDC energy management system to monitor operation of equipment or systems that are not already directly metered for electric or gas use.

Credit 5.2 Measurement and Verification: Tenant Sub metering 3 credit points
The project will include a centrally monitored electronic metering network in the base building design that is capable of being expanded to accommodate and document the future tenant sub-metering. The project will develop and implement an appropriate tenant measurement and verification (M&V) plan that includes a process for corrective action if the results of the M&V



plan indicate that energy savings are not being achieved will be included. Refer to the building systems overview provided with EAp2 and the additional information provided with EAc5.1.

Credit 6 Green Power 2 maybe credit points
Boston Properties may purchase 'green power' for a 2-year period renewable energy contract to provide a minimum of 35% of the building's electricity from renewable sources.

D. Materials and Resources
The project has specified materials and products with recycled content, those made with certified wood and regionally procurable products to the extent possible. Throughout the construction phase of the project the Construction Management team will endeavor to divert Construction and Demolition waste from area landfills and procure materials that are made with FSC certified wood, have recycled content and/or are harvested, extracted and manufactured within 500 miles of the project site.

Prerequisite 1 Storage and Collection of Recyclables Required
Storage of collected recyclables will be accommodated on the ground floor of the project in a designated recycling area. Tenants will bring their recyclables to this central storage room. A contracted waste management company will collect the recyclables on a regular basis.

Credits 2 Construction Waste Management, 75% CWM 2 credit points
Prior to the start of construction the Construction Management team will prepare and submit a Construction Waste Management plan which will be implemented on site. The Construction Manager will endeavor to divert as much demolition debris and construction waste from area landfills as possible with a goal to achieve 75% diversion overall.

Credits 4.1 Recycled Content 10% (post-consumer & 1/2 pre-consumer) 1 credit point
The project specifications require certain materials to include pre and or post consumer recycled content. During construction, materials and products submittals will include documentation of the percentage of pre/post consumer recycled content. The Construction Manager will track the recycled content with a project goal to achieve 10% recycled-content materials based on overall project materials costs.

Credits 4.2 Recycled Content 20% (post-consumer & 1/2 pre-consumer) 1 credit point
The Construction Manager will track the recycled content for each material with a project target to achieve 20% recycled-content materials based on overall project materials costs.

Credit 5.1 Regional Materials, 10% Extracted, Processed and Manufactured Regionally 1 maybe credit point
The project specifications include some materials to be extracted, harvested, recovered and manufactured within a 500 mile radius of the job site. The project has established a target for 10% of the materials and products installed to be regional materials. The Construction Manager will track the submitted and installed materials and products with a goal to achieve the 10% threshold based on overall project materials costs.

Credit 5.2 Regional Materials 20% Extracted, Processed and Manufactured Regionally 1 maybe credit point
The Construction Manager will track the regional materials with a project target to achieve 20% regional materials based on overall project materials costs.

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Credit 6 Certified Wood

1 credit point

The project specifications include wood materials to be from FSC certified forests and from compliant manufacturers and millwork shops. The Construction Manager will track the submitted and installed wood materials and products with a goal to achieve the 50% (by cost) threshold based on overall wood materials costs. Boston Properties will make a final decision on the purchase of certified wood once it has been priced.

E. Indoor Environmental Quality

The interior air quality will be monitored during the construction phase of the project and prior to occupancy. Low emitting materials, (low VOC), will be used throughout construction to maintain and improve air quality within the base building. The tenant fit-outs will be laid out to maximize exposure to views and daylight.

Prerequisite 1 Minimum IAQ Performance

Required

The building mechanical systems are designed to meet or exceed the requirements of ASHRAE Standard 62.1-2007 sections 4 through 7 and/or applicable building codes. The mechanical engineer will complete a ventilation rate procedure (VRP) calculator to verify compliance.

Prerequisite 2 Environmental Tobacco Smoke (ETS) Control

Required

The entire building and the associated site will be non-smoking. This policy will be enforced through posted signage throughout the building and the Master Site.

Credit 1 Outdoor Air Delivery Monitoring

1 maybe credit point

The project will include CO2 monitors and airflow sensors in all the spaces that have an occupant density greater than 25 people per 1,000 sf. All monitors will be installed between 3 and 6ft above the floor. Tenant fit outs will be mandated to meet the requirements of this credit.

Credit 2 Increased Ventilation

1 maybe credit point

Ventilation calculations will be completed during design development to determine if the ventilation rates exceed the requirements of ASHRAE Standard 62.1-2007 by 30% or more. Ventilation rates will be considered and weighed against energy use reduction calculations to determine the best solution for the project.

Credit 3 Construction IAQ Management Plan (during construction)

1 credit point

The Construction Manager will develop and implement an Indoor Air Quality Management Plan for the construction and pre-occupancy phases of the project to meet/exceed the recommended Control Measures of the SMACNA IAQ Guidelines for Occupied buildings Under Construction 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter3).

Credit 4.1 Low-Emitting Materials, Adhesives & Sealants

1 credit point

The specifications for adhesives and sealants used inside the building envelope include requirements for compliance with the low VOC criteria for adhesives and sealants as established in the South Coast Air Quality Management District (SCAQMD) Rule #1168,

Credit 4.2 Low-Emitting Materials, Paints and Coatings

1 credit point

The specifications include requirements for paints and coatings to meet low VOC criteria for paints and coatings in accordance with applicable sections of Green Seal Standard GS-11, Green Seal Standard GC-03 and SCQAMD Rule #1113.



Credit 4.3 Low-Emitting Materials, Flooring Systems

1 credit point

The specifications include compliant flooring materials that meet the applicable requirements of FloorScore certification or the Carpet Rug Institute Green label program.

Credit 4.4 Low Emitting Materials, Composite Wood and Agrifiber Products

1 credit point

The project specifications include composite wood and agrifiber products that contain no added urea-formaldehyde. The Construction Manager will endeavor to use only NAUF compliant materials throughout the Core and Shell build-out. Additionally, the tenant design and construction guidelines will encourage tenants to install only NAUF compliant composite wood materials.

Credit 5 Indoor Chemical and Pollutant Source Control

1 credit point

The project includes walk off mats at regularly used building entries to minimize and control the entry of pollutants into the building and to contain chemical use areas. Janitors closets and other spaces where hazardous gases and/or chemicals will be stored are sufficiently exhausted, have self-closing doors and deck-to-deck partitions. Prior to occupancy, regularly occupied spaces that deliver return and/or outdoor air as supply air will have MERV 13 filtration.

Credit 7 Thermal Comfort, Design

1 maybe credit point

The project HVAC design will be in compliance with ASHRAE 55 for all applicable mechanically ventilated regularly occupied spaces. Design space temperature set points and space relative humidity set points for both heating and cooling will be within the comfort zones described within ASHRAE 55. Local effects such as air speed, radiant temperature, draft, and floor surface temperature will be considered.

Credit 8.2 Daylight and Views, Views for 90% of the spaces

1 credit point

The project has large windows with ample access to daylight and views from both the office and retail regularly occupied spaces throughout the project. The project will provide at least 90% of all regularly occupied spaces with access to outdoor views. Of these spaces with access to views, a direct line of sight will be achieved via vision glazing (between 2'-6" and 7'- 6" above finish floor), and there will be no obstructions above 42 inches..

F. Innovation & Design Processes

The dense, urban location of the project site enables the project to achieve exemplary performance for multiple Sustainable Site credits. Additional innovative strategies are being discussed with the design team including, but not limited to, Greenhouse Keeping and Integrated Pest Management.

Credit 1 Innovation & Design

1 credit point

The innovation credits targeted by the project are listed below (5 total are available):

IDc1.1 Exemplary Performance for SSc2

1 credit point

The project site is located in an area with an average surrounding density that is greater than 120,000 gross square feet per acre, doubling the requirement of 60,000 gross square feet per acre and therefore eligible for an EP credit.

IDc1.2 Exemplary Performance for SSc4.1

1 credit point

The project site is located within ¼ mile walking distance of several bus route stops and ½ mile walking distance of the Kendall/MIT MBTA station providing occupants with over 200 transit rides per day, doubling the transit ridership requirements and therefore eligible for an EP credit.

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IDc1.3 Exemplary Performance for SSc7.1 1 credit point
100% of the parking associated with the Master Site is located within a covered parking structure, doubling the 50% requirement and therefore eligible for an EP credit.

ID credits currently under consideration

IDc1.4 Green Housekeeping/Operations 1 maybe credit point
Boston Properties will explore the use green cleaning products and equipment in the common areas and provide a package for residents explaining the 'green living' components of the project.

IDc1.5 Integrated Pest Management 1 maybe credit point
Boston Properties will explore the implementation of an indoor integrated pest management (IPM) program. The plan will require routine inspection and monitoring, along with the incorporation of integrated methods, specification of emergency application measures for pesticides, and communication strategies to building occupants. All cleaning products included in the IPM plan will adhere to the requirements listed in the Green Housekeeping plan for the project.

Credit 2 LEED Accredited Professional Required, 1 credit point
A LEED AP will provide administrative services to oversee the LEED credit documentation process.

G. Regional Priority Credits

Regional Priority Credits, (RPC) are established by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs and additional credit is awarded to the project. RPCs applicable to the Cambridge area include: SSc3, SSc6.1, SSc7.1 EAc2 and MRc1.1. This project anticipates three RPCs:

- | | |
|--------------------------------------------------|----------------|
| RPc1 SSc3 Brownfield Redevelopment | 1 credit point |
| RPc1 SSc6.1 Stormwater Design - Quantity Control | 1 credit point |
| RPc2 SSc7.1 Heat Island Effect - Nonroof | 1 credit point |
| RPc3 SSc7.2 Heat Island Effect - Roof | 1 credit point |

END OF DOCUMENT

2.2 SUSTAINABILITY

DRAFT LEED SCORECARD



LEED v3 for Core and Shell Development Project Scorecard *DRAFT*

Project Name: **Commercial Building A at 145 Broadway**
Address: Cambridge, MA
Date of Issue: August 9, 2016

LEED Target: Gold per Article 22 Kendall Square

Yes	Maybe	No	SUSTAINABLE SITES		28
24	4	0			
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	Maybe	No	WATER EFFICIENCY		10
5	2	3			
Y			Prereq 1	Water Use Reduction, 20% Reduction	Required
2			Credit 1.1	Water Efficient Landscaping, Reduce by 50%	2
	2		Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	2
		2	Credit 2	Innovative Wastewater Technologies	2
3		1	Credit 3	Water Use Reduction - 30% (2), 35% (3), 40% (4)	2 to 4

Yes	Maybe	No	ENERGY & ATMOSPHERE		37
13	12	12			
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
5	4	12	Credit 1	Optimize Energy Performance	3 to 21
	4		Credit 2	On-Site Renewable Energy	4
2			Credit 3	Enhanced Commissioning	2
	2		Credit 4	Enhanced Refrigerant Management	2
3			Credit 5.1	Measurement & Verification: Base Building	3
3			Credit 5.2	Measurement & Verification: Tenant Submetering	3
	2		Credit 6	Green Power	2

Yes	Maybe	No	MATERIALS & RESOURCES		13
5	2	6			
Y			Prereq 1	Storage & Collection of Recyclables	Required
		5	Credit 1	Building Reuse: Existing Walls, Floors & Roof 25%, 33%, 42%, 50%, 75%	1 to 5
2			Credit 2	Construction Waste Management, Divert 50% / 75% from Disposal	1 to 2
		1	Credit 3	Materials Reuse, 5% / 10%	1
1			Credit 4.1	Recycled Content, 10% (post-consumer + 1/2 pre-consumer)	1
1			Credit 4.2	Recycled Content, 20% (post-consumer + 1/2 pre-consumer)	1
	1		Credit 5.1	Regional Materials, 10% Extracted, Processed & Manufactured Regionally	1
	1		Credit 5.2	Regional Materials, 20% Extracted, Processed & Manufactured Regionally	1
1			Credit 7	Certified Wood	1

Yes	Maybe	No	INDOOR ENVIRONMENTAL QUALITY		12
7	3	2			
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

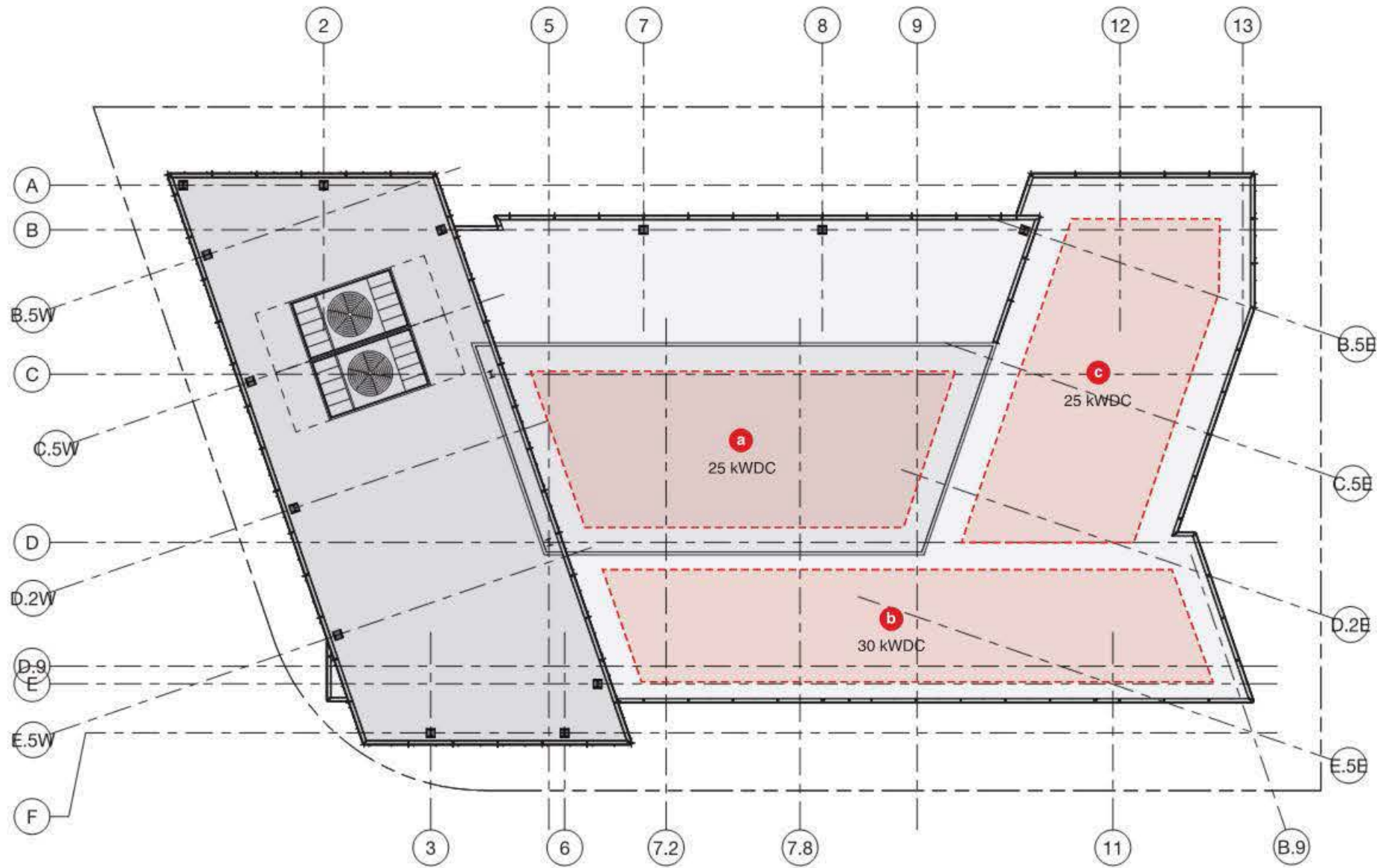
Yes	Maybe	No	INNOVATION IN DESIGN		6
4	2	0			
1			Credit 1.1	Exemplary Performance in SSc2	1
1			Credit 1.2	Exemplary Performance in SSc4.1	1
1			Credit 1.3	Exemplary Performance in SSc7.1	1
	1		Credit 1.4	ID Credit: Green Cleaning	1
	1		Credit 1.5	ID Credit: Integrated Pest Management	1
1			Credit 2	LEED® Accredited Professional	1

Yes	Maybe	No	REGIONAL PRIORITY - Cambridge (credit names have been underlined)		4
4	0	0			
			Regional Priority Cambridge : SSc3, SSc6.2, SSc7.1, SSc7.2, EAc2 (4pts), MRc1 (75%)		
1			Credit 1.1	<u>Regional Priority Cambridge : SSc6.1</u>	1
1			Credit 1.2	<u>Regional Priority Cambridge : SSc7.1</u>	1
1			Credit 1.3	<u>Regional Priority Cambridge : SSc7.2</u>	1
1			Credit 1.4	<u>Regional Priority Cambridge : SSc3</u>	1

Yes	Maybe	No	Project Totals (Certification Estimates)		110
62	25	23			
Certified: 40-49 points, Silver: 50-59 points, Gold: 60-79 points, Platinum: 80+ points					

2.3 SOLAR READY PLAN / GREEN ROOF

ROOF PLAN



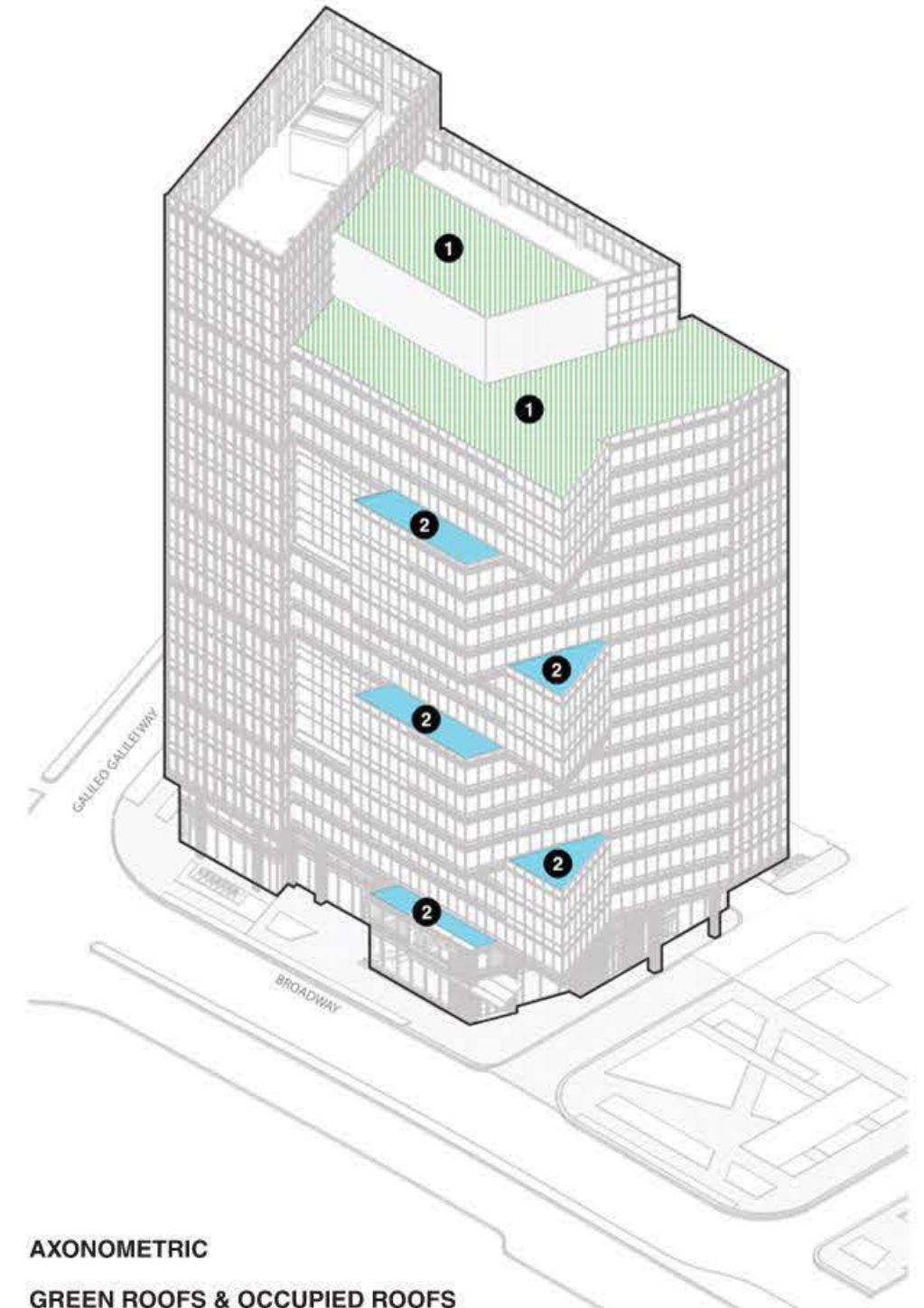
SOLAR READY HIGH LEVEL DETAILS:

- Estimated project size: 80 kWDC (60 kWAC) of ballasted mounting (low profile, 10 degree tilt, 200 degree azimuth)
- Estimated production: 85,000 kWh in year one (estimate includes orientation impact which is minimal and shading impact from building)
- Minimum set back: 6 ft from roof edge
- Structural: estimated 10 to 12lbs/sqft dead load for ballast plus will require mechanical penetrations (based on roof height and location) [rough estimate needs structural analysis]
- Roofing material: Many options are compatible
- Access to electrical room: requires 4 inch chase to electrical room for behind the meter interconnection and potentially to ground level for dedicated meter interconnection
- Electrical room or roof/ wall space for inverter: Room for 3 x SolarEdge SE20k (wall mounted)
<http://www.solaredge.com/sites/default/files/se-three-phase-us-inverter-datasheet.pdf>



NOTE:

The solar ready and green roof sections are offered to demonstrate how 145 Broadway could offer a solar array or green roof in the future. This Design Review proposal does not contemplate an immediate plan to include solar or green roofs.



AXONOMETRIC

GREEN ROOFS & OCCUPIED ROOFS

- 1) Potential Green Roofs
- 2) Potential Occupied Roofs

3. ENVIRONMENTAL IMPACT

3.1 PEDESTRIAN WIND ASSESSMENT

NARRATIVE



Kendall Square MasterPlan

Pedestrian Wind Assessment

RWDI #1603158

August 4, 2016

SUBMITTED BY

Rowan Williams Davies & Irwin Inc.

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3.1 PEDESTRIAN WIND ASSESSMENT

NARRATIVE

Pedestrian Wind Assessment
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1. Introduction

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Boston Properties to complete a pedestrian level wind assessment for the proposed Kendall Square Masterplan in Cambridge, MA. The objective of this assessment is to provide a qualitative evaluation of the potential wind conditions on the project and the impact of the project on the surrounding public outdoor areas in terms of pedestrian wind comfort and safety. This qualitative assessment is based on the following:

- a review of the regional long-term meteorological data from Boston Logan International Airport;
- 3D e-model received by RWDI on July 15, 2016;
- wind-tunnel studies undertaken by RWDI for similar projects in Cambridge and the surrounding cities;
- our engineering judgment, experience and expert knowledge of wind flows around buildings^{1,2,3}; and,
- use of software developed by RWDI (Windestimator²) for estimating the potential wind conditions around generalized building forms.

If necessary, conceptual measures to improve wind conditions will also be provided. This qualitative approach provides a screening-level estimation of potential wind conditions. In order to quantify the wind conditions and to refine wind control solutions, physical scale model tests would be required. Note that other wind issues, such as those related to thermal comfort, door operability, wind loading, etc., are not considered in the scope of the assessment.

2. Site and Building Information

The proposed development site is located in Cambridge, MA in the block bound by Broadway to the south, Galileo Galilei Way to the west and Binney Street to the north. Cambridge Center passes through the development site.

¹ C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", 10th International Conference on Wind Engineering, Copenhagen, Denmark.

² H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", ASCE Structure Congress 2004, Nashville, Tennessee.

The proposed development consists of four buildings ranging from 177 ft to 393 ft in height (Image 2a). The Phase 1 and the north building in Phase 2 are intended for commercial use and the central block (Phases 2 (south) and 3) are residential buildings connected by a large garage podium. The existing lots for each phase is occupied by low-rise buildings as shown in Image 2b. Publically accessible areas on and around the site include main building entrances, sidewalks and walkways between buildings.

Most public areas at grade level in the vicinity are densely landscaped with large canopy-type trees, which is positive for wind control. The site is located in a densely built up area comprising of several mid-rise building (similar in height to the proposed towers) in all directions and low-rise residential development in the distance to the west north and northwest. Downtown Boston is about 1.5 miles to the southeast.

3. Meteorological Data

The analysis was completed for two main periods of the year, namely the summer months (May to October) and winter (November to April). Meteorological data from Boston Logan International Airport for the period from 1990 to 2015 were used as reference for wind conditions in the region.

The distributions of wind frequency and directionality for summer and winter seasons are shown in the wind roses in Image 3. Winds from the southwest and west-northwest directions are predominant in the summer, as indicated by the wind rose on the left in Image 3. The wind rose on the right shows the winter data, indicating the predominance of winds from west through northwest.

Strong winds of a mean speed greater than 20 mph measured at the airport (red bands) occur more often in the winter than the summer and are predominantly from the southwest, northwest and northeast quadrants. These

³ H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", Journal of Wind Engineering and Industrial Aerodynamics, vol.104-106, pp.397-407.

3.1 PEDESTRIAN WIND ASSESSMENT

NARRATIVE



strong winds could potentially be the source of uncomfortable or even severe wind conditions, depending upon the site exposure or development design.

4. Pedestrian Wind Criteria

The RWDI wind comfort criteria deal with both pedestrian safety and comfort, as they relate to the force of the wind. These criteria have been developed by RWDI through research and consulting practice since 1974. They have also been widely accepted by municipal authorities as well as by the building design and city planning community.

Safety: Pedestrian safety is linked to excessive gust wind speeds that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance occur more than 0.1% of the time or 9 hours per year, the wind conditions are considered severe.

Comfort: Wind conditions are considered suitable for sitting, standing, strolling or walking if the wind speeds corresponding to the respective categories are expected for at least four out of five days (80% of the time).

Sitting: Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away.

Standing: Gentle breezes suitable for main building entrances and bus stops.

Strolling: Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park.

Walking: Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.

Uncomfortable: None of the comfort categories are satisfied.

Wind control measures are typically required at locations where winds are rated as uncomfortable or they exceed the wind safety criterion.

These criteria for wind forces represent average wind tolerance. They are sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate.

Pedestrians on walkways and parking lots will be active and wind speeds comfortable for walking or strolling are appropriate during the summer and winter. Lower wind speeds comfortable for standing are desired at building

entrances where people are apt to linger. On playgrounds, sitting areas and other amenity spaces, low wind speeds comfortable for sitting or standing are desired during the summer. In the winter, wind conditions in these areas may not be of a serious concern due to limited usage and therefore higher wind activity may be acceptable.

5. Pedestrian Wind Conditions

Predicting wind speeds and occurrence frequencies involves the assessment of building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies on pedestrian wind conditions around buildings, yielding a broad knowledge base. This knowledge has been incorporated into RWDI's proprietary software that allows, in many situations, for a qualitative, screening-level numerical estimation of pedestrian wind conditions without wind tunnel testing. The following sections discuss the predicted impact of the proposed development on wind conditions on and around the development site.

5.1 Generic Wind Flow Patterns

The following discussion describes the impacts of the proposed project on wind conditions. In our discussion references will be made to a few generic wind flow phenomena. Tall buildings tend to intercept winds at high elevations and direct them down towards the street in a phenomenon called *downwashing* (Image 4a). The downwashed winds could subsequently accelerate around building corners (Image 4b), channel along street canyons (Image 4c) and/or accelerate under any bridge connections (Image 4d). If one or more of these wind flow phenomena occurs for the prevailing wind directions, there is the potential for higher than desired or potentially severe wind activity at ground level.

5.2 Impact of the Proposed Development

The proposed Phase 1, 2 (commercial building) and 3 buildings are fairly similar in height to several of the taller buildings in the neighborhood to the south and west. However, all of the towers are taller than existing buildings in

3.1 PEDESTRIAN WIND ASSESSMENT

NARRATIVE



the immediate vicinity and the surroundings to the west, northwest, north and northeast, which leaves them exposed to prevailing winds from those directions. Therefore, the tall towers will result in downwashing and acceleration of winds on the streets surrounding the development, as well as the walkways between the towers. However, the tower design includes deep setbacks, low podiums and closely spaced buildings which would protect the streets from high wind activity to a large extent (Image 5).

The sidewalks around the development are currently lined with dense canopy-type trees which would shelter the sidewalks from adverse wind effects in the summer and parts of spring and fall when the trees retain their dense foliage. During the rest of the year when the trees are bare, they are ineffective against strong winds. The predicted wind flow pattern around the proposed development is illustrated in Image 5.

Safety

The proposed towers would increase wind activity around the development. However, as discussed, the densely built up surroundings protect the streets from adverse wind activity. It is expected that wind speeds at ground level on and around the development would meet the pedestrian wind safety criterion.

Comfort

For the same reasons discussed under the Safety section, wind conditions around the development are predicted to be appropriate for pedestrian activities. Overall, wind speeds at most areas are anticipated to be comfortable for standing or strolling in the summer (Image 6a). Areas covered by dense street trees would be protected further and wind conditions in those areas would likely be calm and comfortable for sitting.

During the winter, deciduous trees do not retain their foliage and therefore would not be effective for wind control. Additionally, winds are seasonally stronger in the winter. Wind conditions at most areas on and around the development are predicted to be comfortable for strolling or walking (Image 6b).

Overall wind conditions would be fairly similar to that experienced around the existing site. Increased wind activity would be localized around the taller towers. Although the towers would increase wind activity at ground level, the conditions would be appropriate for pedestrian use throughout the year. During the winter, the higher wind speeds predicted would not be a concern due to limited outdoor pedestrian activity. If lower wind speeds are desired in areas rated "strolling" or "walking" in Image 6 (to locate an entrance or seating benches for example), dense plants, trees or other landscaping features, or wind screens may be used for wind control. Such features would have to be approximately 20%-30% porous and 6-8 ft tall in order to be effective (See examples in Image 7). It would be beneficial for main entrances to be designed with closed vestibules or a large lobby so as to provide patrons with a protected waiting area on windy days and in the winter.

Wind tunnel studies would be required to quantify conditions and subsequently develop specific wind control measures for each area; RWDI can assist with solution development as the design progresses.

In the event of any other significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.

3.1 PEDESTRIAN WIND ASSESSMENT

EXHIBITS



Kendall Square MasterPlan

Pedestrian Wind Assessment

RWDI #1603158

August 4, 2016

SUBMITTED BY

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3.1 PEDESTRIAN WIND ASSESSMENT

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Image 1 – Aerial View of the Project Site and Existing Surroundings

3.1 PEDESTRIAN WIND ASSESSMENT

EXHIBITS

Pedestrian Wind Assessment
August 4, 2016

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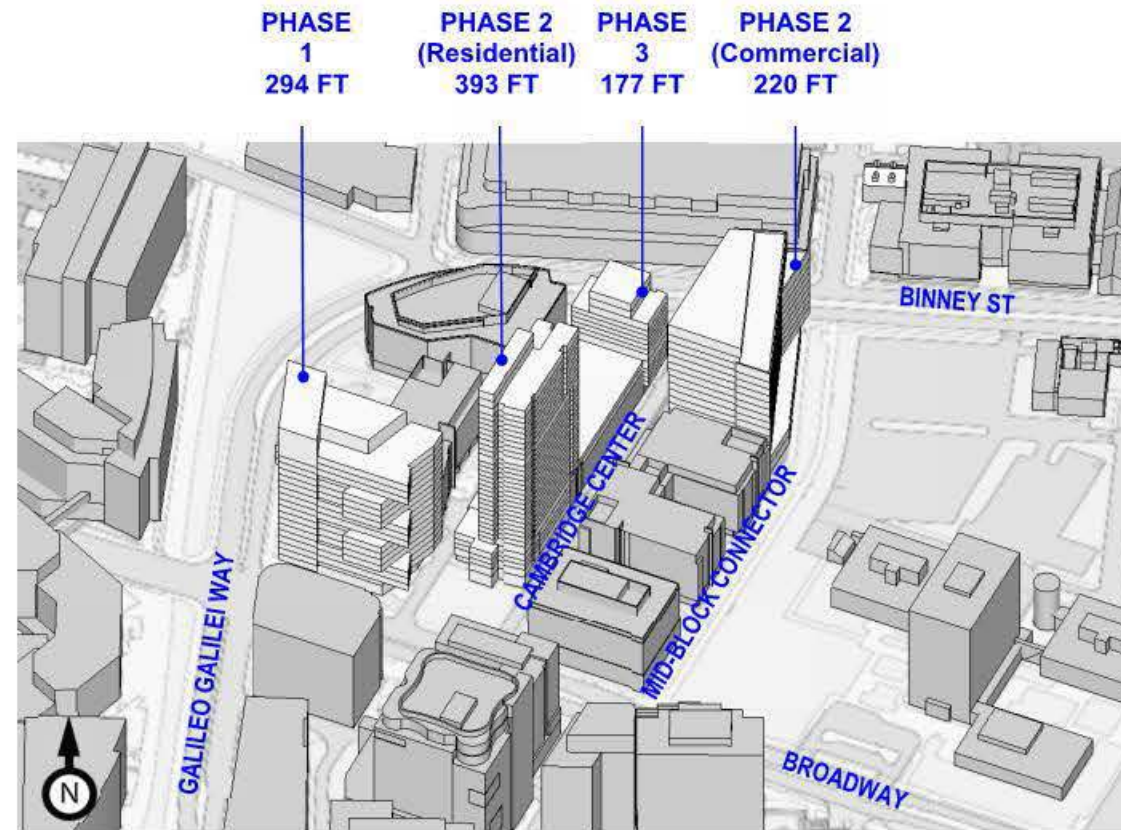


Image 2a – Proposed Development Context and Building Heights

3.1 PEDESTRIAN WIND ASSESSMENT

EXHIBITS

Exhaust Re-Entrainment Design Review
July 27, 2016

Kendall Square Master Plan
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Image 2b – Existing Site Context

3.1 PEDESTRIAN WIND ASSESSMENT

EXHIBITS

Pedestrian Wind Assessment
August 4, 2016

Kendall Square Master Plan
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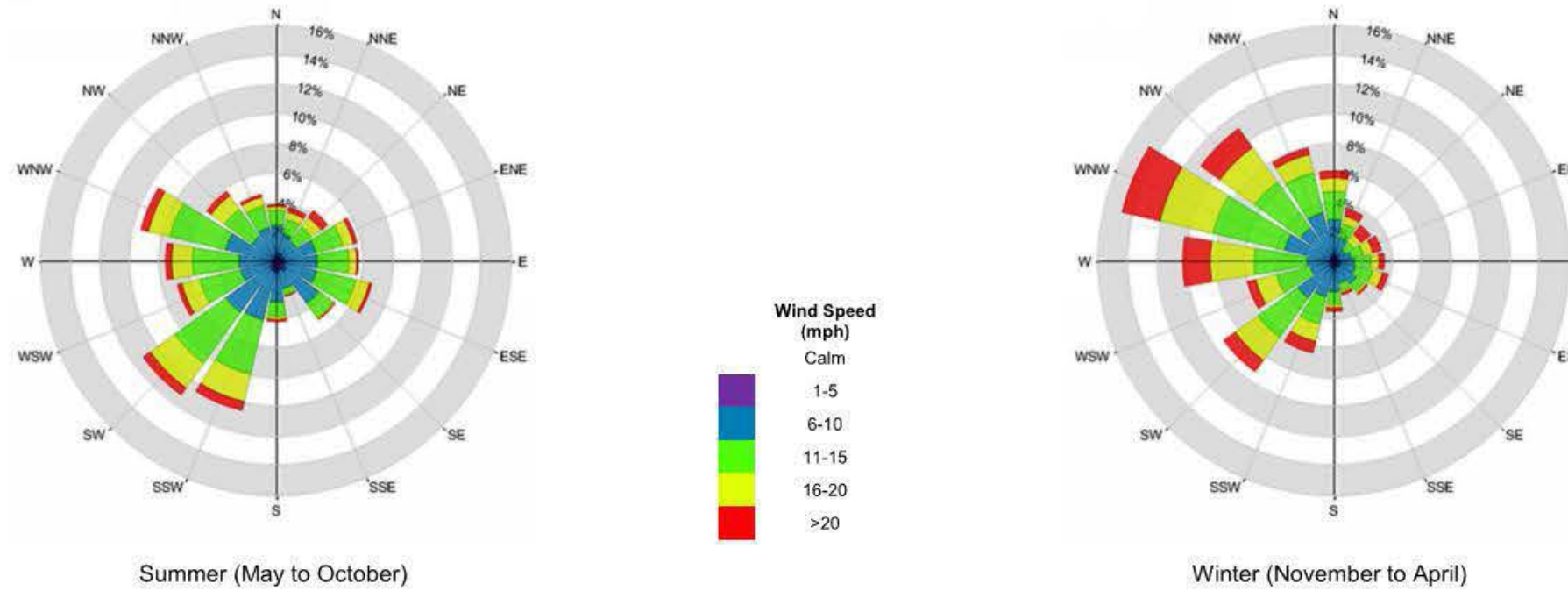


Image 3 – Directional Distribution (%) of Winds (Blowing From) Boston Logan International Airport (1990 to 2015)

3.1 PEDESTRIAN WIND ASSESSMENT

EXHIBITS

Pedestrian Wind Assessment
August 4, 2016

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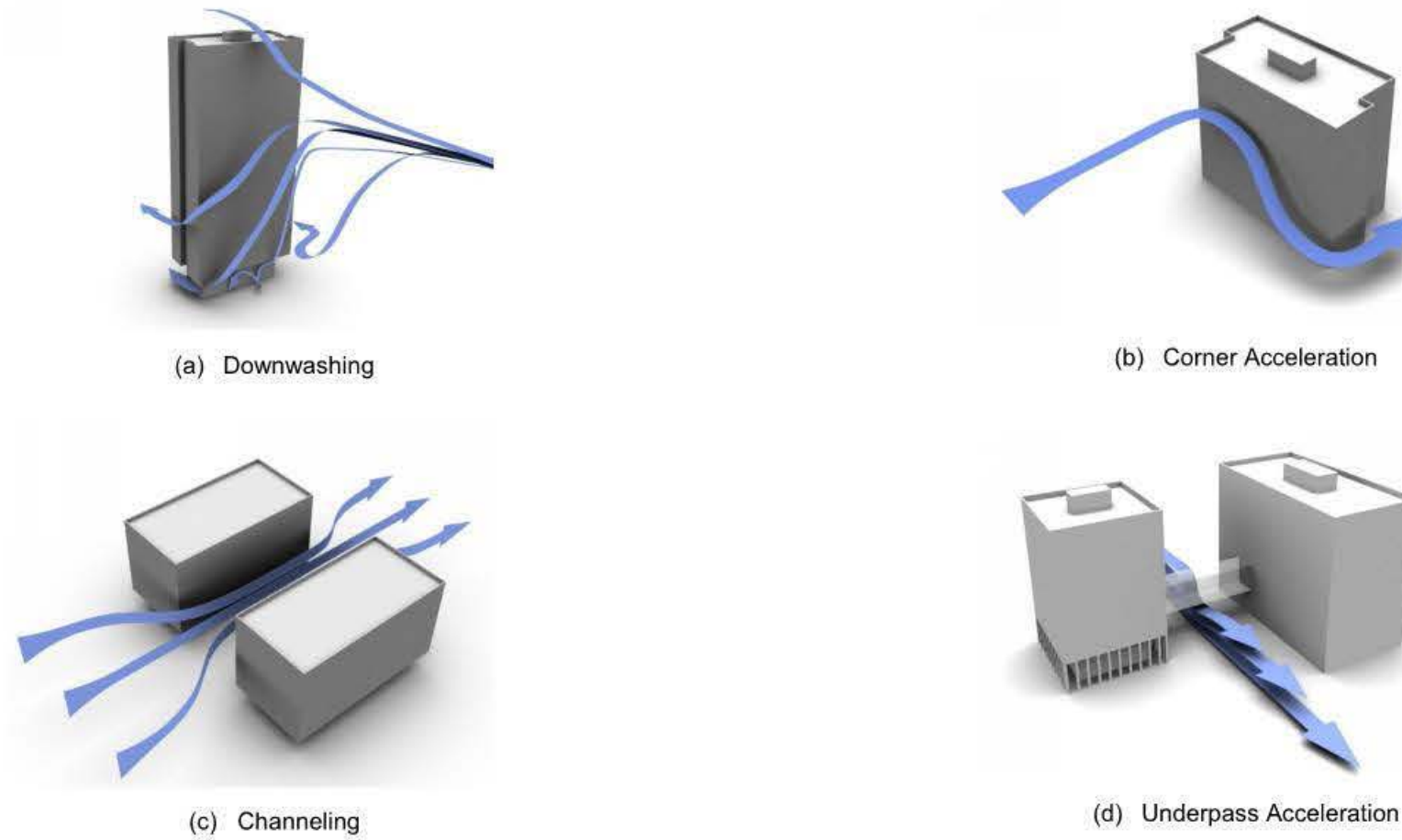


Image 4 – Generic Wind Flow Patterns

3.1 PEDESTRIAN WIND ASSESSMENT

EXHIBITS

Pedestrian Wind Assessment
August 4, 2016

Kendall Square Master Plan
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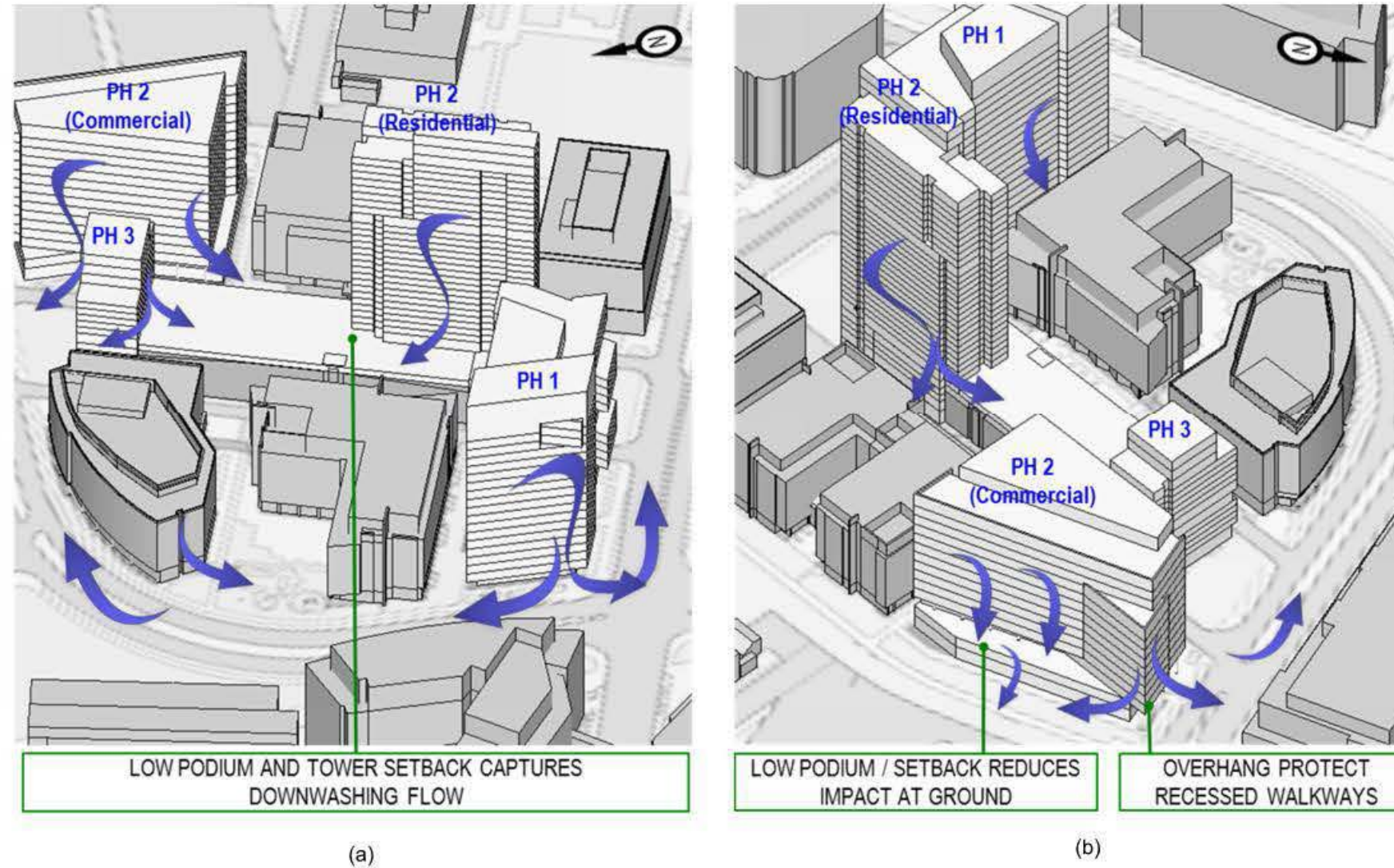


Image 5 – Predicted Wind Flow Patterns Around the Development

3.1 PEDESTRIAN WIND ASSESSMENT

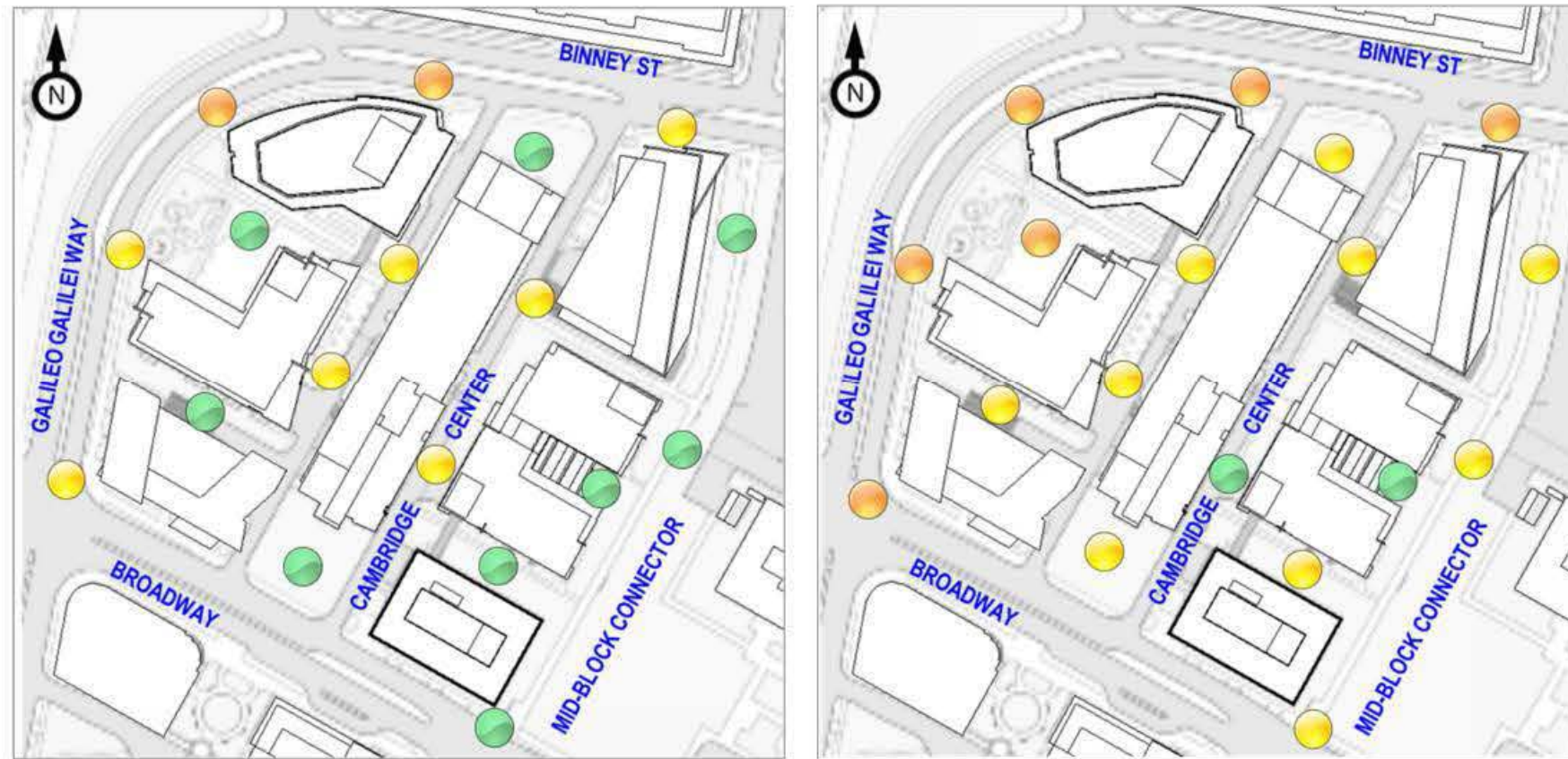
EXHIBITS

Pedestrian Wind Assessment
August 4, 2016

Kendall Square Master Plan
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Description of Wind Conditions:
 Low wind speeds comfortable for passive activities ● sitting or standing
 Moderate wind speeds comfortable for active pedestrians ● strolling or walking



(a) Summer
(Assuming Dense Street Landscaping)

(b) Winter
Assuming No Street Landscaping

Image 6 – Predicted Wind Conditions Around the Development

3.1 PEDESTRIAN WIND ASSESSMENT

EXHIBITS

Pedestrian Wind Assessment
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Kendall Square Master Plan
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(a) Canopies Above Entrance



(b) Wind Screens

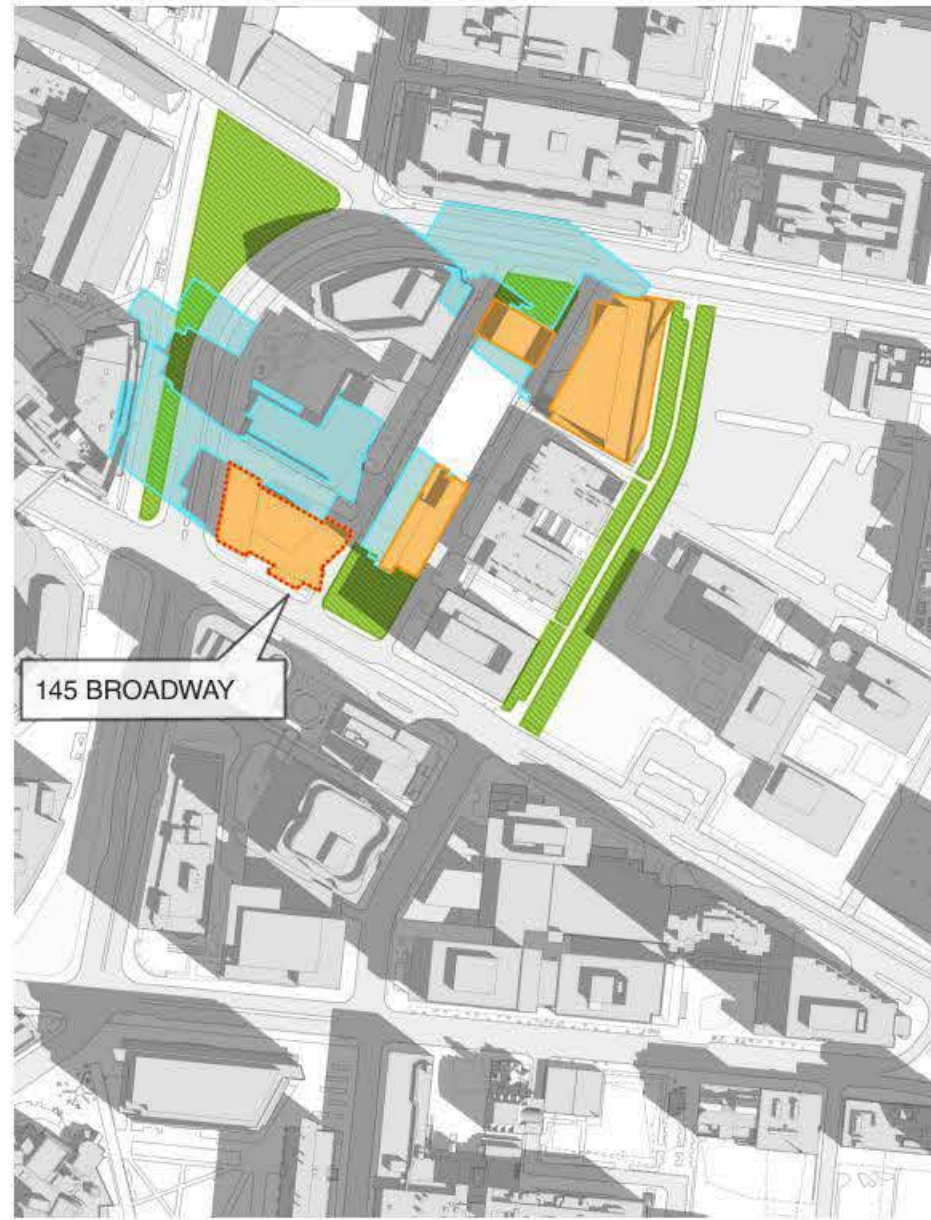
Image 7 – Examples of Wind Control Measures

3.2 SHADOW STUDY

145 BROADWAY

EQUINOX (MARCH 21 & SEPTEMBER 21)

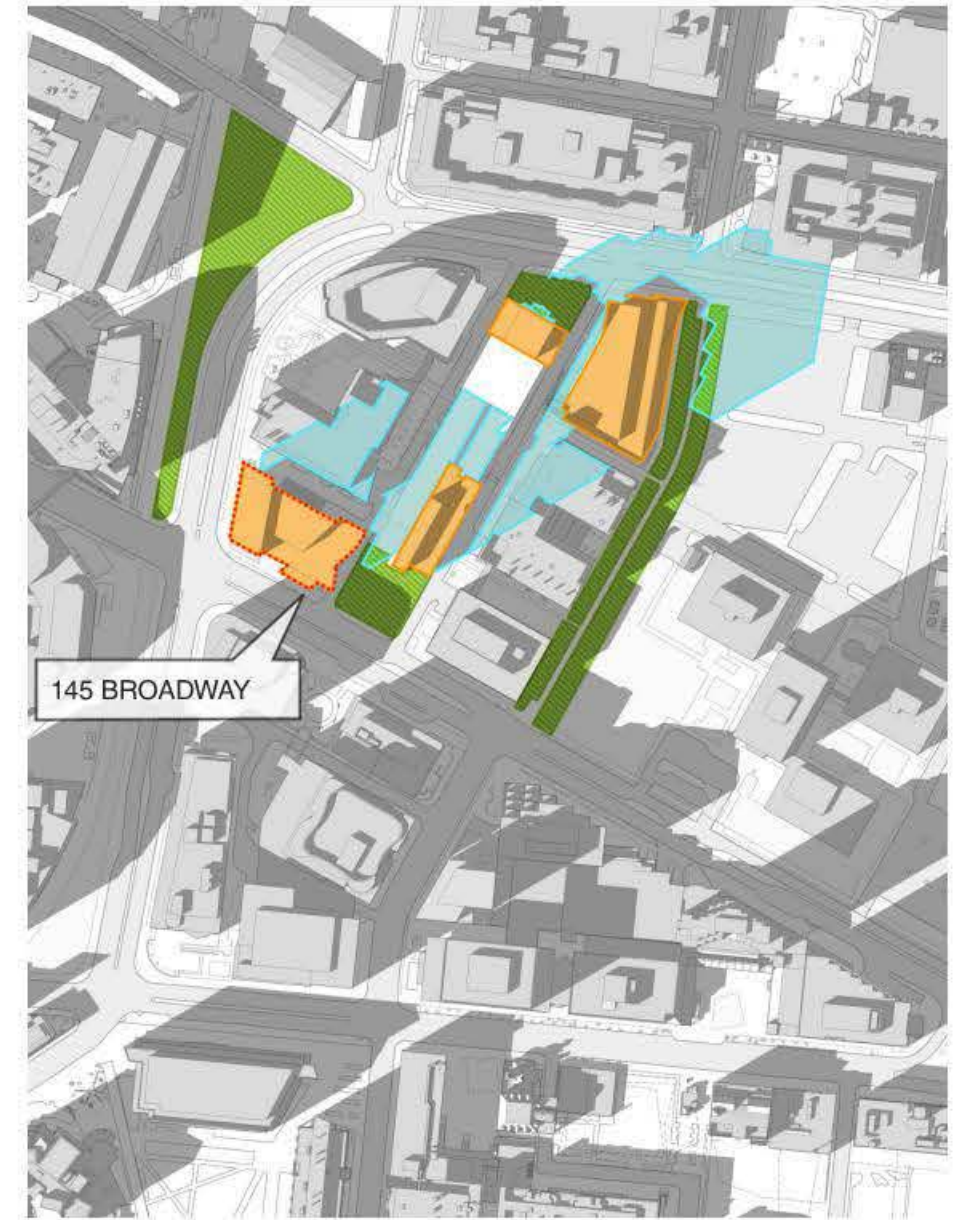
March 21 and September 21 are the Spring and Fall Equinoxes, respectively on which Cambridge experiences roughly equal length day and night.






MARCH 21, 9:00 AM



MARCH 21, 12:00 PM



MARCH 21, 3:00 PM

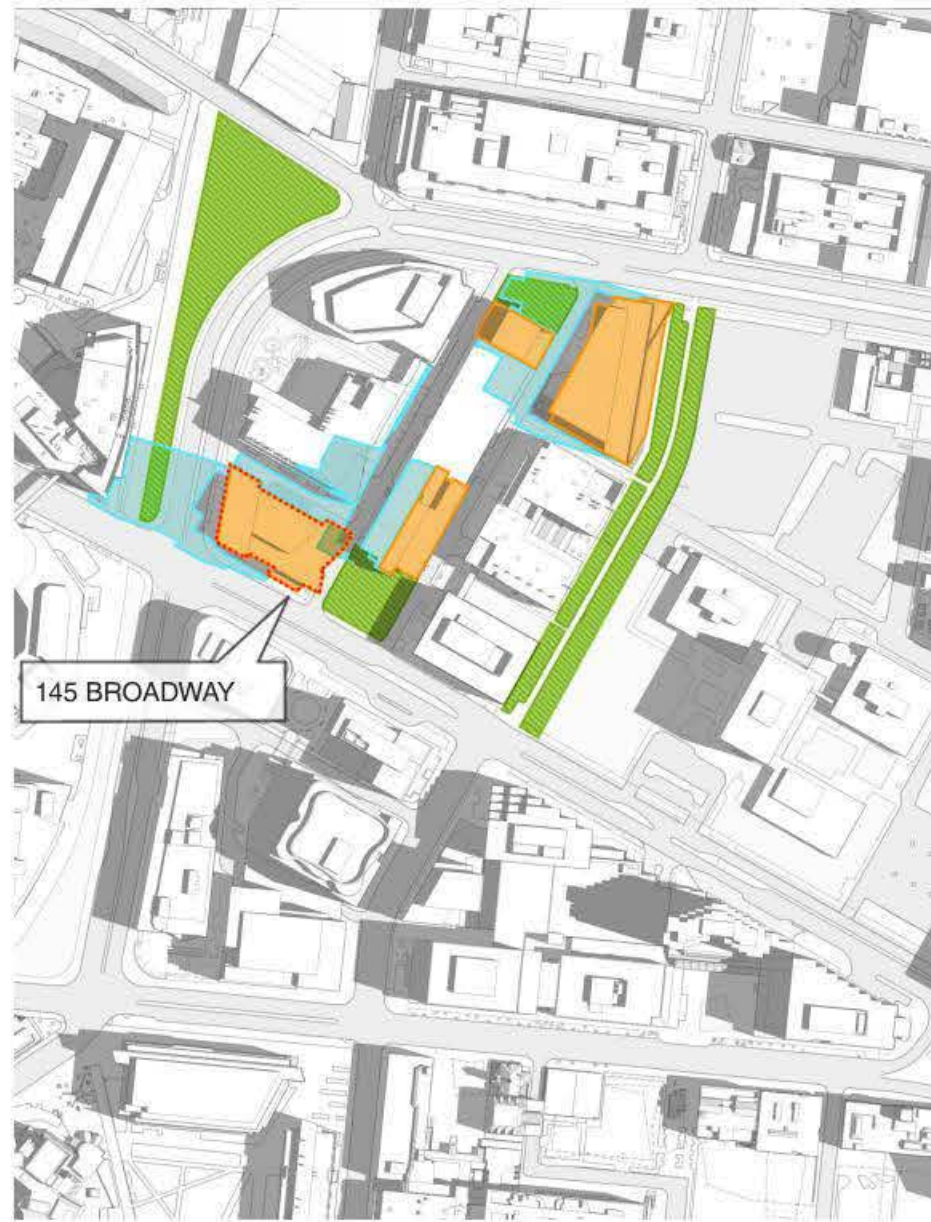
-  New Shadow
-  Existing Shadow
-  Proposed New Building

3.2 SHADOW STUDY

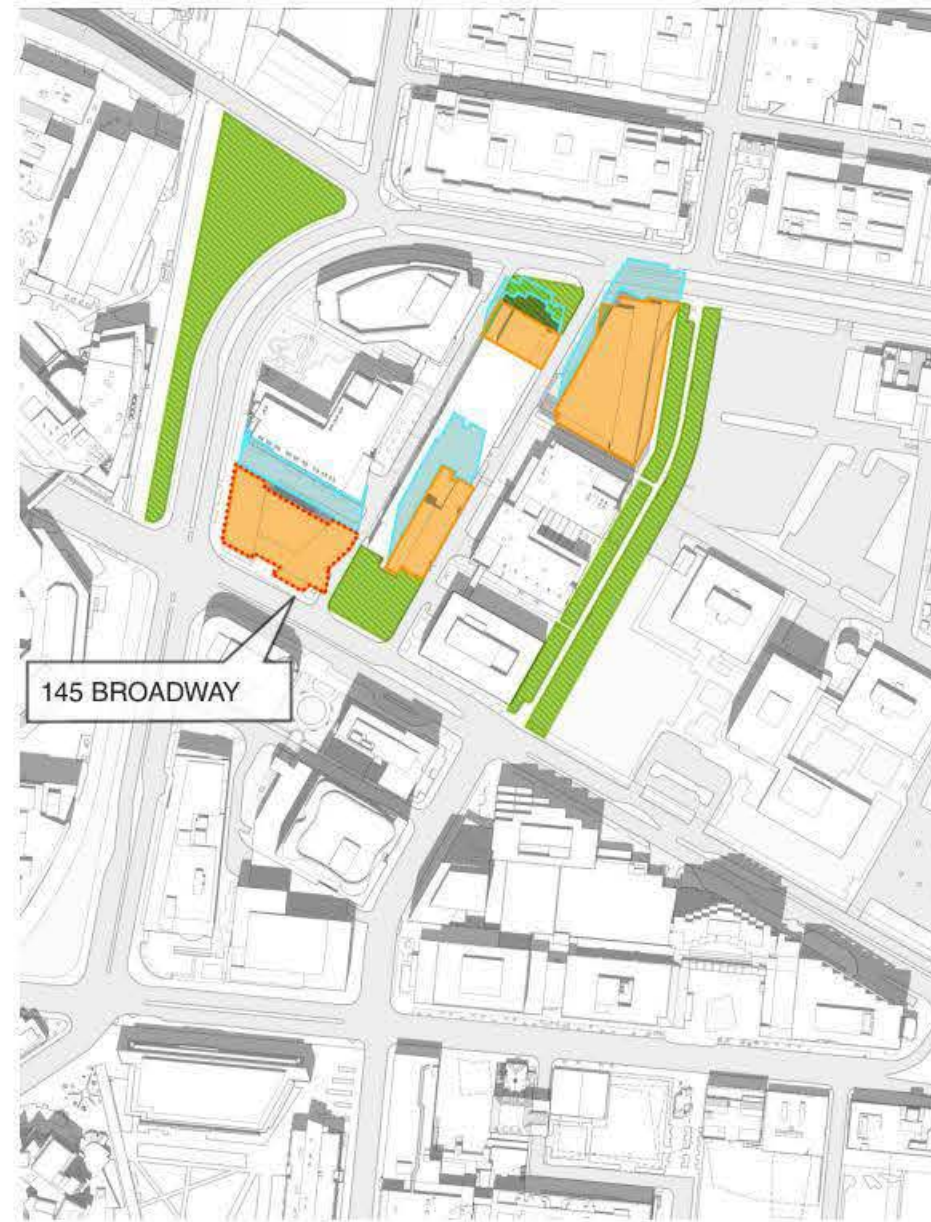
145 BROADWAY

SUMMER SOLSTICE (JUNE 21)

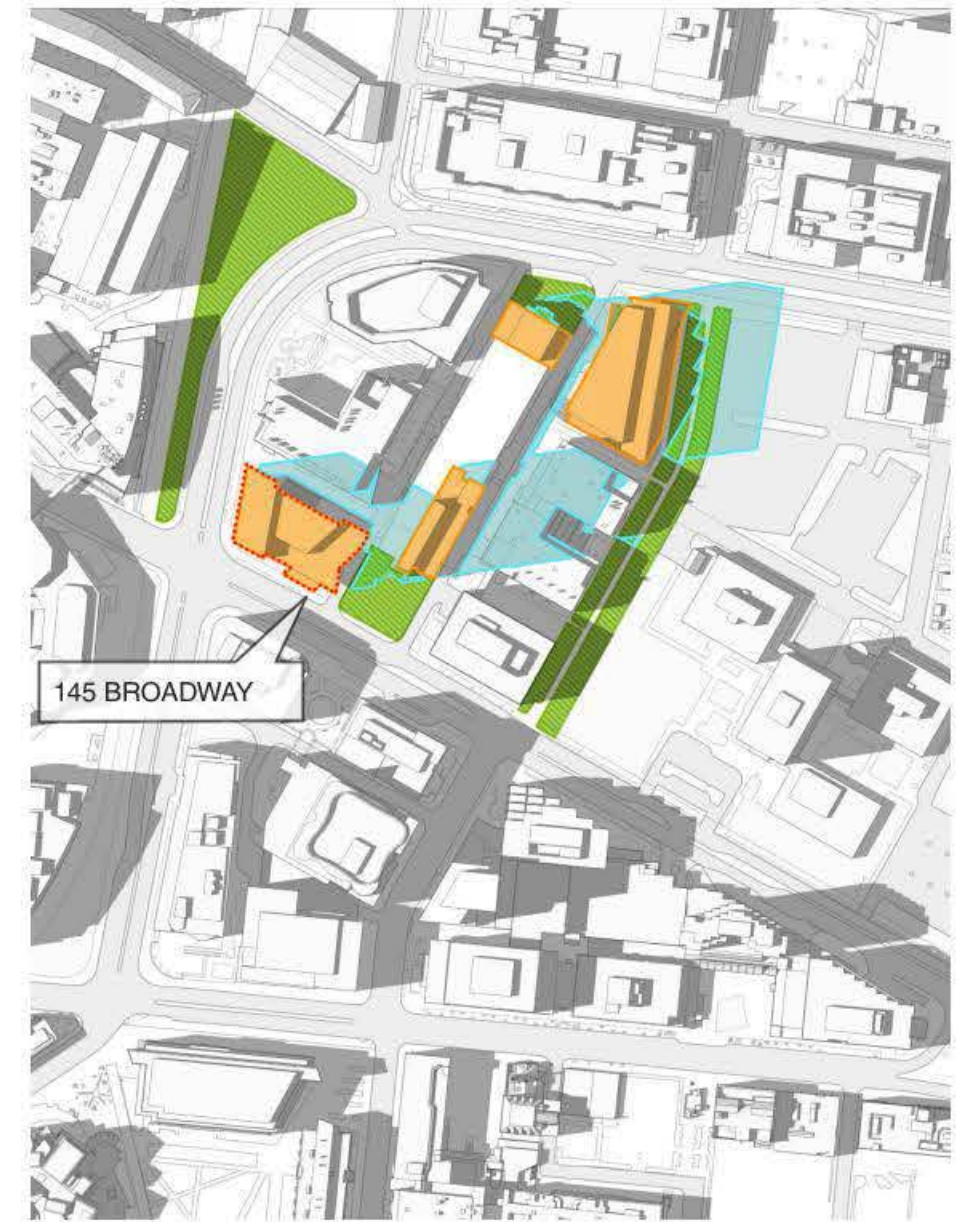
June 21 is the summer solstice with the longest day of the year with the least amount of net new shadow.






JUNE 21, 9:00 AM



JUNE 21, 12:00 PM



JUNE 21, 3:00 PM

-  New Shadow
-  Existing Shadow
-  Proposed New Building

3.2 SHADOW STUDY

145 BROADWAY

WINTER SOLSTICE (DECEMBER 21)

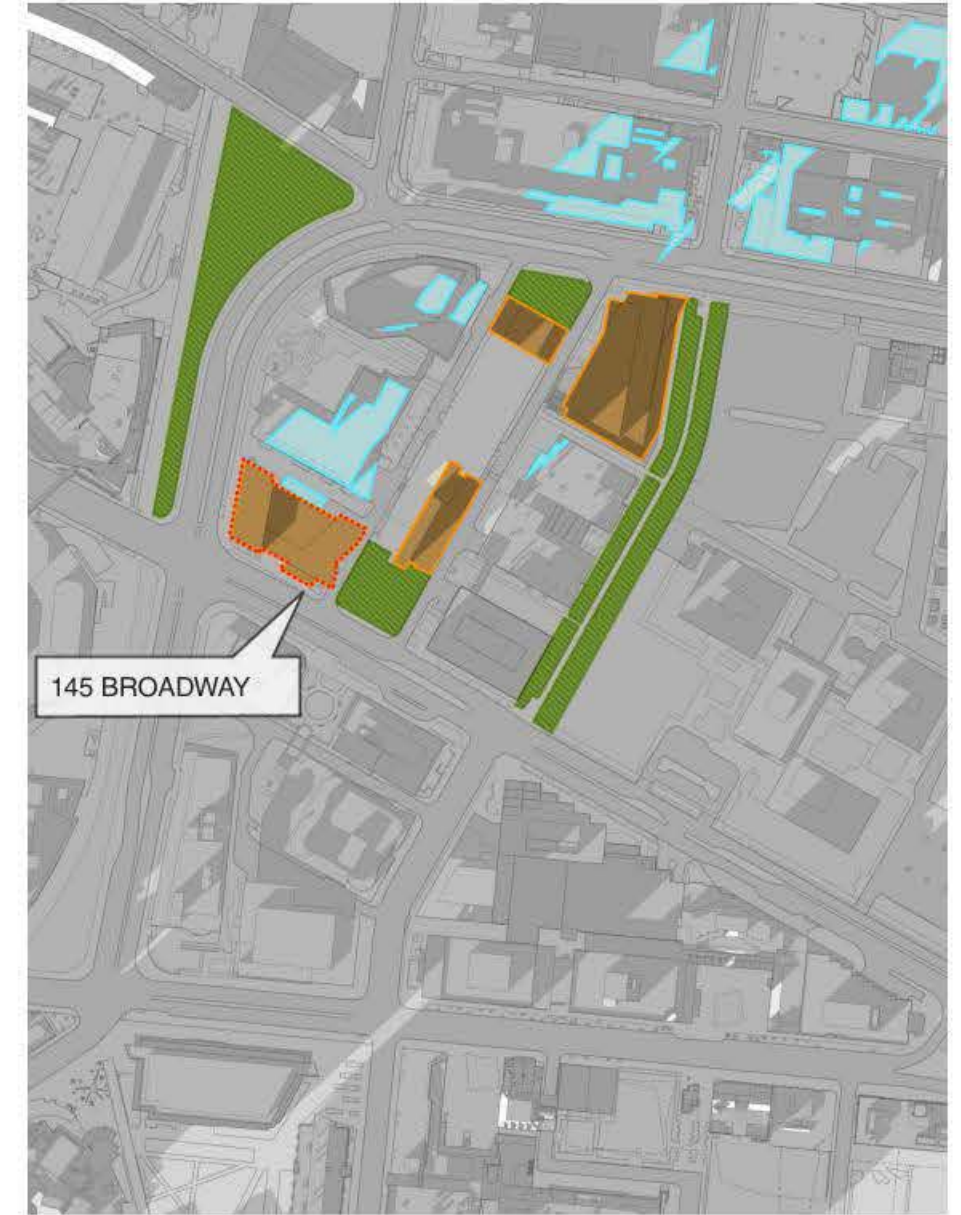
December 21 is the winter solstice and the shortest day of the year and, therefore, Cambridge experiences long shadows throughout the day in most locations.



DECEMBER 21, 9:00 AM



DECEMBER 21, 12:00 PM



DECEMBER 21, 3:00 PM

- New Shadow
- Existing Shadow
- Proposed New Building