3. Sustainabilty Narrative & LEED Scorecard

Kendall Square Initiative SoMa Site 2
Article 22 Submission
June 28, 2021
Revision September 23, 2021

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INTRODUCTION

MIT's Kendall Square Site 2 building is a high-performance laboratory/office building that will build upon the previous initiatives at MIT's Kendall Square Initiative. The Site 2 building design is in line with MIT's ambition to develop buildings that are highly energy-efficient, environmentally conscious, and healthy for occupants and visitors as well as MIT's ambition to enhance the community. The building program of the 13-story building includes retail/lobby spaces on the ground floor; an outdoor terrace; laboratory and office space; other back-of-house and support spaces; and 3 levels of underground parking.

The Site 2 project team has pursued an integrated design process that includes continuous participation from the technical experts to enhance and improve the overall design. This comprehensive approach allows the development to incorporate sustainability best practices in design and operation, stormwater capture and reuse, transportation, and landscape strategies.

While the Kendall Square Site 2 project was not explicitly mentioned in MIT's Fast Forward: MIT's Climate Action Plan for the Decade; ultimately, the building's design emphasis on efficiency and reduced carbon emissions will contribute to MIT's vision for a carbon neutral future.

The team is committed to ensuring that the Site 2 project is high-performing, that it meets the criteria for a Gold rating as required under the PUD-5 Zoning Requirements (Article 22) and that it achieves at least 60 credit points under LEED v4. Additionally, the project team has investigated opportunities to transition to an all-electric building design on Day-2. The energy studies performed show that the all-electric design would result in a 6-10% increase in annual operating cost, roughly 15% reduction in annual energy use, and about 2.5% decrease in annual greenhouse gas emissions compared to the Base Proposed Design.

Consistent with Section 22.25.1 of the Cambridge Zoning Ordinance, MIT has prepared this Green Building Report package to include the following:

- Green Building Checklist
- Green Building Rating System Narrative + Scorecard
- Net Zero Narrative
- Credentials of the Green Building Project's designated Green Building Professional and affidavit

Consistent with Section 22.25.2 of the Cambridge Zoning Ordinance, updated versions of these documents will be provided at time of building permit submission.

Green Building Project Checklist

Green Building Project Location: 200 Main Street, Cambridge, MA 02142

Applicant
Name: David Manfredi
Address: 25 Drydock Avenue, Floor 7, Boston, MA 02210
Contact Information
Email Address: dmanfredi@elkus-manfredi.com
Telephone #: 617 426 1300

Project Information (select all that apply):

- ✖ ☐ New Construction – GFA: 320.600 SF
- ☐ Addition – GFA of Addition: ______
- ☐ Rehabilitation of Existing Building – GFA of Rehabilitated Area: ______
  - ☐ Existing Use(s) of Rehabilitated Area: ______
  - ☐ Proposed Use(s) of Rehabilitated Area: ______
- ☐ Requires Planning Board Special Permit approval
- ☐ Subject to Section 19.50 Building and Site Plan Requirements
- ☐ Site was previously subject to Green Building Requirements

Green Building Rating Program/System:

- ✖ ☐ Leadership in Energy and Environmental Design (LEED) – Version: V4 Gold
  - ☐ Building Design + Construction (BD+C) – Subcategory: Core & Shell
  - ☐ Residential BD+C – Subcategory: ______
  - ☐ Interior Design + Construction (ID+C) – Subcategory: ______
  - ☐ Other: ______
- ☐ Passive House – Version: ______
  - ☐ PHIUS+
  - ☐ Passivhaus Institut (PHI)
  - ☐ Other: ______
- ☐ Enterprise Green Communities – Version: ______

Affidavit Form for Green Building Professional Special Permit

Green Building Project Location: Kendall Square Initiative SoMa Site 2, Cambridge MA 02142

Green Building Professional

Name: David Manfredi FAIA, LEED AP

☒ Architect

☐ Engineer

License Number: 5553

Company: Elkus Manfredi Architects Ltd

Address: 25 Drydock Avenue, Floor 7, Boston MA 02210

Contact Information

Email Address: dmanfredi@elkus-manfredi.com

Telephone Number: (617)426-1300

I, David Manfredi, as the Green Building Professional for this Green Building Project, have reviewed all relevant documents for this project and confirm to the best of my knowledge that those documents indicate that the project is being designed to achieve the requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.

(Signature) 6.25.21 *(Date)*

Attach either:

☒ Credential from the applicable Green Building Rating Program indicating advanced knowledge and experience in environmentally sustainable development in general as well as the applicable Green Building Rating System for this Green Building Project.

☐ If the Green Building Rating Program does not offer such a credential, evidence of experience as a project architect or engineer, or as a consultant providing third-party review, on at least three (3) projects that have been certified using the applicable Green Building Rating Program.

ELKUS | MANFREDI ARCHITECTS

June 28, 2021

City of Cambridge
795 Massachusetts Avenue
Cambridge MA 02139

Re: Kendall Square Initiative SOMA Site 2

Dear City of Cambridge:

As CEO and Founding Principal of Elkus Manfredi Architects, I am leading the planning and design of Kendall Square Initiative SOMA Site 2. I, David Manfredi, certify that I am knowledgeable of the project's green building strategies, designs, plans and details and to the best of my knowledge this project has been planned and designed to meet the prerequisites and earn the credits necessary to achieve Gold level (minimum of 60 points) using the LEED BD+C for Core and Shell and New Construction v4 Rating Systems. The referenced project is being planned to meet the Green Building Project requirements under Article 22 of the Cambridge Zoning Ordinance.

Sincerely,

David Manfredi FAIA, LEED AP
CEO & Founding Principal
Elkus Manfredi Architects Ltd.

ELKUS MANFREDI ARCHITECTS LTD
[address] 25 DRYDOCK AVENUE BOSTON MASSACHUSETTS 02210 [tel] 617.426.1300 [web] WWW.ELKUS-MANFREDI.COM

GREEN BUILDING RATING SYSTEM NARRATIVE + SCORECARD

The project will pursue the LEED v4 BD+C: Core and Shell (CS) rating system, which is tailored for buildings that include exterior shell and core mechanical, electrical, and plumbing units, without a complete interior fit-out within the project scope. MIT is committed to achieving LEED Gold certification which requires the project to earn all 12 prerequisites and at least 60 credit points.

The LEED Scorecard provided in the following section serves as a platform for tracking the project's targeted LEED strategies and credit status throughout design and construction. Currently, the LEED Appraisal indicates the following point breakdown:

- High probability: 77 points
- Medium probability: 16 points
- Low probability: 11 points
- Not possible: 7 points

LEED CREDIT NARRATIVE

The project will meet the LEED v4 CS Minimum Program Requirements and each of the required Prerequisites. All credit points described below are being pursued unless noted as a 'Maybe' credit or if it is determined that some of the credits currently under consideration would not be attainable.

With seventy-seven (77) LEEDv4 points in the 'high probability' category, the project exceeds well beyond the LEEDv4 Gold certification requirements. As the design progresses, the project team is committed to exploring opportunities to pursue additional credits under the Energy & Atmosphere, Water Efficiency, and Indoor Environmental Quality categories.

Integrative Process

Credit 1: Integrative Process [1 Point]

- The design team conducted a preliminary energy analysis and water budget before the completion of the Schematic Design (SD) phase, and both will be documented in the buildings' OPR & BOD.

Location & Transportation

The project is located on a previously developed site in urban Cambridge, close to several public transportation services including an MBTA transit stop and public bus services. Occupants shall have access to bicycle racks and showers, as well as electric vehicle charging stations.

Credit 1: LEED for Neighborhood Development Location [Not Possible]

- The site is not part of a LEED for Neighborhood Development, so this credit is not possible.

Credit 2: Sensitive Land Protection [2 Points]

- The project is located on a previously developed urban site in Cambridge.

Credit 3: High Priority Site [3 Points]

- A comprehensive site environmental survey will be conducted once the current building is demolished. Cleanup work will be pursued, as necessary, to remediate the site area in accordance with applicable laws and regulations.

Credit 4: Surrounding Density and Diverse Uses [6 Points]

- The project is in an urban area in the City of Cambridge. The surrounding density is greater than 35,000 sf/acre. The surrounding community is replete with housing, restaurants, shops, grocery stores, educational and religious institutions, performance venues, and other community amenities.

Credit 5: Access to Quality Transit [6 Points]

- The project site is located within 0.1-mile walking distance and easily accessible from the Kendall Square MBTA Station. Local bus routes connect the location to other areas of the community and Boston.

Credit 6: Bicycle Facilities [1 Point]

- Short-term and long-term bicycle parking will be provided for occupants and visitors. Shower facilities will be located in the building to serve full-time occupants. Site and roadway access will be provided to enhance the bicycle network already so prevalent in the City of Cambridge.

Credit 7: Reduced Parking Footprint [1 Point]

- The parking area has been designed to meet the code requirement, but with reduced capacity compared to the Institute of Transportation Engineers' Transportation Planning Handbook.

Credit 8: Green Vehicles [1 Point]

- The project will provide electric vehicle supply equipment (ESVE) in at least 5% of all parking spaces used by the project.

Sustainable Site

The team is taking a comprehensive approach to the site, landscape, habitat creation, stormwater management, and human use.

Prerequisite 1: Construction Activity Pollution Prevention [Required]

- The construction manager will follow best practice construction methods and submit and implement an Erosion and Sedimentation Control (ESC) Plan for construction activities related to the construction of this project. The ESC Plan shall conform to the erosion and sedimentation requirements of the 2012 EPA Construction General Permit and specific municipal requirements for the City of Cambridge.

Credit 1: Site Assessment [1 Point]

- The civil and landscape team have conducted a comprehensive site survey to study topography, hydrology, climate, vegetation, soils, human use, and human health effects to achieve credit requirements.

Credit 2: Site Development: Protect or Restore Habitat [2 Points]

- The credit intends to restore damaged areas to provide habitat and promote biodiversity. The team is designing the project's landscape using native or adapted vegetation to meet credit requirements.

- More than 30% of the total site area is designated for pedestrian-oriented open space. The outdoor space will enhance the landscape while providing significant services and a thriving community.

Credit 4: Rainwater Management [2 Points + 1 Maybe Point]

- The current design for stormwater management retains the 85th percentile rain event using the Kendall SoMa district system. The design team is considering a combination of green infrastructure strategies such as permeable pavers, catchment basins to manage 90th percentile rain events in combination with the Kendall SoMa district system.

Credit 5: Heat Island Reduction [1 Point + 1 Maybe Point]

- Roofs have been designed with high-albedo materials to reflect heat and mitigate urban heat island effects. Trees and shading elements are being optimized to further reduce heat island effects on hardscape areas. All parking is located below grade.

Credit 6: Light Pollution Reduction [1 Point]

- All exterior luminaires have been carefully selected and designed to improve nighttime visibility and to avoid light pollution.

Credit 7: Tenant Design and Construction Guidelines [1 Point]

- The project will provide Tenant Design and Construction Guidelines for future building tenants. The guidelines will outline the sustainable design and energy efficiency measures implemented in the core and shell building and provide detailed guidance for the tenants to design and build in alignment with the project sustainability goals.

Water Efficiency

The project will specify low-flow and low-flush plumbing fixtures to achieve Water Efficiency.

Prerequisite 1 and Credit 1: Outdoor Water Use Reduction [2 Points + 1 Maybe Point]

- The target reduction of outdoor water use will be achieved by native/adapted plants with low water demand, as well as an efficient irrigation system.

Prerequisite 2 and Credit 2: Indoor Water Use Reduction [2 Points + 2 Maybe Points]

- The project includes 100% gender-neutral restrooms. The project team is considering various options of high efficient flow and flush fixtures. The project will achieve more than 30% indoor water use reduction and install WaterSense labeled equipment.

Prerequisite 3 and Credit 4: Water Metering [1 Point]

- The project will install water meters to measure and evaluate water consumption. Beyond the whole building water metering, the project will install permanent water meters for two or more water subsystems to achieve the credit.

Credit 3: Cooling Tower Water Use [1 Point]

- The design team has conducted potable water analysis for cooling towers installed in the project. This will conserve water used for cooling tower makeup while controlling microbes and corrosion in the condenser water system.

Energy and Atmosphere

The building systems shall be designed to optimize energy performance and will not use refrigerants that are harmful to the environment. Commissioning agents will be engaged to confirm the building systems are installed and function as intended and designed.

Prerequisite 1 and Credit 1: Fundamental and Enhanced Commissioning and Verification [6 Points]

- The project will engage a commissioning agent (CxA) and develop and perform fundamental commissioning. The scope of work will also include the enhanced commissioning requirements for the building systems. The CxA's will review the owner's project requirements and the basis of design, develop and implement a commissioning plan, review the project documents, and perform commissioning of installed HVAC, lighting, lighting controls, and domestic hot water systems. Additionally, monitoring-based commissioning and envelope commissioning will be pursued..

Prerequisite 2 and Credit 2: Energy Performance [14 Points + 1 Maybe Point]

- The project team is using a whole building energy model to assess the annual predicted energy use. The current model demonstrates that the project meets the minimum, 5% improvement by annual energy cost compared to the Baseline case. The design is targeting 14-15 credit points by selecting efficient building systems and a high-performance building envelope.

Prerequisite 3 and Credit 3: Energy Metering [1 Point]

- Meters will be installed to provide data on total energy consumption. When applicable, sub-meters will be installed for tenant spaces to independently meter energy consumptions for advanced energy metering.

Credit 4: Demand Response [Not Possible]

- Credit is not anticipated.

Credit 5: Renewable Energy Production [1 Point]

- The design includes 7,282 square feet of façade integrated solar panels (nearly 120 KW capacity) to generate on-site electricity that will offset more than 1% of the building's estimated annual energy cost, achieving at least 1 point.

Credit 6: Enhanced Refrigerant Management [1 Point]

- The design team will select refrigerants that are used in mechanical systems to minimize the emission of compounds that contribute to ozone depletion and climate change.

Credit 7: Green Power and Carbon Offsets [2 Maybe Points]

- A primary strategy for this project will be a reduction in energy consumption. MIT will consider green power purchasing if other LEED credits are necessary to achieve the target certification rating.

Materials and Resources

Healthy building objectives encourage building design and construction to examine materials and avoid the use of hazardous chemicals. This will be aligned with credit requirements in the LEED Materials and Resources category.

Prerequisite 1: Storage & Collection of Recyclables [Required]

- The current design includes designated areas for the collection and storage of recyclable materials, including mixed paper, corrugated cardboard, glass, plastics, and metals.

Prerequisite 2: Construction and Demolition Waste Management Planning [Required]

- The construction team will develop a construction and demolition waste management plan to reduce waste disposed of in landfills by recovering, reusing, and recycling materials.

Credit 1: Building Life-Cycle Impact Reduction [1 Point + 2 Maybe Points]

- The design team has performed a preliminary whole building life-cycle assessment of the project building's structure and enclosure to optimize the environmental performance of products and materials using the OneClick LCA tool.In the Construction Phase, the team will consider cement replacement of concrete, recycled steel opportunities, and potential low-impact façade systems to further reduce the project's embodied carbon and life cycle impact

Credit 2: Building Product Disclosure & Optimization: Environmental Product Declarations [1 Point]

- The credit requires the use of at least 10 different products (under v4.1 CS) with environmental product declarations. The team will specify products following the credit requirements.

Credit 3: Building Product Disclosure & Optimization: Sourcing of Raw Materials [1 Maybe Point]

- This credit encourages selecting products verified to have been extracted or sourced responsibly. The team will specify products following the credit requirements.

Credit 4: Building Product Disclosure & Optimization: Material Ingredients [1 Point + 1 Maybe Point]

- The credit requires using at least 10 different products (under v4.1 CS) that demonstrate the chemical inventory of the product, such as Health Product Declaration (HPD), Cradle to Cradle, and Declare. The team will specify products following the credit requirements.

Credit 5: Construction & Demolition Waste Management [1 Point + 1 Maybe Point]

- The construction team will reduce waste disposed of in landfills by recovering, reusing, and recycling materials, with at least 50% diversion from landfills with 2 material streams. The design team will review feasibility of achieving 75% waste diversion from landfill, pending regional waste hauling practices at the time of construction. As the project moves into the Construction Phase, the design team will continue to investigate opportunities to maximize the demolition waste diversion rate beyond the 50% minimum threshold required for the credit.

Indoor Environmental Quality

The building occupants will be able to maintain a comfortable environment through enhanced air quality and access to thermal and lighting controls.

Prerequisite 1 and Credit 1: Indoor Air Quality Strategies [2 Points]

- The building mechanical systems will be designed following ASHRAE 62.1 requirement to supply the minimum required ventilation air for occupants. The project will provide entryway systems, MERV 13 filters, and proper exhausts to avoid contamination from exterior particulates and prevent interior cross-contamination. The project will provide CO_2 monitoring as an additional enhanced IAQ strategy.

Prerequisite 2: Environmental Tobacco Smoke (ETS) Control [Required]

- Smoking will be prohibited inside the building and within 25 ft of any entrances or air intakes.

Credit 2: Low-Emitting Materials [2 Points + 1 Maybe Point]

- The credit is aligned with the Materials and Resources category. The design team will specify compliant materials with low VOC emissions.

Credit 3: Construction IAQ Management Plan [1 Point]

- Building construction teams will develop and implement indoor air quality (IAQ) management plan for the construction and preoccupancy phases to minimize any IAQ problems associated with construction.

Credit 4: Daylight [Not possible]

- Daylight analysis helped inform the envelope design for adequate daylighting and visual comfort. The project achieves the daylight threshold requirements outlined by LEED for at least 55-75% of the regularly occupied floor area. Blinds will be furnished and installed by the tenant and the core and shell building credit is not possible for this reason.

Credit 5: Quality Views [1 Point]

- The building will provide quality views for 75% of the regularly occupied building floor area. The quality views out of the building will include landscaped areas, sky, pedestrian walkways, the Charles River, the Boston skyline, and/or streetscapes.

Innovation

The project team has identified potential Innovation credits which are listed below.

Credit 1: Green Building Education [1 Point]

- The project will take advantage of the educational value of the green building features of a project and provide a comprehensive Green Education program. The team will explore incorporating signage programs, case studies, or educational outreach programs/tours.

Credit 2 and 3: O+M Starter Kit [1 Point + 1 Maybe Point]

- Green housekeeping is a recommended best practice. The team will discuss establishing the following policies as applicable: Site Management Policy; Purchasing and Waste Policy; Maintenance and Renovations Policy; Green Cleaning Policy; Integrated Pest Management.

Credit 4: Purchasing – Lamps [1 Point]

- This innovation credit will be earned by specifying low-mercury lighting which reduces the toxicity of waste streams.

Credit 5: Integrated Analysis of Building Materials (Pilot Credit) [1 Point]

- The team will specify three different permanently installed products that have a documented qualitative analysis of potential health, safety, and environmental impacts of the product over its life cycle.

Credit 6: LEED Accredited Professional [1 Point]

- As many members of the team are LEED Accredited Professionals (AP), a LEED AP will provide administrative services to oversee the LEED credit documentation process.

Regional Priority Credits

Regional Priority Credits (RPC) are established LEED credits designated by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs an additional credit is awarded to the project. The credits applicable to the City of Cambridge region include Rainwater management, Optimize energy performance, Building life-cycle impact reduction, Indoor water use reduction, Renewable energy production, and High priority site. This project anticipates the achievement of three RPCs: High priority site; Rainwater Management; Optimized energy performance.

LEED v4 for BD+C: Core & Shell
MIT Site 2
last updated: 09/20/2021

Achievability			
high	med	low	NP
77	16	11	7
80	Projected Pts		

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 or more points
Achievability rating: High = 90%, Med = 60%, Low = 10%, NP = not possible.

high	med	low	NP	Credit	Name	Standard	Phase
1					**Integrative Process**	Standard	Phase
1				IP Credit 1	Integrative Process	Perform preliminary energy model and water budget before the completion of SD and document in OPR & BOD.	Design
20	0	0	0		**Location & Transportation**	Standard	Phase
			20	LT Credit 1	LEED for Neighborhood Development Location	Locate the project in within a development certified under LEED for Neighborhood Development.	Design
2				LT Credit 2	Sensitive Land Protection	Locate the development footprint on land that has been previously developed - OR - does not meet LEED criteria for sensitive land (prime farmland, floodplains, habitat for threatened species, near water bodies, in or near wetlands).	Design
3				LT Credit 3	High Priority Site	Locate the project on an infill site in historic district (2pt) - OR - site with priority designation (2pt) - OR - brownfield site where contaminated soil/groundwater remediation is required (3pts).	Design
6				LT Credit 4	Surrounding Density and Diverse Uses	Locate on a site with an existing density of 22,000sf/acre - 35,000 sf/acre and within 1/2 mile of 4-8 basic services.	Design
6				LT Credit 5	Access to Quality Transit	Locate project within 1/2 mile of a rail station or ferry terminal that meets min. daily transit service - OR - 1/4 mile of bus, streetcar or rideshare that meets min. daily transit service.	Design
1				LT Credit 6	Bicycle Facilities (v4.1)	Provide short term (2.5% peak visitors) and long term (5% all regular occupants) bike parking within 200ft (short term) of any main entrance and 300 ft (long term) of any functional entry, FTE showers, and access to bicycle network.	Design
1				LT Credit 7	Reduced Parking Footprint (v4.1)	1) Provide no off-street parking (1pt) OR 2) Provide parking capacity below base ratios determined by ITE Planning Handbook by 30% (1pt) OR 3) Provide dedicated parking for carshare vehicles (1pt) OR 4) Sell parking separately from all property sales or leases/implement a daily parking fee at a cost, equal to or greater than the daily cost of municipal public transit (1pt).	Design
1				LT Credit 8	Electric Vehicles (v4.1)	Provide electric vehicle supply equipment (EVSE) for 2% (or 2 spaces, whichever is greater) of parking spaces OR make 6% of parking spaces (or at least 6 spaces) EV ready for future use.	Design
9	2	0	0		**Sustainable Sites**	Standard	Phase
Y				SS Prereq 1	Construction Activity Pollution Prevention	Create and implement erosion control plan that meets the 2003 EPA Construction General Permit.	Construction
1				SS Credit 1	Site Assessment	Complete comprehensive site survey; topography, hydrology, climate, vegetation, soils, human use and human health effects.	Design
2				SS Credit 2	Site Development: Protect or Restore Habitat (v4.1)	Protect 40% of greenfield area, restore soils, and restore 25% of previously developed site with native/adapted plants (2pts) - OR - provide $0.20/sf to accredited land trust (1pt).	Design
1				SS Credit 3	Open Space (v4.1)	Provide outdoor space greater than or equal to 30% of the total site area (including building footprint), with min. 25% planted with two or more types of vegetation. Green roofs can be used toward the vegetation requirement.	Design
2	1			SS Credit 4	Rainwater Management (v4.1)	Retain runoff for the 80th percentile (1pt) or 85th percentile (2pts) or 90th percentile (3pts) using low-impact development (LID) and green infrastructure (structural or non-structural). For zero lot line, reduce the rainfall event for the 70th percentile (1pt), 75th percentile (2pts) or 80th percentile (3pts).	Design
1	1			SS Credit 5	Heat Island Reduction	Meet high albedo requirements for roof and site (2pts) - OR - place a minimum of 75% parking under cover (1pt).	Construction
1				SS Credit 6	Light Pollution Reduction	Meet uplight and light trespass requirements, and do not exceed exterior signage luminance requirements.	Design
1				SS Credit 7	Tenant Design and Construction Guidelines	Publish an illustrated document to educate tenants in implementing sustainable design and construction features in their tenant improvement build-outs.	Construction
6	3	1	2		**Water Efficiency**	Standard	Phase
Y				WE Prereq 1	Outdoor Water Use Reduction: 30%	Reduce outdoor water use by 30% over the baseline specified in LEED.	Design
Y				WE Prereq 2	Indoor Water Use Reduction: 20%	Reduce indoor water use by 20% over the baseline specified in LEED, use fixtures with WaterSense label, and meet requirements for process water use.	Design
Y				WE Prereq 3	Building-Level Water Metering	Install permanent water meters for building and grounds, and commit to share data with USGBC for 5 years.	Design
2	1			WE Credit 1	Outdoor Water Use Reduction (v4.1): 50% / 75% /100% Reduction	Reduce potable water used for irrigation by 50% (1pt) / 75% (2 pts) / 100% (3 pts)	Design
2	2		2	WE Credit 2	Indoor Water Use Reduction: 25% / 30% / 35% / 40% / 45% / 50%	Reduce building water use over LEED baseline.	Design
1		1		WE Credit 3	Cooling Tower Water Use	Conduct a water analysis to optimize cooling tower cycles. Maximizing cycles (1pt), >10 cycled or 20% non-potable water use (2pts).	Design
1				WE Credit 4	Water Metering	Install permanent water meters for two or more water subsystems.	Design
23	3	6	1		**Energy & Atmosphere**	Standard	Phase
Y				EA Prereq 1	Fundamental Commissioning and Verification	Engage commissioning agent by end of DD, develop and execute a commissioning plan, and prepare O&M plan for current facilities.	Construction
Y				EA Prereq 2	Minimum Energy Performance	Reduce energy cost by 2%, compared to ASHRAE 90.1-2010, Appendix G; meet mandatory provisions of ASHRAE 90.1-2010. -OR Comply with HVAC and service water heating requirements for the climate zone in ASHRAE 50% Advanced Energy Design Guide, and meet ASHRAE 90.1-2010 mandatory and prescriptive provisions.	Design
Y				EA Prereq 3	Building-Level Energy Metering	Install meters to provide data on total energy consumption, and commit to share data with USGBC for 5 years.	Design
Y				EA Prereq 4	Fundamental Refrigerant Management	Eliminate CFCs in building HVAC&R, and complete CFC phase-out conversion before project completion for any CFC equipment to remain.	Design
6				EA Credit 1	Enhanced Commissioning	Complete CD review, post occupancy review, and recommissioning manual (3pts), and develop monitoring procedures (+1pt) - AND/OR - complete envelope Cx (+2pts)	Construction
3				EA Credit 2	Optimize Energy Performance: 3% / 5% / 7%	Reduce building energy cost by 3% / 5% / 7% compared to ASHRAE 90.1-2010, Appendix G.	Design
3				EA Credit 2	Optimize Energy Performance: 9% / 11% / 13%	Reduce building energy cost by 9% / 11% / 13% compared to ASHRAE 90.1-2010, Appendix G.	Design
3				EA Credit 2	Optimize Energy Performance: 15% / 17% / 19%	Reduce building energy cost by 15%/ 17%/ 19% compared to ASHRAE 90.1-2010, Appendix G.	Design
3				EA Credit 2	Optimize Energy Performance: 21% / 23% / 26%	Reduce building energy cost by 21% / 23% / 26% compared to ASHRAE 90.1-2010, Appendix G.	Design
2	1			EA Credit 2	Optimize Energy Performance: 29% / 32% / 35%	Reduce building energy cost by 29%/ 32%/ 35% compared to ASHRAE 90.1-2010, Appendix G.	Design
		2	1	EA Credit 2	Optimize Energy Performance: 39% / 43% / 47%	Reduce building energy cost by 39%/ 43%/ 47% compared to ASHRAE 90.1-2010, Appendix G.	Design
1				EA Credit 3	Advanced Energy Metering	Install meters for tenant spaces to independently meter energy consumptions for all systems dedicated to tenant space, with minimum of one meter per energy source per floor. Install advanced metering for base-building energy sources, per reference guide.	Design
		2		EA Credit 4	Demand Response	Design building and equipment for participation in demand response programs through load shedding or shifting (2pts) - OR - if DR program not available, provide infrastructure for future (1pt).	Construction
1		2		EA Credit 5	Renewable Energy Production: 1% / 3% / 5%	Produce renewable energy on-site for 1% / 3% / 5% of building energy consumption, calculated by cost.	Design
1				EA Credit 6	Enhanced Refrigerant Management	Select refrigerants with low global warming potential and ozone depletion potential.	Construction
	2			EA Credit 7	Green Power and Carbon Offsets	Engage a 5 year contract for at least 50% or 100% of the project's energy from green power, carbon offsets, or RECs.	Construction

4	5	2	3	Materials & Resources		Standard	Phase
Y				MR Prereq 1	Storage & Collection of Recyclables	Provide space for the collection and storage of paper, cardboard, glass, plastic, metals, and at least two of the following: batteries, mercury-containing lamps, and electronic waste.	Design
Y				MR Prereq 2	Construction and Demolition Waste Management Planning	Develop and implement a construction and demolition waste management plan.	Construction
1	2		3	MR Credit 1	Building Life-Cycle Impact Reduction (v4.1)	Option 1: Maintain existing building structure, envelope, and interior nonstructural elements of a historic building (5pts).- OR - Option 2: Renovate an Abandoned or Blighted Building (5 pts) OR Option 3: Path 1 Maintain a combination of structural and non-structural elements (25%/50%/75%) (2pt/3pt/4pt) OR Path 2a - maintain existing walls, floors and roofs (25%/50%/75%) (1pt/2pt/3pt) OR Path 2b - Maintain interior non-structural elements (1pt) OR Option 4: Whole-building life-cycle assessment. Path 1 (1pt) (conduct a LCA of the structure and enclosure), Path 2 (2pts) (conduct a LCA of the projects structure and enclosure demonstrating a min. 5% reduction in at least 3 of the 6 categories (one must be GWP), Path 3 (3pts) (conduct a LCA of the structure and encloser demonstrating a 10% reduction, Path 4 (4pts) (demonstrate a 20% reduction for GWP and 10% reduction in two other impact categories.)	Construction
1		1		MR Credit 2	Building Product Disclosure & Optimization (v4.1): Environmental Product Declarations	C&S: Use 10 products sourced from three different manufacturers that meet disclosure criteria (1pt) : LCA and EPD is 1 product, Product Specific Type III EPD is 1 product, Industry-wide Type III EPD with 3rd party certification is 1 product, Product specific type III EPD are 1.5 products - AND/OR - use products that exhibit optimized performance 10% by cost (1 pt.) or 10 products from 3 different manufacturers through a Life Cycle Impact Reduction Action Plan, Life Cycle Impact Reductions in Embodies Carbon or any of the 6 impact categories.	Construction
	1	1		MR Credit 3	Building Product Disclosure & Optimization (v4.1): Sourcing of Raw Materials	Use products sourced that meet at least one responsible sourcing and extraction criteria (extended producer responsibility and/or take-back program (50%), bio-based materials (50%-100%), FSC certified wood products (100%), material reuse (200%), recycled content (100%)) for at least 20% from at least 3 different manufacturers (1 pt.) / or 40% from at least 5 manufacturers of the total materials cost (2pts).	Construction
1	1			MR Credit4	Building Product Disclosure & Optimization (v4.1): Material Ingredients	C&S: Use 10 products sourced from three different manufacturers that demonstrate the chemical inventory of the products (1pt) - AND/OR - use products from at least three different manufacturers that document their material ingredient optimization by 10% material cost or 10 compliant programs (1pt) through a Material Ingredient Screening and Optimization Action Plan, Advanced Inventory & Assessment or Material Ingredient Optimization	Construction
1	1			MR Credit 5	Construction & Demolition Waste Management (v4.1)	Divert 50%, two material streams (1pt) OR - 50% using Certified Commingled Recycling Facility (1 pt) - OR - 75%, three material streams (2pts), - OR Divert 75% using commingled facilities and 1 more material stream (2pts) - OR- generate less than 2.5 lbs waste/sf (2pts)	Construction
6	1	2	1	Indoor Environmental Quality		Standard	Phase
Y				EQ Prereq 1	Minimum IAQ Performance	For mechanically ventilated spaces: Meet minimum outdoor air intake flow requirements determined by ASHRAE 62.1-2010 ventilation rate procedure, meet sections 4 through 7 of ASHRAE 62.1-2010, and monitor outdoor air intake flows. For naturally ventilated spaces: Meet minimum outdoor air opening and space configuration requirements determined by ASHRAE 62.1-2010 natural ventilation procedure; confirm natural ventilation is effective per CIBSE Applications Manual AM10, March 2005 Fig. 2.8.; and meet one of the following: measure exhaust airflow; provide automatic indication devices on natural ventilation openings; or monitor CO2 concentrations.	Design
Y				EQ Prereq 2	Environmental Tobacco Smoke (ETS) Control	Prohibit smoking inside building, locate exterior smoking areas at least 25 feet away from building, and post no-smoking signage within 10 ft of all building entrances.	Design
2				EQ Credit 1	Enhanced Air Quality Strategies	Provide entryway systems, prevent interior cross-contamination, and specify MERV 13 filters (1pt) - AND/OR - prevent exterior contamination or increase ventilation or monitor CO2 (1pt).	Design
2	1			EQ Credit 2	Low-Emitting Materials (v4.1): 2 / 3 / 4 / 5 categories	Achieve the threshold level of compliance with VOC emissions and content standards for 2, 3, 4 or 5 product categories 1-3 pts + exemplary.	Construction
1				EQ Credit 3	Construction IAQ Management Plan	Develop an IAQ plan for construction and preoccupancy phases that meets SMACNA IAQ Guidelines for Occupied Buildings Under Construction.	Construction
		2	1	EQ Credit 4	Daylight (v4.1): 40% / 55% / 75%	Option 1: Meet spatial daylight autonomy and annual sunlight exposure requirements as defined in IES LM-83-12 for each regularly occupied space through simulation. The average sDA value for the floor area is at least 40% (1pt), 55% (2pts), 75% (3pts) or each reg. occup. space achieves sDA of at least 55% (exemplary performance) - OR - Option 2: Simulation Illuminance Calculation - meet illuminance level requirements for percentage 55% (1pt), 75% (2pts), 90% (3pts) of regularly occupied floor area through simulation or Option 3: Measurement 55% at 1 time (1pt), 75% at 2 times (2pts), 90% at 2 times (3pts).	Design
1				EQ Credit 5	Quality Views	Provide direct views to the outside that meet 2 out of 4 LEED view criteria in 75% of regularly occupied spaces.	Design
5	1	0	0	Innovation		Standard	Phase
1				IN Credit 1.1	Innovation in Design, Green Building Education	Provide comprehensive Green Education program and signage.	Construction
1				IN Credit 1.2	Innovation in Design, O+M Starter Kit	Green Cleaning Policy + Integrated Pest Management	Construction
	1			IN Credit 1.3	Innovation in Design, O+M Starter Kit (2nd point)	Site Management -OR- Ongoing Purchasing and Waste -OR- Facility Maintenance and Renovations Policy	Construction
1				IN Credit 1.4	Innovation in Design, Purchasing - lamps	Implement the lighting purchasing plan to limit mercury content.	Construction
1				IN Credit 1.5	Innovation in Design, Integrated Analysis of Building Materials (Pilot Credit)	Specify and install at least 3 compliant materials	Construction
1				IN Credit 2	LEED™ Accredited Professional	LEED Accredited Professional on design team.	Construction
3	1	0	0	Regional Priority		Standard	Phase
1				RP Credit 1.1	Regional Priority, High priority site	Point threshold: 2 – Locate the project on site with priority designation	Design
	1			RP Credit 1.2	Regional Priority, Indoor water use reduction	Point threshold: 4 – Achieve more than 40% of indoor water use reduction	Design
1				RP Credit 1.3	Regional Priority, Rainwater management	Point threshold: 2 – Manage on site the runoff from the developed site for the 95th percentile	Design
1				RP Credit 1.4	Regional Priority, Optimize energy performance	Point threshold: 8 – Achieve more than 17% of annual energy cost saving	Design
	1			RP Credit 1.3	Regional Priority, Renewable energy production	Point threshold: 2 – Offset 3% of the total building annual energy cost with renewable energy generation	Design
			1	RP Credit	Regional Priority, Building life-cycle impact reduction	Point threshold: 2 – Reuse or salvage 25% or more building materials -OR- conduct a whole-building life-cycle assessment	

NET ZERO NARRATIVE

PROJECT PROFILE

The information included in this Net Zero narrative submission is based on 100% Design Development Phase analysis of the MIT Kendall Square Site 2 project. Performance values and systems included in this documentation are subject to change through the final design.

Development Characteristics

Lot Area (sq.ft.):	+/- 72,477 sf
Existing Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Dormitory: 163,733 sf
Proposed Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Office: +/- 310,000 sf Active Use/Retail: +/- 10,600 sf
Proposed Building Height(s) (ft. and stories):	200 ft (top of occupied space), 13 occupied floors
Proposed Dwelling Units:	0
Proposed Open Space (sq.ft.):	+/- 33,560 sf
Proposed Parking Spaces:	+/- 257
Proposed Bicycle Parking Spaces (Long-Term and Short-Term):	Longterm: 94 Short-Term: 32

Green Building Rating System

Choose the Rating System selected for this project:

LEED-Leadership in Energy & Environmental Design (U.S. Green Building Council)			
Rating System & Version:	LEED Core and Shell v4	Seeking Certification?*	Yes
Rating Level:	Gold	# of Points:	77 High probability points

Enterprise Green Communities			
Rating System & Version:		Seeking Certification?*	No
Rating Level:		# of Points:	

Passive House Institute US (PHIUS) or Passivhaus Institut (PHI)			
Rating System & Version:		Seeking Certification?*	No

*(*NOTE: Certification is not required through the Green Building Requirements. However, you may choose to indicate if the Project Team intends to pursue formal certification through these Green Building Rating Programs (or their affiliates).)*

PROPOSED PROJECT DESIGN CHARACTERISTICS

Building Envelope

Assembly Descriptions:

Roof:	Roof membrane over underlayment board and polystyrene insulation
Foundation:	Rigid insulation at base of building to 4' below grade
Exterior Walls:	Unitized curtainwall with triple insulating glass, mineral fiber insulation at spandrel areas to achieve minimum R-10
Windows:	Triple insulating glass with low-e coating
Window-to-Wall Ratio:	62%
Other Components:	External shading - 18" deep vertical shades on south elevation - 5 x 12" deep (1ft interval) horizontal shades on south tower & south podium - 1 x 12" deep horizontal shade on east tower - 6" vertical fins on north and west walls on both tower and podium levels Vertical Photovoltaic panels at Level 15 Mechanical Screen wall

Envelope Performance:

(Provide estimates of the thermal transmittance (U-value) for the building envelope compared to "Baseline" standards required by the Massachusetts Stretch Energy Code, latest adopted edition.)

	Proposed		Baseline	
	Area (sf)	U-value	Area (sf)	U-value
Window	+/-96,282	0.248	61,870	0.38
Wall	+/-58,394	0.10	92,806	0.064
Roof	+41,166	0.02	41,166	0.032

Envelope Commissioning Process:

MIT understands the lasting value of strong commissioning practices. MIT will pursue envelope commissioning in line with LEED v4 Enhanced Commissioning Requirements, including Envelope Commissioning. To ensure the building is constructed in alignment with the design and energy efficiency goals, MIT will engage a Building Envelope Commissioning Agent, (BECxA). The BECxA will review the project documents, provide suggestions to the design team, and conduct on-site testing to confirm the constructed building envelope meets the Owner's project requirements.

Building Mechanical Systems

Systems Descriptions:

Space Heating:	-Hot water from (4) 6,000 MBH gas fired condensing boilers for base building, each capable of handling 33% of the load (N+1 redundancy); -Dedicated (2) 500 MBH gas fired condensing boilers for retail/tower CW loop -Chilled Beams for space conditioning for Office and Lab spaces, FCUs for lobbies, and Water-source heat pumps for retail spaces
Space Cooling:	-Chilled water (CHW) from (3) 800-ton high efficiency centrifugal chillers each with VFD drives -Chilled Beams for space conditioning for Office and Lab spaces, FCUs for lobbies, and Water-source heat pumps for retail spaces
Heat Rejection:	-(3) 800-ton evaporative open cooling towers w/ variable speed fan motors; Dedicated 600-ton open loop cooling tower+ supplemental boilers for serving retail CW loop
Pumps & Auxiliary:	-Variable Speed pumps for CHW, HW, and CW
Ventilation:	-Dedicated outside air units with energy recovery providing ventilation
Domestic Hot Water:	-Electric water heater 50 gallon for each hot water pressure zone (2)
Interior Lighting:	-All LED lighting fixtures with occupancy and daylight controls
Exterior Lighting:	-All LED lighting fixtures with installed capacity of ~3.0 kW
Other Equipment:	-Plug Loads – 1.5 W/SF in the office spaces, 8.0 W/SF in the lab spaces

Systems Commissioning Process:

MIT will commission building systems to maintain performance and ensure maximum energy savings and emissions reductions as outlined in LEED v4 Enhanced Commissioning Requirements.

BUILDING ENERGY PERFORMANCE MEASURES

Overview

(Broadly describe the ways in which building energy performance has been integrated into the following aspects of the project's planning, design, engineering, and commissioning. More detail on specific measures can be provided in appendices.)

Land Uses:	The building will include commercial office and/or lab uses on the upper floors, retail and active uses on the Ground Floor, and three levels of below-grade parking. The open space will promote connections with the environment, encourage retail spill-out from the building, and engage outdoor activities. The project will provide bicycle infrastructure and connectivity to multimodal public transportations to promote walking and bicycling throughout the development. A driveway provides access to the garage and loading dock of the adjacent Sloan School with pedestrian-friendly circulation. To reduce stormwater runoff, the driveway will be paved with permeable unit pavers.
Building Orientation and Massing:	The massing of the building is intended to complement the ensemble of buildings MIT has developed South of Main (SoMa). The base volume is oriented in a north-south direction with its long edge along Wadsworth Street to reinforce pedestrian connectivity to the Charles River and MIT Campus. The rotated upper volume is set back from and parallel to Main Street to reduce overall building massing impact on Main Street while increasing ground level open space to the east and creating a unique shaded open space. Building footprints defined by street grid, which has been designed to allow connectivity through a previous super-block site. From there, setbacks have been designed to maximize daylight to the street level, while park areas have been located to take advantage of the best solar exposures and daylight.
Envelope Systems:	The building's exterior envelope is composed of triple-insulated high-performance glazing in a unitized aluminum curtain wall system. Each of the building's façades addresses their respective solar exposures. On the south and east elevations, horizontal and vertical sun shades are carefully placed based on detailed solar analysis, reducing both solar heat gain and glare to allow for a comfortable interior working environment. Because the building does not receive any direct sunlight on the north elevation and is in shadow during the day on the west elevation, solar shading is not needed on these façades. Glazing sizes have been maximized in order to reduce thermal bridging and optimize daylight and views to the exterior.

Mechanical Systems:	- High-performance on-site chiller and boiler plant - Water-side economizer - High-performance run-around glycol energy recovery coil for the lab exhaust - Higher supply air temperature reset for the DOAS AHUs to reduce the reheat energy - A decoupled system with DOAS units and active chilled beams for conditioning the tenant spaces - Variable speed exhaust fan system
Renewable Energy Systems:	Highly efficient photovoltaic (PV) panels will be on the facades and roof of the M2 mechanical Penthouse. The electricity generation is anticipated to be approximately 98,800 KWH per year.
District-Wide Energy Systems:	N/A
Other Systems:	Thirteen electric vehicle charging stations will be provided in the below-grade parking garage for 5% of the total parking capacity.

Integrative Design Process

(Describe how different parties in the development process (owners, developers, architects, engineers, contractors, commissioning agents) have collaborated in the design. Include the Basis of Design and Owner's Project Requirements and describe how they have been informed by planning activities such as meetings or design charettes. Describe how continuing collaborative processes will inform Schematic/Design and Construction Documents.)

The design team has pursued an integrated design process that includes continuous participation from the technical experts to enhance and improve the overall design. This comprehensive approach allows the development to incorporate sustainability best practices in design and operation, stormwater capture and reuse, transportation, and landscape strategies.

The team conducted a preliminary energy analysis and water budget before the completion of the Schematic Design (SD) phase, and both will be documented in the buildings' OPR & BOD.

MIT, Atelier Ten, Elkus Manfredi, Nitsch, Hargreaves, and Buro Happold engaged in robust conversations on sustainability. Beyond the regular team meetings and discussions incorporating sustainability concepts, the design process included numerous workshops centered on sustainability.

- Sustainability Workshop – August 24, 2020
- Façade and Daylighting Meeting – September 24, 2020
- Stormwater management and water reuse discussion – October 01, 2020
- SD Energy Analysis Meeting – November 6, 2020
- Sustainability/ LEED approach meeting- November 30, 2020
- Façade, shading and daylighting discussions- September through November 2020
- Building electrification discussions – September through November 2020
- Renewable Energy feasibility studies/meetings – Spring 2021

MIT has continued to employ an integrative team process throughout the design development phase to maintain focus on sustainability and building performance.

Green Building Incentive Program Assistance

(Describe any programs applicable to this project that would support improved energy performance or reduced greenhouse gas emissions, and which of those programs have been contacted and may be pursued. Programs may be offered by utility companies, government agencies, and other organizations, and might include rebates, grants, financing, technical assistance, and other incentives.)

The project team is considering financial support opportunities available through Mass Save. Applicable programs include the Commercial New Construction and Major Renovations program. MIT is familiar working with Eversource for the Mass Save program through other projects such as the Residences at 165 Main Street (Kendall Square Site 1), Commercial building at 238 Main street (Kendall Square Site 3), Academic administrative offices at Buildings E37, E38 (Kendall Square Site 4), and Commercial building at 314 Main Street (Kendall Square Site 5).

The Commercial New Construction and Major Renovations program offers multiple pathways for achieving financial support. Path 2: Whole Buildings Energy Use Intensity (EUI) Reduction has been identified as the most applicable pathway for this project. The program provides financial incentives based on percent EUI reductions beyond the Mass Save Baseline and provides cost share for technical assistance (up to 75%) as well as financial incentives to help projects achieve the EUI goal. Projects begin earning incentives for a 10% EUI reduction relative to the Mass Save Baseline. In addition, an optional Verification Incentive will be explored which would provide financial support to assist projects in ensuring the EUI target set during design is achieved post occupancy. The project team will investigate these incentive opportunities further to ensure the project is eligible for the maximum incentive benefit possible.

The project team will also explore financial assistance for the installation of electric vehicle charging stations. Both Eversource and National Grid offer financial support for the electrical infrastructure required to support EV charging stations.

The team will continue to evaluate the applicable incentive programs as the design progresses.

NET ZERO SCENARIO TRANSITION

(Describe the technical framework by which the project can be transitioned to net zero greenhouse gas emissions in the future, acknowledging that such a transition might not be economically feasible at first. This description should explain the future condition and the process of transitioning from the proposed design to the future condition.)

	Net Zero Condition:	Transition Process:
Building Envelope:	Minimal upgrades to the current design which consists of a high-performance curtainwall system	Likely minimal upgrades required to achieve Net Zero.
HVAC Systems:	Heat pump chiller(s) + ASHPs meeting majority (~90% +) of heating demand. Electric boilers for supplemental heating on peak demand days.	One of the three chillers to be replaced with a water-to-water heat pump chiller to provide primary heating and simultaneous heating and cooling. Gas-fired boilers to be transitioned to ASHPs and/or electric boilers.
Domestic Hot Water:	No change	N/A
Lighting:	No change	N/A
Renewable Energy Systems:	No Change	N/A
Other Strategies:	Electrical infrastructure in the BOD shall be designed to handle the future all-electric HVAC infrastructure	N/A

ENERGY SYSTEM COMPARISON

Overview

(This section should describe the results of an analysis comparing the technical and financial feasibility to meet the projected HVAC and domestic hot water demands of the building using energy systems that do not consume carbon-based fuels on-site compared to code-compliant energy systems that consume carbonbased fuels on-site.)

The non-carbon fuel scenario is identical to the net zero scenario. Please refer to the information above for the Net Zero scenario for a description of how the building would operate without combustion based fuels for non-backup equipment.

Assumptions

(Describe what building energy systems were included and excluded in your analysis and why.)

	Included in analysis?		Describe the systems for which this was analyzed or explain why it was not included in the analysis:
	Yes	No	
Solar Photovoltaics:	X		Solar Photovoltaics are included in the Proposed Design. Description in Building Energy Performance Measures section.
Solar Hot Water:		X	Excluded. The rooftop area is fully utilized for active building mechanical systems
Ground-Source Heat Pumps (Geothermal):		X	Geothermal capacity within feasible area of the project site boundary would not meet the demand of project.
Water-Source Heat Pumps:	X		Description in Net Zero Scenario above.
Air-Source Heat Pumps:	X		Description in Net Zero Scenario above.
Non-CarbonFuel District Energy:		X	Building is owned and operated independently of adjacent buildings
Other NonCarbon-Fuel Systems:		N/A	N/A

Non-Carbon-Fuel Scenario

The non-carbon fuel scenario is identical to the net zero scenario. Please refer to the information above for the Net Zero scenario for a description of what systems would be used in a non-carbon fuel scenario.

Solar-Ready Roof Assessment

(The purpose of this assessment is to determine the technical feasibility of solar energy system installation, either as part of the proposed project or in the future. It is helpful to supplement this narrative with a plan depicting the information provided.)

Total Roof Area (sq. ft.):	+/-41,166 sf
Unshaded Roof Area (sq. ft.):	+/-2,580 sf
Structural Support:	A ballasted array of photovoltaic panels are planned for the roof of the upper mechanical penthouse (Level 15 roof) which will be supported by structural steel framing and deck. The array will be accessed from an exterior ladder, oriented south, and tilted 5 degrees.
Electrical Infrastructure:	The PV output will be connected to the building's 4000A, 480V Main Switchboard with a dedicated circuit breaker. The connection will be in accordance with Article 705.12 of the MA Electric Code.
Other Roof Appurtenances:	The roof houses the mechanical equipment and cooling towers, limiting the available roof area for photovoltaic (PV) panels. Space is reserved for the purpose of installing air source heat pumps as well.
Solar-Ready Roof Area (sq. ft.):	Based on information above, the design team identified mechanical penthouse roof and facades as alternative building surfaces that could support PV installations. 5,782 sf PV on East, South, West, North facades 1,500 sf ballasted PV array on Level M2 roof
Capacity of Solar Array:	Based on the solar-ready area described above, the total installed energy capacity of the proposed PV array is 120 KW (1% of the building's annual energy consumption). This is an estimate. Final PV capacity to be determined based on product selection.
Financial Incentives:	MIT will investigate financial incentive programs to reduce the first cost of the proposed PV array.
Cost Feasibility:	N/A

Results

(Briefly summarize the results of the analysis and how it has informed the design of the project. Also include figures for the "Non-Carbon-Fuel Scenario" in the concluding Summary Table at the end of the Net Zero Narrative. Attachments can be provided with more specific figures and metrics regarding installation, maintenance, and upkeep costs (exclusive of operating fuel expenses), but a full report is not necessary.)

	Proposed Design		Non-Carbon-Fuel Scenario	
	Installation Cost	Maintenance Cost	Installation Cost	Maintenance Cost
Space Heating				
Space Cooling				
Heat Rejection				
Pumps & Aux.				
Ventilation				
Domestic Hot Water				
(Financial Incentives)	TBD		TBD	
Total Building Energy System Cost	$30-35M (as of June 21, 2021)		Estimate under development	

The design team is encouraged by the reduction in operational energy, specifically heating energy exhibited by the heat pump chillers and air-source heating equipment. The additional cost of heating will be evaluated against the potential decrease in future carbon emissions to determine what measures could be included in the final design.

As utility grid emissions improve for electricity generation, the ASHPs/ Electric boilers can be installed to make a significant reduction in operational carbon emissions. The design team is committed to preparing for an all-electric future and is evaluating in greater depth the potential feasibility for the hybrid solution with a heat-pump chiller at the site. The heat pump chiller would be designed similarly to the full-electrification scenario and would serve the primary heating demand however, natural gas boilers would provide secondary heating loads and heating in power-loss situations.MIT and the design team will ensure the project will have the capability to transition to all-eletric on Day 2.

ANTICIPATED ENERGY LOADS AND GREENHOUSE GAS EMISSIONS

Assumptions

(Describe the assumptions and methodology used to conduct preliminary energy modeling and set energy targets for the project. Specifically describe what components of the building were included and excluded.)

The project will demonstrate energy code compliance by adhering to the 9th Edition – Revised of the Massachusetts Building Code - 780 CMR, Chapter 13.00 - Energy Efficiency, including Appendix AA (MA Stretch Code). The baseline building is modeled to adhere to the methodology described by ASHRAE 90.1-2013 Appendix G, with MA Amendments. The model considers current design assumptions about occupancy, hours of operation, internal loads, envelope criteria, and mechanical system design. Tenant areas were modeled assuming a 50/50 distribution of office and lab areas with generic space layouts, consistent with the building design criteria.

In addition, to comply with Section C406 of MA Energy Code, the baseline and proposed buildings capture the energy use reductions associated with the following three C406 measures:

- C406.2: More efficient HVAC performance
- C406.3: Reduced Lighting Power Density
- C406.4: Enhanced Digital Lighting Controls

The anticipated energy analysis results included in this documentation are based on the 100% Design Development phase drawings and are subject to change through the final design. Updated energy results will be performed with each major design submission.

Annual Projected Energy Consumption and Greenhouse Gas (GHG) Emissions

The preliminary energy modeling results should be shown in a table format similar to what is shown below. It should compare the "baseline building" (Massachusetts Stretch Energy Code) to the proposed design, as well as the future "net zero" scenario described later in this narrative.

	Baseline Building		Proposed Design		Future Scenario		Non-Carbon-Fuel Scenario	
	MMBTU	*% of Total*	*MMBTU*	*% of Total*	*MMBTU*	*% of Total*	*MMBTU*	*% of Total*
Space Heating	23,000	47%	9,750	27%	3,850	13%	3,850	13%
Space Cooling	1,200	2%	1,100	3%	2,000	7%	2,000	7%
Heat Rejection	550	1%	500	1%	300	1%	300	1%
Pumps & Aux.	200	0%	300	1%	150	0%	150	0%
Ventilation	6,000	12%	6,250	17%	6,250	21%	6,250	21%
Domestic Hot Water	800	2%	800	2%	800	3%	800	3%
Interior Lighting	3,300	7%	3,250	9%	3,250	11%	3,250	11%
Exterior Lighting	200	0%	50	0%	50	0%	50	0%
Misc. Equipment	13,750	28%	13,750	38%	13,750	45%	13,750	45%
	$US, MMBTU, kBTU/SF		*$US, MMBTU, kBTU/SF*	*% Reduction from Baseline*	*$US, MMBTU, kBTU/SF*	*% Reduction from Baseline*	*$US, MMBTU, kBTU/SF*	*% Reduction from Baseline*
Site EUI	126		92	27%	78	38%	78	38%
Source EUI	251		218	13%	220	12%	220	12%
Total Energy Use	49,000		35,750	27%	30,400	38%	30,400	38%
Total Energy Cost	~$1.51 M		~1.41M	6%	~1.52M	-1%	~1.52M	-1%
	kWh or Therms	*% of Total Energy*	*kWh or Therms*	*% of Total Energy*	*kWh or Therms*	*% of Total Energy*	*kWh or Therms*	*% of Total Energy*
On-Site Renewable Energy Generation	N/A	0	98,800	1%	98,800	1%	98,800	1%
Off-Site Renewable Energy Generation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	Baseline Building	Proposed Design	
	Tons CO2 [/SF]	*Tons CO2 [/SF]*	*% Reduction from Baseline*
GHG Emissions	4,035	3,360	17%
GHG Emissions per SF	0.010	0.009	17%

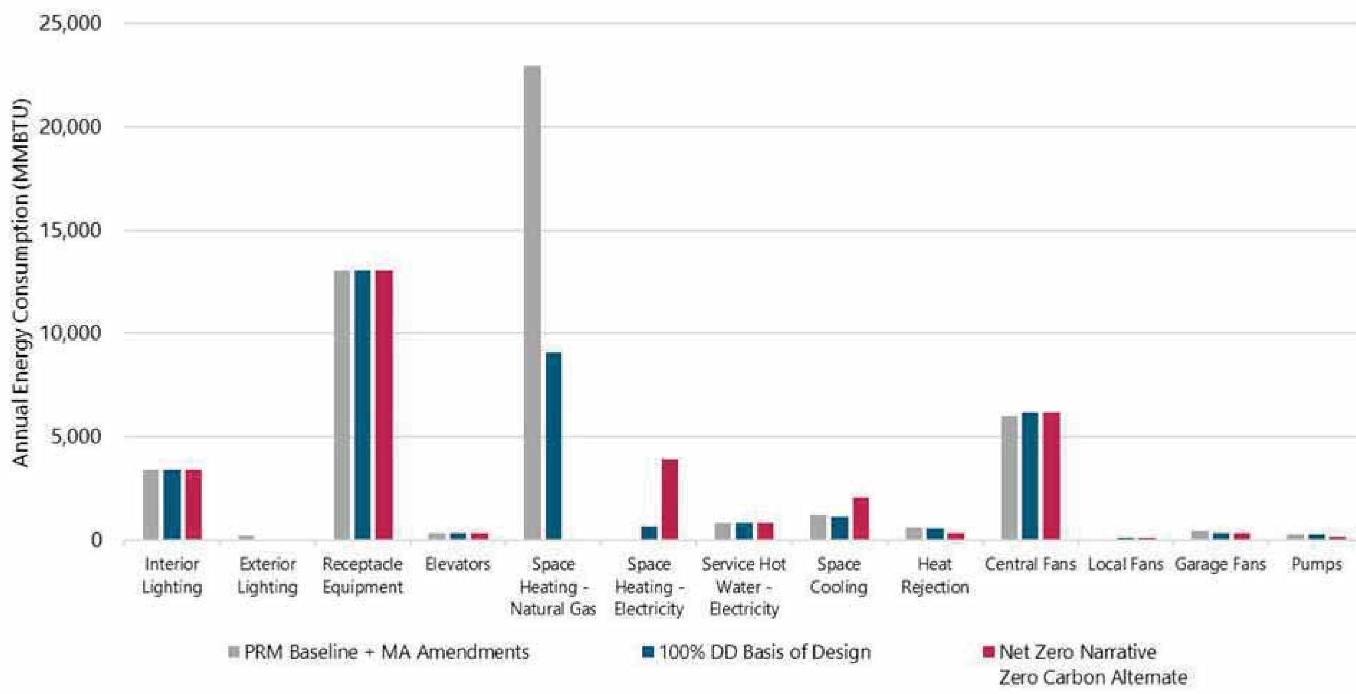


Figure 1: 100% DD Phase Energy Analysis Results- Annual Energy Use Comparison

4. Acoustical Narrative

ACENTECH
33 Moulton Street
Cambridge MA 02138
617 499 8000
acentech.com

26 May 2021

Julie Chang AIA, LEED AP ** via email (jchang@elkus-manfredi.com) **
Elkus Manfredi Architects
25 Drydock Avenue
Boston, MA 02210

Subject: MITIMCO Kendall Square Site 2 (Parcel M)
Summary of Exterior Noise Evaluation (v.2)
Standard Design
Acentech Project No. 633639

Dear Ms. Chang:

This letter presents the exterior sound evaluation for the building equipment planned for the MITIMCO Site 2 project in Cambridge, MA. The City of Cambridge noise ordinance as well as the Commonwealth of Massachusetts noise criteria apply to this project site. A more detailed evaluation of the entire South of Main (SOMA) sound impact to the neighborhood was conducted in 2015 and included in the Article 19 submission (dated July 13, 2015). This report confirms some earlier assumptions and provides updated evaluations for Site 2.

APPLICABLE NOISE REGULATION

Massachusetts

The Massachusetts Department of Environmental Noise Protection (MassDEP) defines noise pollution by the condition resulting when:

- The equipment increases broadband sound level by more than 10 dBA above ambient, or
- The equipment with tonal sound - when any octave band center frequency sound pressure level exceeds the two adjacent bands by 3 dBA or more

For this building, we confirmed the existing background sound levels are high enough in the project area that meeting the City of Cambridge Noise Ordinance would be the more stringent regulation. We would also need to comply with the MassDEP regulation for the emergency generators.

City of Cambridge

The City of Cambridge Noise Regulation has fixed sound level limits for daytime and nighttime hours. There are different limits based on the zoning district. Based on the City of Cambridge Zoning Map, the equipment of our project should meet the Residential Zoning District at the closest residential buildings and hotel. At the rest of the nearby buildings, the project should meet the Business Zoning District limits. The City defines daytime as the period between the hours of 7AM and 6PM except Sunday and holidays.

PREDICTED SOUND EMISSION LEVELS

The project's engineer has provided us with the mechanical equipment sound data for the base building project. We have predicted the sound emission levels of the future equipment to the nearest community residential locations during normal operation. For the nighttime sound estimates, we have included appropriate operation setbacks for the cooling towers and air handling units. These estimates do not include tenant-supplied equipment or fan systems designed for fire emergencies. The list below shows equipment used in our acoustic analysis.

MECHANICAL EQUIPMENT

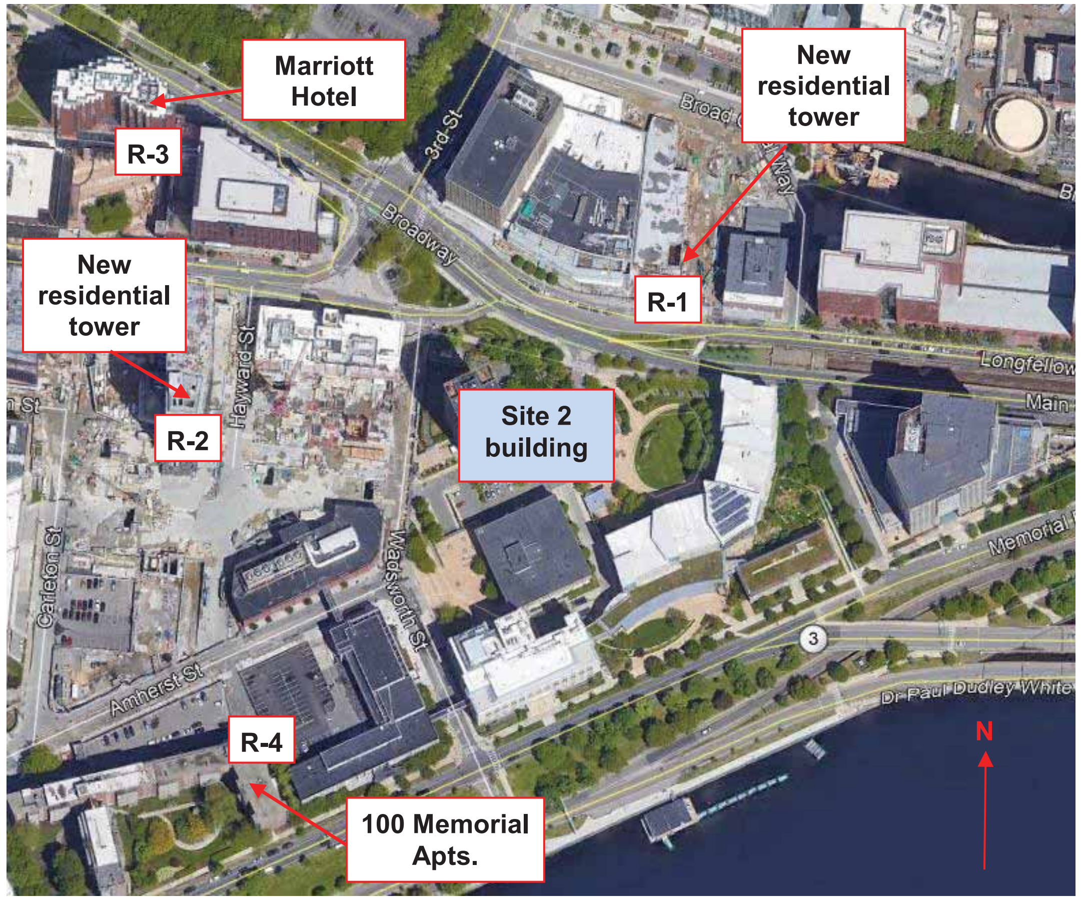
The following lists the mechanical equipment items associated with the core/shell design of the building and expected to contribute to the exterior sound levels during normal conditions:

- *Exhaust and Supply Air Fans - located within the building and on the roof to serve the underground parking garage, boiler room, chiller room, penthouse, and other building spaces.*
- *Air Handling Units - located in Level 14 penthouse*
- *Cooling Towers - located on Level 15 (roof)*
- *Standby Diesel Generators – located on Level 15 (roof)*

A number of sound-attenuating features have been incorporated into the architectural and mechanical design of the project to mitigate noise emissions to the surrounding community, including:

- A solid appearance screen / noise barrier wall will be erected around the rooftop mechanical equipment, shielding lower-elevation neighboring areas from noise emitted by the cooling towers, the two generator sets, the several exhaust supply fans, and the lower portion of the specialty lab exhaust fan stacks.
- The cooling towers will be equipped with the manufacturer's reduced noise fans and variable-frequency drives.
- The exhaust stacks for the fans in the lab exhaust air handling units will be equipped with tubular sound attenuators.
- The main air handling units and other equipment will draw outside air and exhaust air through louvers and sound-attenuating plenum systems at the 14th level mechanical penthouse and first level outer walls.
- Various inline exhaust and supply fans located within the building for ventilation will be outfitted with sound attenuators to the exterior.
- Mechanical penthouse enclosing the chillers, boilers, pumps, and air handling units, with louvers and roof openings outfitted with sound attenuators as needed to mitigate sound to the exterior.
- Diesel emergency generators on Level 15/roof in acoustic enclosures and fitted with suitable high-performing engine mufflers.

The figure below shows the project location and the closest adjacent residential / hotel receivers:



Tone Evaluation

Based on the equipment sound data and the predicted sound levels at the closest receivers, we do not anticipate the equipment to produce a tonal sound condition as defined by MassDEP.

Predicted Equipment Sound Levels

Based on the mechanical equipment sound data and the noise control measures described above, we predicted the equipment sound levels at the nearest residential receivers. Table 1 presents the estimated project sound levels without the existing background sound levels and standby generators.

Receiver Location	Estimated Overall Daytime/Nighttime Sound Levels, excluding emergency generators (dBA)	Sound Limits (dBA)
R-1	48/45	60 dBA (day) 50 dBA (night)
R-2	47/44	
R-3	41/38	
R-4	38/35	

Table 1. Predicted project sound levels at residential receivers with planned noise control measures (without standby generators)

Table 2 presents the estimated project sound levels without the existing background sound levels, but with the two standby generators included for daytime testing.

Receiver Location	Estimated Overall Daytime Sound Levels, including emergency generators (dBA)	Sound Limits (dBA)
1	59	60 dBA (day)
2	58	
3	49	
4	47	

Table 2. Predicted project sound levels at residential receivers with planned noise control measures (with standby generators)

The predicted A-weighted sound levels with the noise control measures described above are within the applicable allowable daytime and nighttime overall sound limits.

CONCLUSION

Based on our evaluation of the mechanical equipment proposed for SOMA MITIMCO Site 2 project, the equipment sound emissions to the community are within the acceptable sound limits and will not produce a tonal sound condition.

****

I trust this letter provides the information that you need at this time. If you have questions, please call or email Bob Berens and/or me (rberens@acentech.com and jbarnes@acentech.com).

Sincerely yours,
ACENTECH INCORPORATED

James D. Barnes, P.E., F. INCE
Principal Consultant

xc: R. Berens/Acentech

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5. Wind Study

REPORT

KENDALL SQUARE SOMA SITE 2

CAMBRIDGE, MA

PEDESTRIAN WIND STUDY
RWDI # 2000222
July 20, 2021
Updated October 20, 2021

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed Kendall Square SoMa Site 2 development in Cambridge, MA. The predicted wind conditions for the No Build and Build configurations are illustrated in Figures 1A through 6B, as well as in Tables 1 and 2. These results can be summarized as follows:

Effective Gust

- Wind speeds that meet the effective gust criterion of 31 mph are predicted at all pedestrian areas assessed for the No Build and Build configurations, both annually and seasonally. One exception is the area near the southwest corner of the tower at the Level 5 amenity terrace where the criterion is expected to be exceeded by 1 mph during the spring in the Build configuration.

Mean Speed

- The annual mean wind speeds on the existing site (No Build configuration) are generally comfortable for the intended pedestrian use. There are no areas with dangerous wind conditions on either an annual or seasonal base.
- With the addition of the project to the site, to represent the Build configuration, the annual mean wind speeds in the extended surroundings are expected to remain unchanged. Appropriate wind conditions are predicted along the project perimeter and throughout the nearby pedestrian areas, including entrances, walkways and the grade level outdoor seating spaces. No areas with dangerous wind conditions are expected on either an annual or seasonal base.
- On the Level 5 amenity terrace, the annual mean wind speeds are predicted to be conducive to passive patron use at most areas, exceptions are areas on the west side of the terrace and near the southwest corner of the tower. No areas with dangerous wind conditions are expected on either an annual or seasonal base.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed Kendall Square SoMa Site 2 development in Cambridge, MA. The project (site shown in Image 1) is located at the intersection of Main Street and Wadsworth Street on the east campus of Massachusetts Institute of Technology (MIT). The site is currently occupied by a high-rise apartment building and surrounded by mid to high-rise structures and Charles River. Downtown Boston and Boston Logan International Airport are located approximately 1.5 and 3 miles to the east of the project site, respectively. The proposed development is a 14-story laboratory tower consisting of a 9-story cantilever element extending toward the east and an outdoor amenity terrace on Level 5.

The objectives of the study were to assess the effect of the proposed development on local wind conditions in pedestrian areas on and around the study site and provide recommendations for minimizing adverse effects. This quantitative assessment was based on wind speed measurements on a scale model of the project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to appropriate criteria for gauging wind comfort and safety in pedestrian spaces. The assessment focused on critical pedestrian areas, including sidewalk, walkways, building entrances and the Level 5 amenity terrace.

This report presents the project objectives, background, RWDI's approach, and a discussion of the results. It also provides conceptual wind control measures, where necessary.

Image 1: Aerial View of the Project Site and Surroundings (Photo Courtesy of Google™ Earth)

2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

A – No Build: Existing site with existing surroundings (Image 2A), and,

B – Build: Proposed project with existing surroundings (Image 2B).

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 1200 ft radius of the study site. Note that the existing and proposed landscaping features were also included in the wind tunnel scale model of the project and surroundings – deciduous species were modeled without foliage to represent the winter conditions. The wind and turbulence profiles in the atmospheric boundary layer beyond the modeled area were also simulated in RWDI's wind tunnel. The wind tunnel model was instrumented with 91 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 5 ft above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in a 10-degree increment. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site and was reviewed by the project team.

PEDESTRIAN WIND STUDY
KENDALL SQUARE SOMA SITE 2
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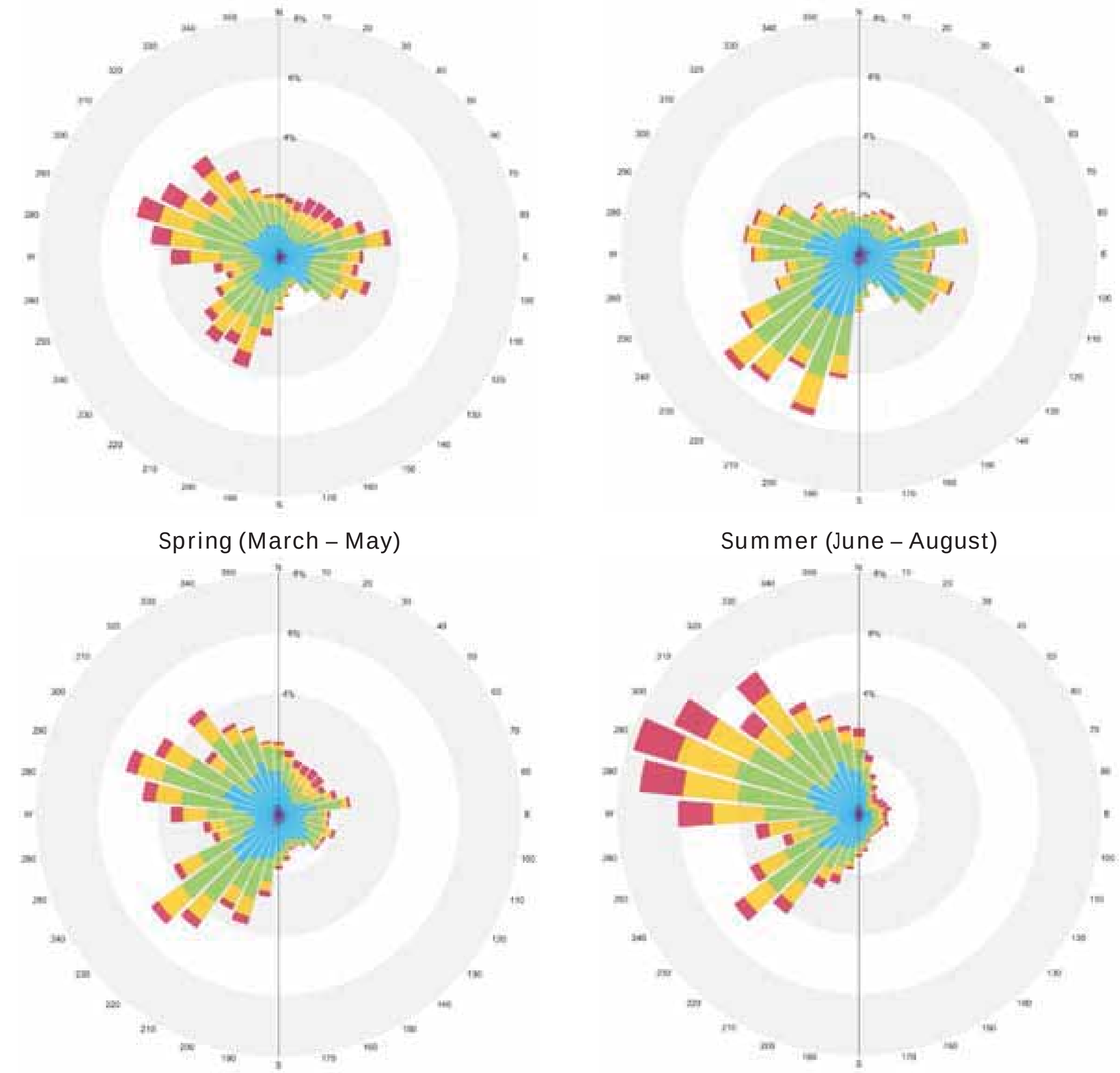
October 20, 2021



Spring (March – May) | Summer (June – August)

Fall (September – November) | Winter (December – February)

Wind Speed (mph)	Spring	Summer	Fall	Winter
Calm	2.8	3.0	3.4	2.6
1-5	6.8	9.4	8.7	6.5
6-10	28.9	38.8	34.6	27.9
11-15	32.3	34.4	32.0	30.9
16-20	19.2	11.8	14.5	19.7
>20	10.1	2.6	6.8	12.4

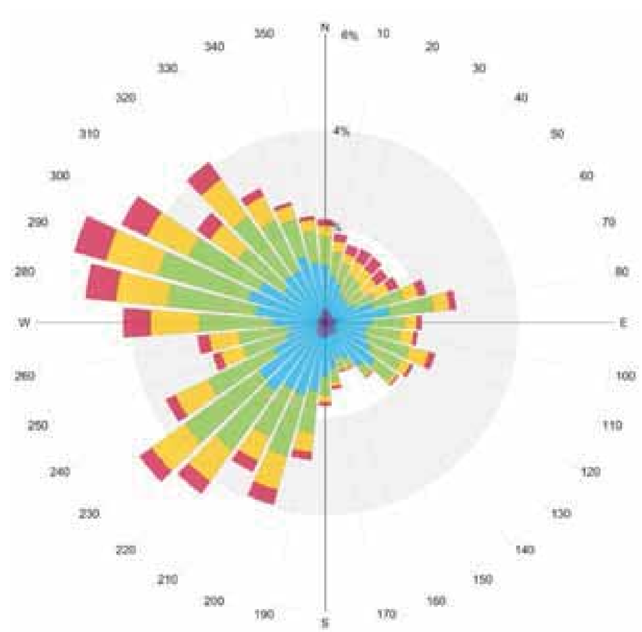
(Probability (%) for Spring, Summer, Fall, Winter)

Image 4: Seasonal Directional Distribution of Winds Approaching Boston Logan International Airport from 1995 through 2018

2.2 Meteorological Data

The results from wind tunnel tests were combined with long-term meteorological data, recorded during the years 1995 through 2018 at Boston Logan International Airport, to predict full scale wind conditions for the entire year and for each of the four seasons. Image 3 presents the annual wind rose, summarizing the directional distribution of wind speeds and frequencies. Similarly, seasonal wind climate for spring (March to May), summer (June to August), fall (September to November) and winter (December to February) seasons are summarized in the wind roses of Image 4.

On an annual basis, as shown in Image 3, the most common wind directions are those between south-southwest and northwest. Winds from the east-northeast to the east-southeast are also relatively common. In the case of strong winds (red bands), west through northwest and northeast are the dominant wind directions.



Wind Speed (mph)	Probability (%) Annual
Calm	3.0
1-5	7.9
6-10	32.5
11-15	32.4
16-20	16.3
>20	7.9

Image 3: Annual Directional distribution of winds approaching Boston Logan International Airport from 1995 through 2018

PEDESTRIAN WIND STUDY
KENDALL SQUARE SOMA SITE 2
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Image 2A: Wind Tunnel Study Model – No Build Configuration

Image 2B: Wind Tunnel Study Model - Build Configuration

2.3 Pedestrian Wind Criteria

The pedestrian wind criteria implemented for the current study uses two standards for assessing the relative wind comfort of pedestrians. First, the 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

Wind Acceptability	Effective Gust Speed (mph)
Acceptable	≤ 31
Unacceptable	> 31

** 1% exceedance or 99 percentile wind speeds*

The second set of criteria used to determine the acceptability of specific locations is based on the work of Melbourne. 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 one-hour mean wind speed exceeded 1% of the time.

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

1% exceedance or 99 percentile wind speeds

The consideration of wind conditions in planning outdoor activity areas is important since high winds in an area tend to deter the 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 mechanical forces of winds on the pedestrians.

The wind climate found in Cambridge is generally comfortable for the pedestrian use of sidewalks and thoroughfares and meets the 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.

This study involved state-of-the-art measurements and analysis techniques to predict wind conditions. Nevertheless, some uncertainties in predicting the wind comfort levels must be taken into account. For example, the sensation of comfort among individuals can be quite variable as variations in age, health, clothing and other human factors can change a particular response of an individual. Thus, 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, meaning that the wind speeds reported are for the frequency of occurrence stated (1% of the time) and higher wind speeds will occur but on a less frequent basis.

3 RESULTS AND DISCUSSION

The predicted wind conditions in terms of mean and effective gust speeds pertaining to the tested configurations are graphically depicted on site plans in Figures 1A through 6B located in the "Figures" section of this report. These conditions and the associated wind speeds are presented in Tables 1 and 2 in the "Tables" section. 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 on an annual base. 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 (Figures 3A through 6B).

In general, wind conditions comfortable for walking are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at main entrances where pedestrians are apt to linger. Wind speeds comfortable for sitting are ideal for outdoor terraces planned for passive activities during the warmer months of the year.

3.1 No Build Configuration

Mean wind speeds on and around the existing project site and along the sidewalks of the nearby streets are comfortable for walking, standing, or sitting (Figure 1A). Wind speeds higher than those comfortable for walking occur to the distant south of the site, along the east sidewalk of Wadsworth Street (Location 42 in Figure 1A).

There are no areas with mean wind speeds categorized as dangerous either annually or seasonally (Figure 1A and Table 2). The effective gust criterion of 31 mph is met at all locations on and around the site on both annual and seasonal bases (Figure 2A and Table 2).

3.2 Build Configuration

3.2.1 Grade Level (Locations 1 through 79)

The proposed development is of similar height to the existing apartment building on the site and the surrounding buildings to the west, north and east. However, it has a significantly larger floor plan and a different orientation relative to the existing apartment building. With the addition of the proposed development, mean wind speeds in the extended surrounding areas are predicted to remain generally similar to those in the No Build configuration (Figure 1B). These wind conditions are suitable for the intended use of various pedestrian area, including sidewalks, walkways and the existing outdoor spaces to the east and south of the proposed development (Locations 49 and 50 and 37-39, respectively, in Figure 1B). Due to the blockage provided by the project, lower wind activity is predicted on the south side relative to the No Build configuration; for example, wind conditions at Location 42 are expected to become comfortable for walking on an annual base in the Build configuration (Figure 1B). Wind speeds at the west corner of Galaxy Park, along Main Street, are predicted to become uncomfortable for walking, 1 mph above the criterion (Location 70 in Figure 1B).

Appropriate wind conditions are expected along the project perimeter and throughout the immediate surrounding areas. These wind speeds are suitable for the intended use of pedestrian areas, including main building entrances (Locations 1, 5, 7 and 11 in Figure 1B), north side retail entries (Locations 3 and 4), stair tower entrance (Location 15) and the seating area near the northeast corner (Location 16).

There are no areas with mean wind speeds categorized as dangerous either annually or seasonally (Figure 1B and Table 2). The effective gust criterion of 31 mph will be met at all locations on and around the site on both annual and seasonal bases (Figure 2A and Table 2).

3.2.2 Level 5 Outdoor Terrace (Locations 80 through 91)

Mean wind speeds throughout the Level 5 amenity terrace are predicted to be mostly comfortable for sitting or standing on an annual base, which is suitable for the anticipated passive activities in the area (Figure 1B). Exceptions are areas on the west side of the amenity where elevated wind speeds are expected (Locations 84, 85 and 91 in Figure 1B). The high wind activity at these areas is due to either the exposure to the northwest winds or the redirection of the southwest winds by the south façade of the cantilever tower and their subsequent acceleration on the amenity level. It is worth noting that the wind conditions at Locations 84 and 91 are expected to be conducive to sitting or standing during the summer, when the outdoor areas are typically in use (see Locations 84 and 91 in Table 2).

There are no areas with mean wind speeds categorized as dangerous either annually or seasonally (Figure 1B and Table 2). The effective gust criterion of 31 mph will be met at all locations on both annual and seasonal bases (Figure 2B and Table 2), except for the area near the southwest corner of the tower during the spring months (see Location 85 in Table 2).

To moderate the wind activity near the corner of the taller component (Location 85), a wide canopy/trellis wrapping around the southwest corner can be considered. Implementation of vertical wind control features in the form of planters or porous wind screens can also help diffuse the energy of accelerating winds. Examples of the application of the recommended wind control solutions are shown in Image 5.

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KENDALL SQUARE SOMA SITE 2
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Image 5: Examples of Wind Mitigation Strategies Applicable to the Project

4 APPLICABILITY OF RESULTS

The drawings and information listed below were received from Elkus Manfredi Architects and were used to construct the scale model of the proposed Kendall Square SoMa Site 2 development. The wind conditions presented in this report pertain to the proposed project as detailed in the architectural design drawings listed in the table below. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may be affected. Therefore, for any changes in the design, it is recommended that RWDI be contacted and requested to review their potential impact on wind conditions.

File Name	File Type	Date Received (mm/dd/yyyy)
MIT_SITE_2-Core_Shell-v19lab_detached	REVIT	01/19/2021
kendall site 2 BASE	DWG	01/19/2021

5 REFERENCES

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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.

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8. 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.

9. 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.

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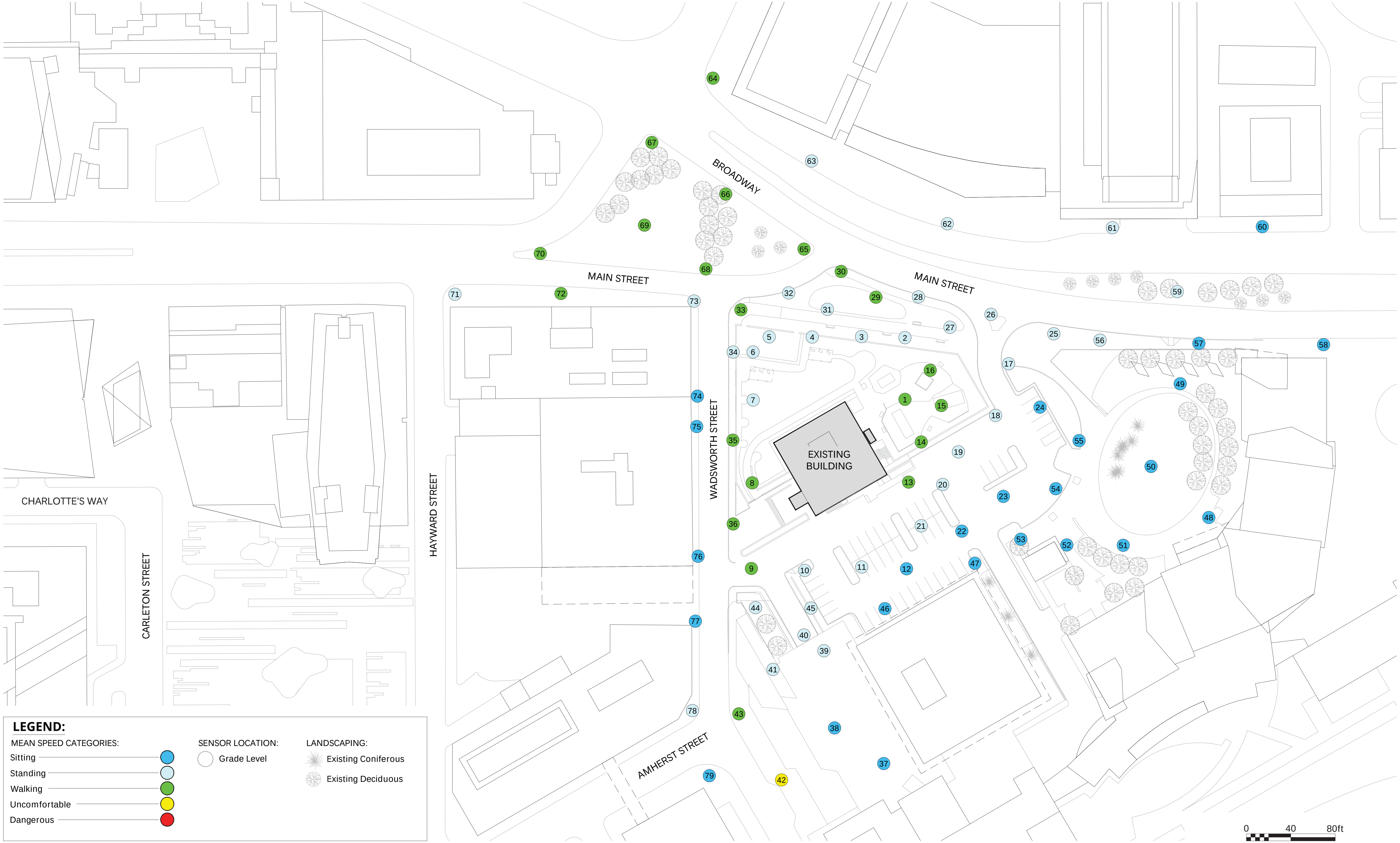
FIGURES



Pedestrian Wind Conditions - Mean Speed
No Build
Annual (January to December)

Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project 2000222

Drawn by: GRE	Figure: 1A
Approx. Scale:	1" 80'
Date Revised:	Oct. 20, 2021

Pedestrian Wind Conditions—Mean Speed (No Build, Annual)

Pedestrian Wind Conditions - Mean Speed
Build
Annual (January to December)

Kendall Square SoMa Site 2 - Cambridge, MA

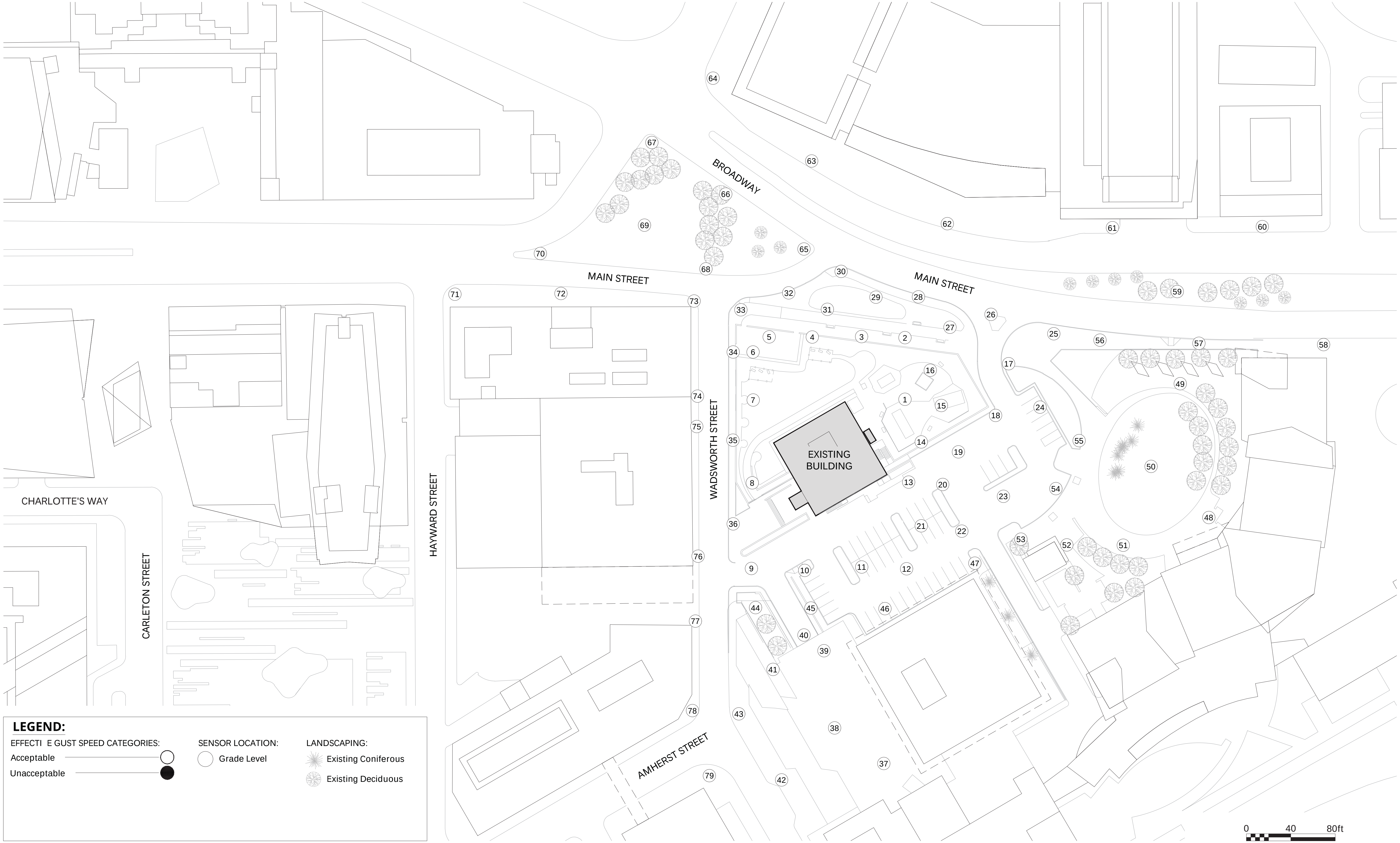
True North

Project #2000222

Drawn by: GRE | Figure: 1B
Approx. Scale: 1"=80'
Date Revised: Oct. 20, 2021

RWDI

Pedestrian Wind Conditions—Mean Speed (Buildout, Annual)



Pedestrian Wind Conditions - Effective Gust Speed
No Build
Annual (January to December)

Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project #2000222

Drawn by:	GRE	Figure:	2A
Approx. Scale:	1"=80'		
Date Revised:	Oct. 20, 2021		

Pedestrian Wind Conditions—Effective Gust Speed (Existing, Annual)

Pedestrian Wind Conditions - Effective Gust Speed
Build
Annual (January to December)

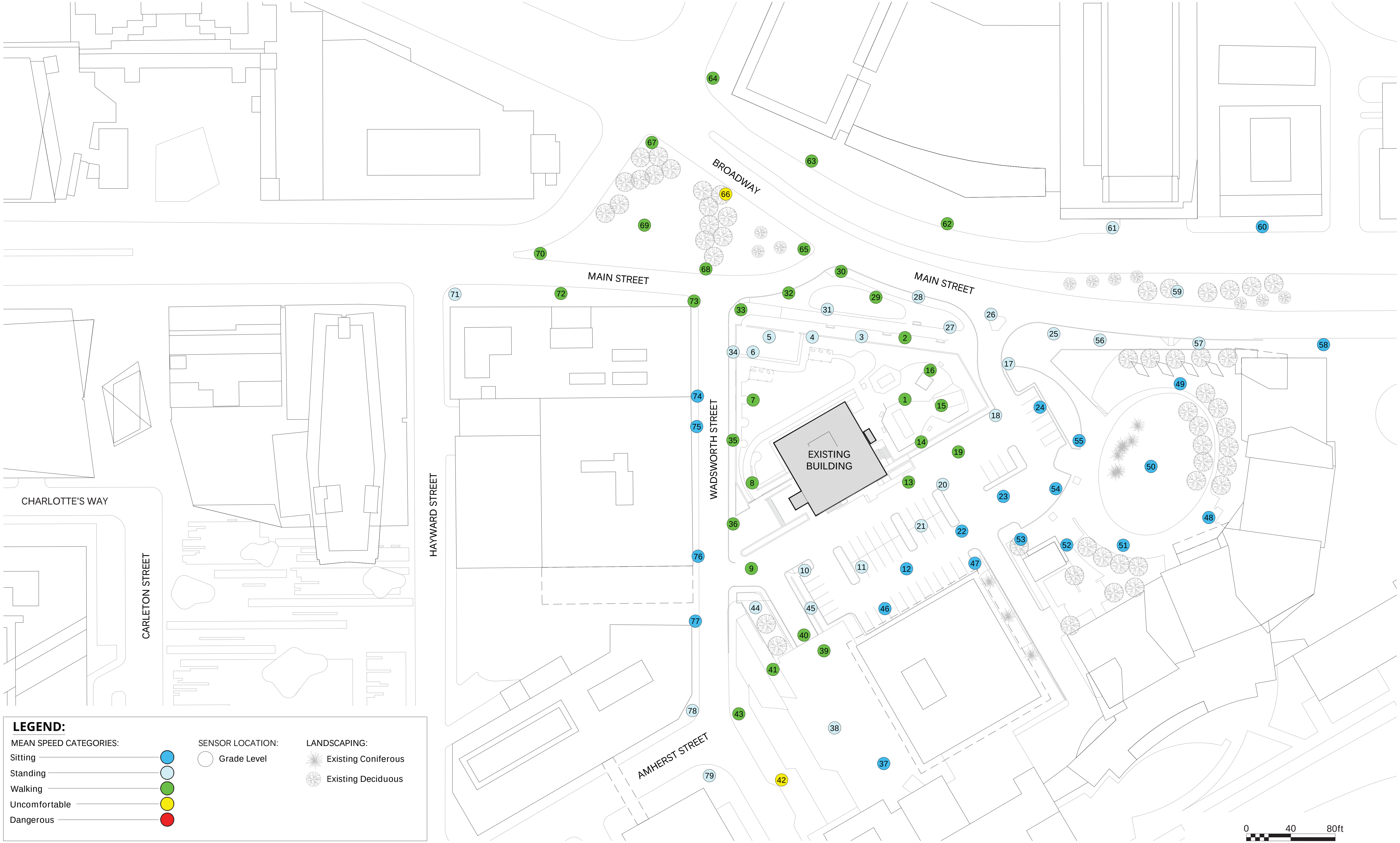
Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project #2000222

Drawn by:	GRE	Figure:	2B
Approx. Scale:	1"=80'		
Date Revised:	Oct. 20, 2021		

Pedestrian Wind Conditions—Effective Gust Speed (Buildout, Annual)



Pedestrian Wind Conditions - Mean Speed
No Build
Spring (March to May)

Kendall Square SoMa Site 2 - Cambridge, MA

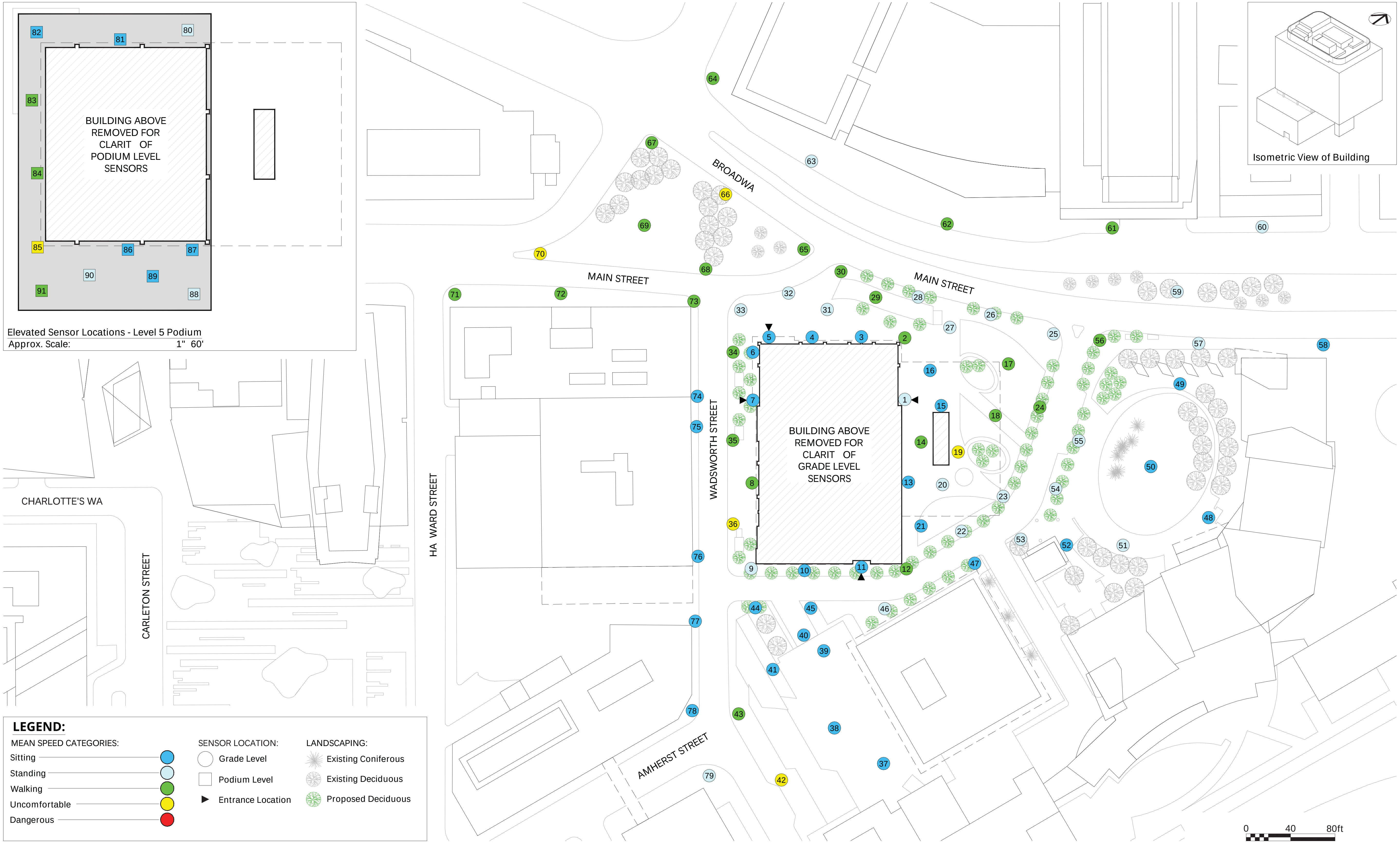
True North

Project #2000222

Drawn by: GRE	Figure: 3A
Approx. Scale:	1"=80'
Date Revised:	Oct. 20, 2021

RWDI

Pedestrian Wind Conditions–Mean Speed (Existing, Spring)



Pedestrian Wind Conditions - Mean Speed
Build
Spring (March to May)

Kendall Square SoMa Site 2 - Cambridge, MA

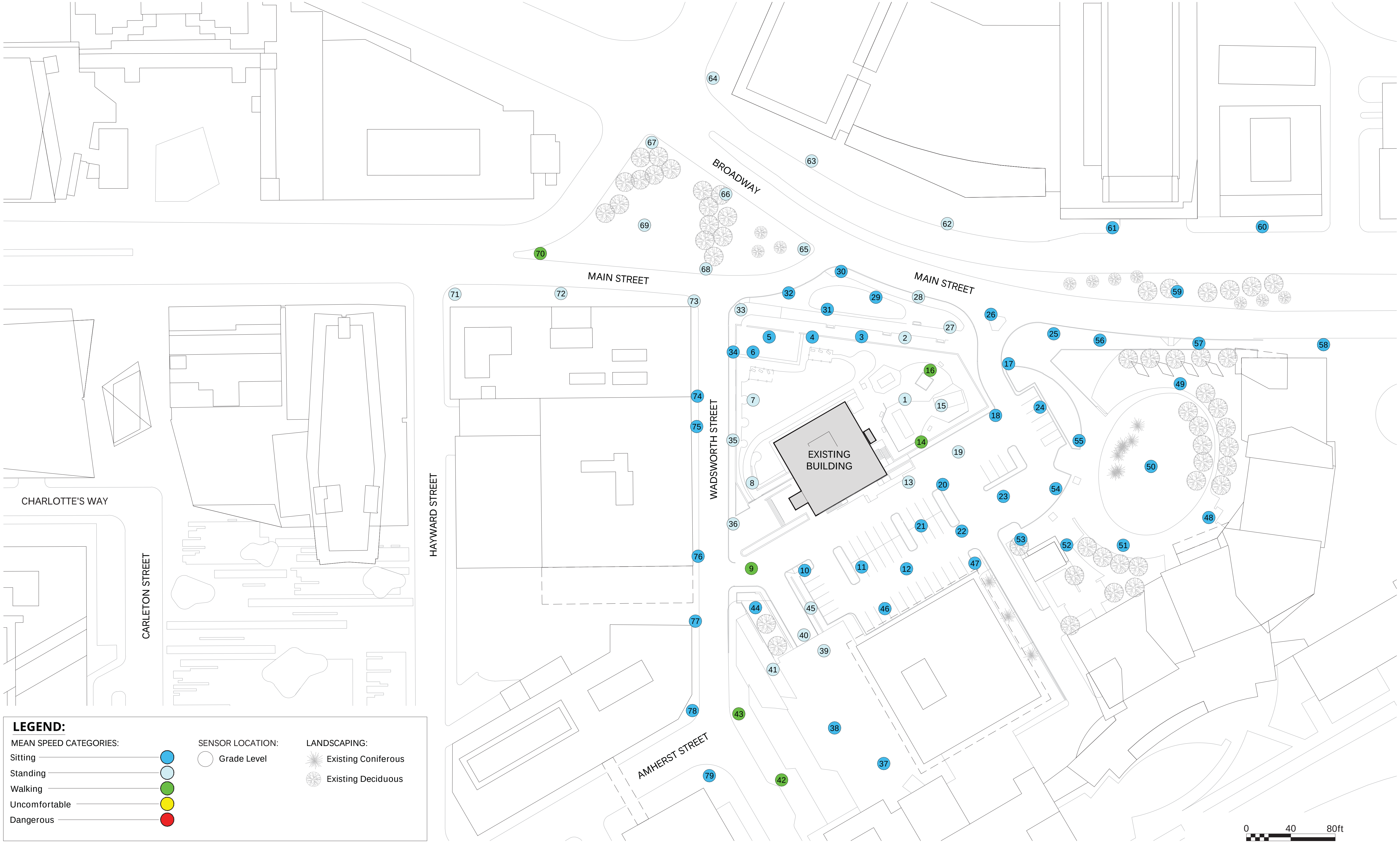
True North

Project 2000222

Drawn by: GRE | Figure: 3B
Approx. Scale: 1" 80'
Date Revised: Oct. 20, 2021

RWDI

Pedestrian Wind Conditions–Mean Speed (Buildout, Spring)



Pedestrian Wind Conditions - Mean Speed
No Build
Summer (June to August)

Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project #2000222

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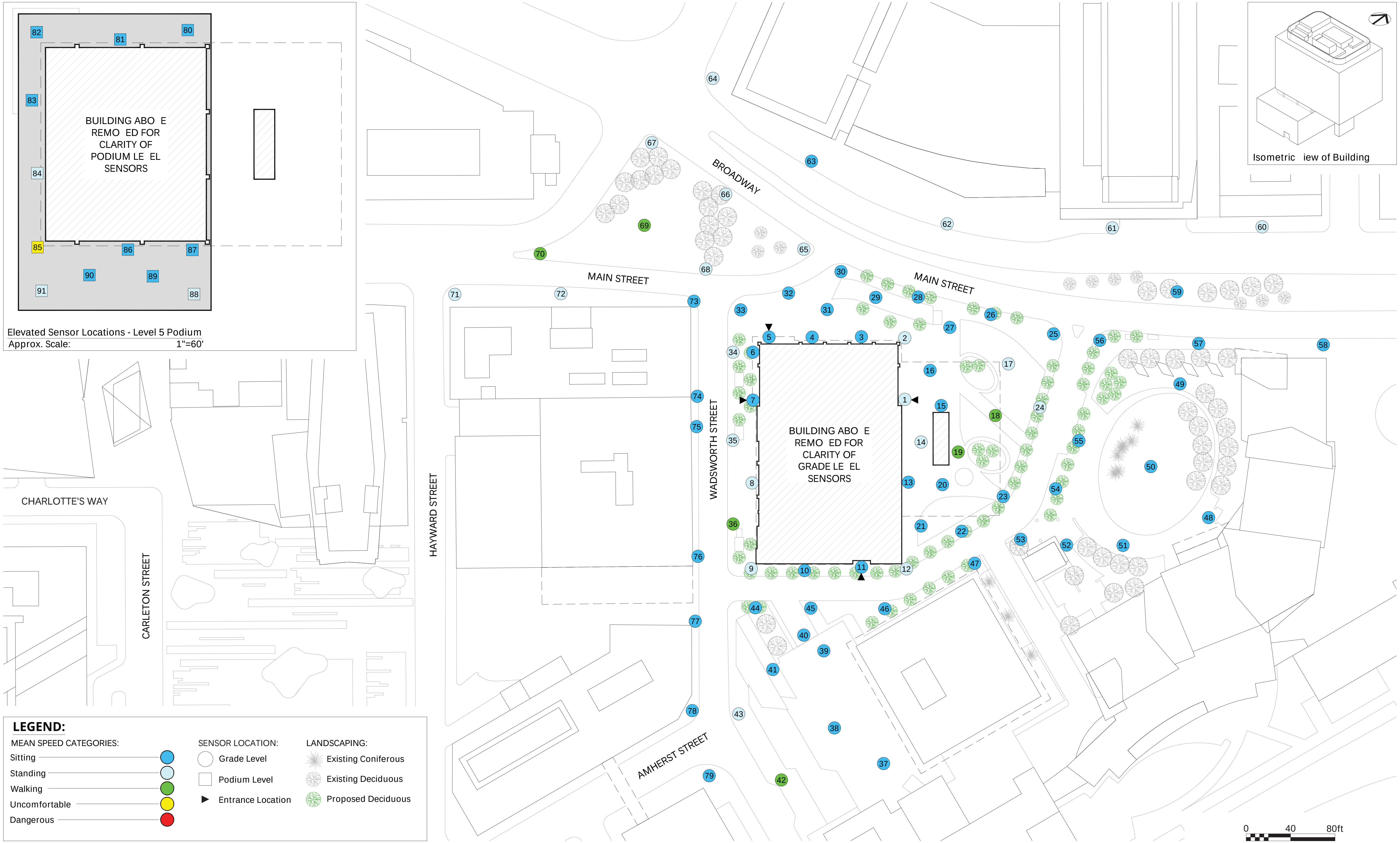
Approx. Scale:	1"=80'		
Date Revised:	Oct. 20, 2021		



Pedestrian Wind Conditions - Mean Speed
Build
Summer (June to August)

Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project #2000222

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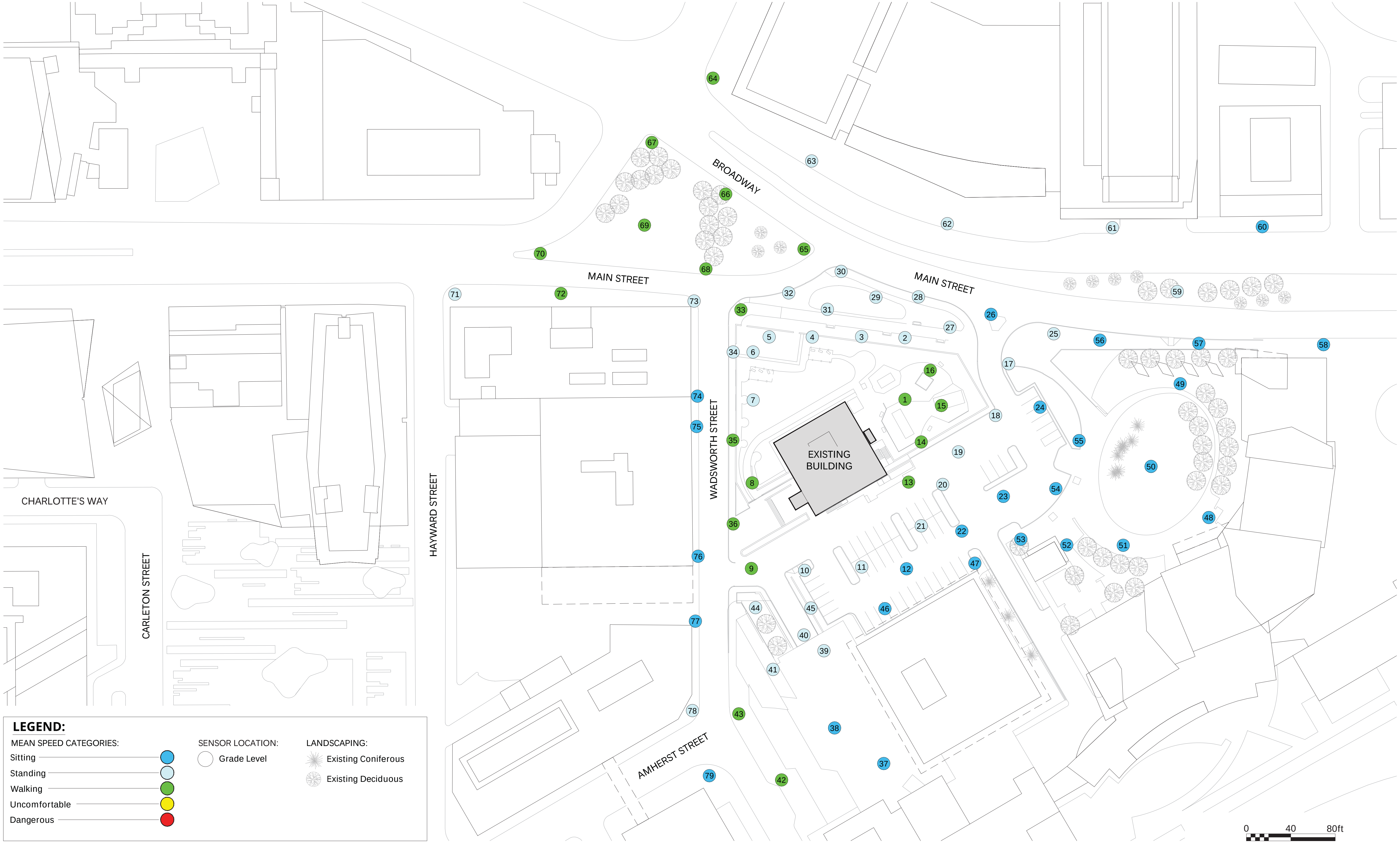
Approx. Scale: 1"=80'
Date Revised: Oct. 20, 2021

RWDI

Pedestrian Wind Conditions—Mean Speed (Buildout, Summer)



Pedestrian Wind Conditions - Mean Speed

No Build

Fall (September to November)

Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project #2000222

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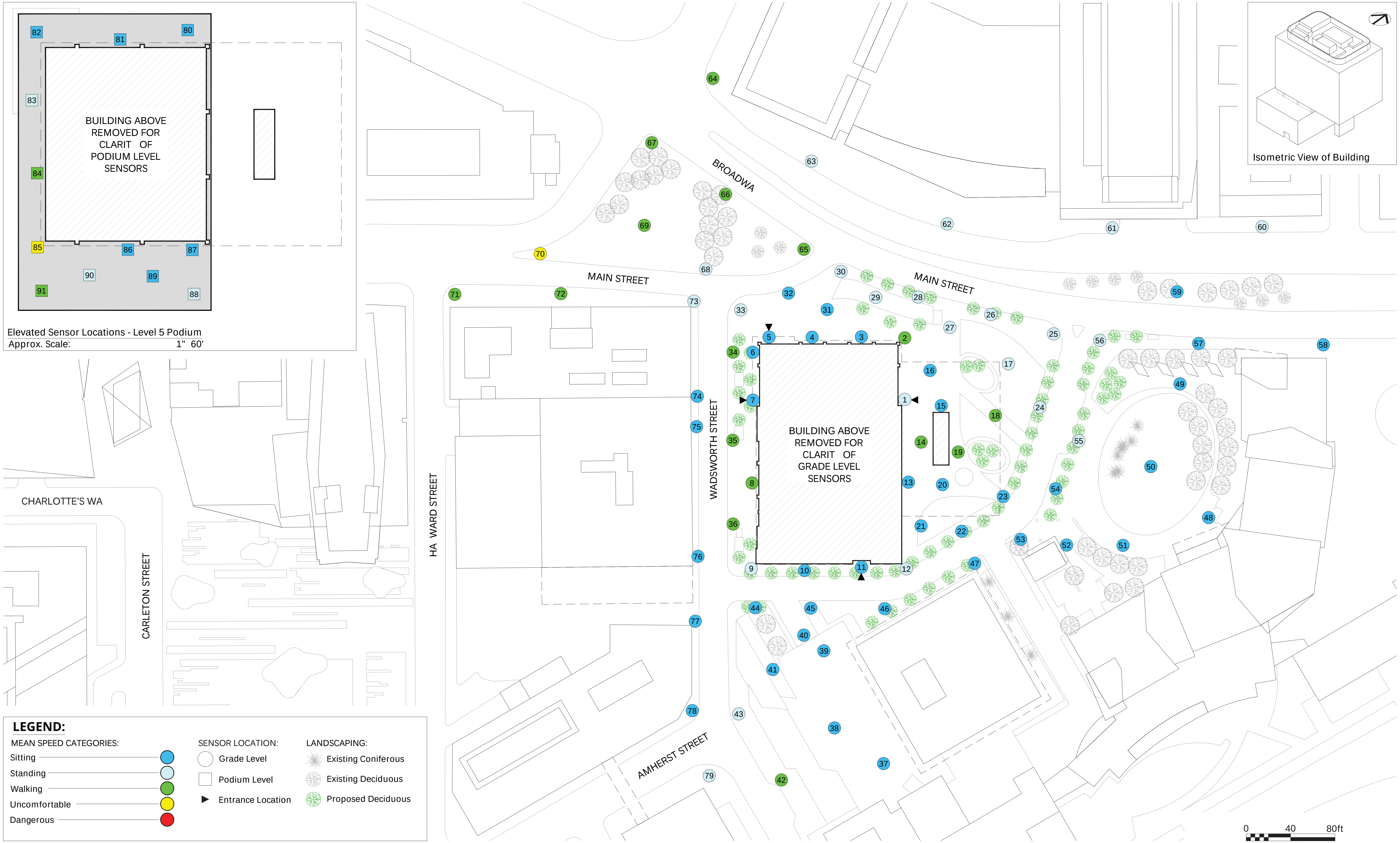
Approx. Scale:	1"=80'		
Date Revised:	Oct. 20, 2021		

RWDI



Pedestrian Wind Conditions - Mean Speed
Build
Fall (September to November)

Kendall Square SoMa Site 2 - Cambridge, MA

True North

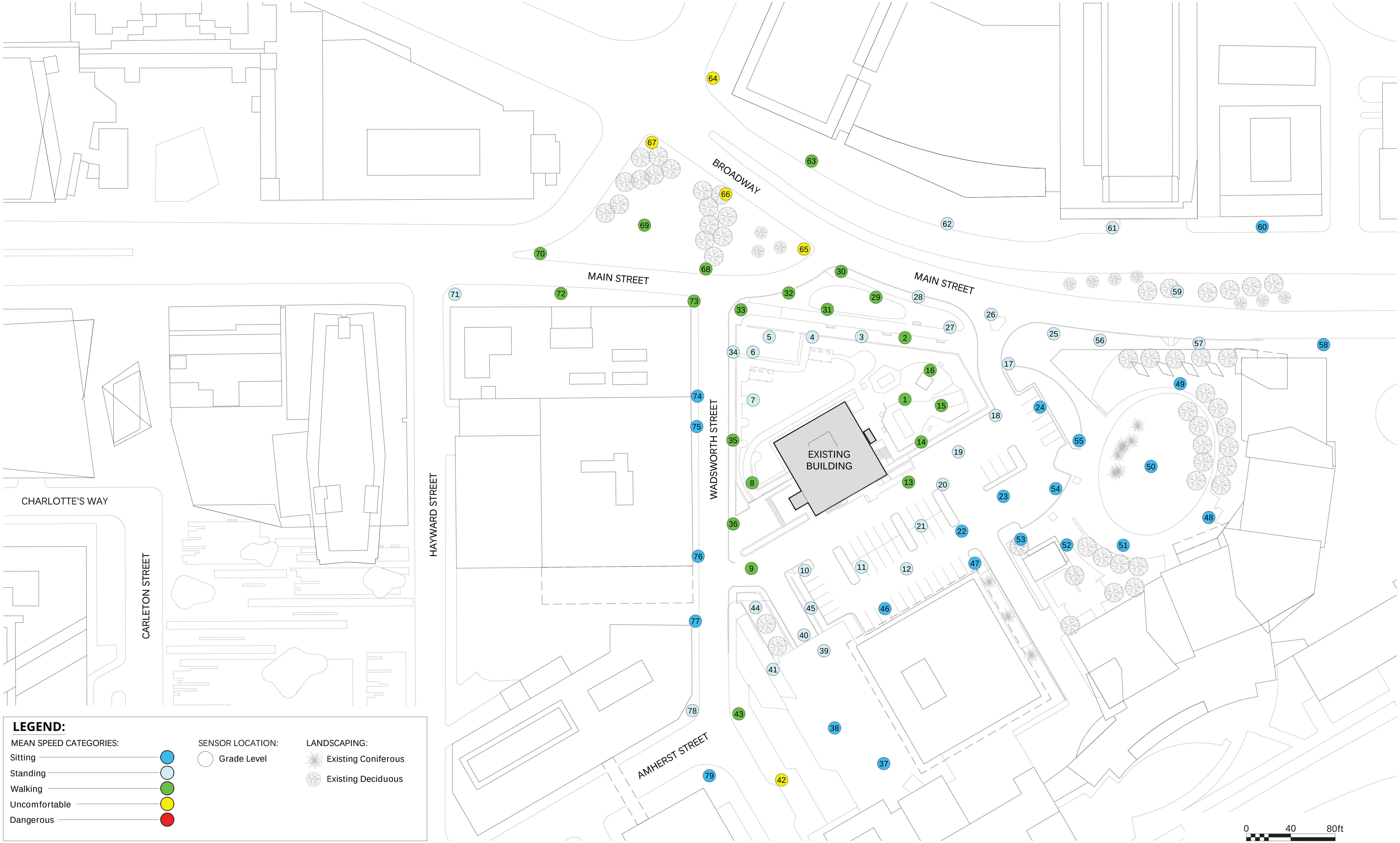
Project 2000222

Drawn by: GRE Figure: 5B

Approx. Scale: 1" 80'

Date Revised: Oct. 20, 2021

Pedestrian Wind Conditions—Mean Speed (Buildout, Fall)



Pedestrian Wind Conditions - Mean Speed
No Build
Winter (December to February)

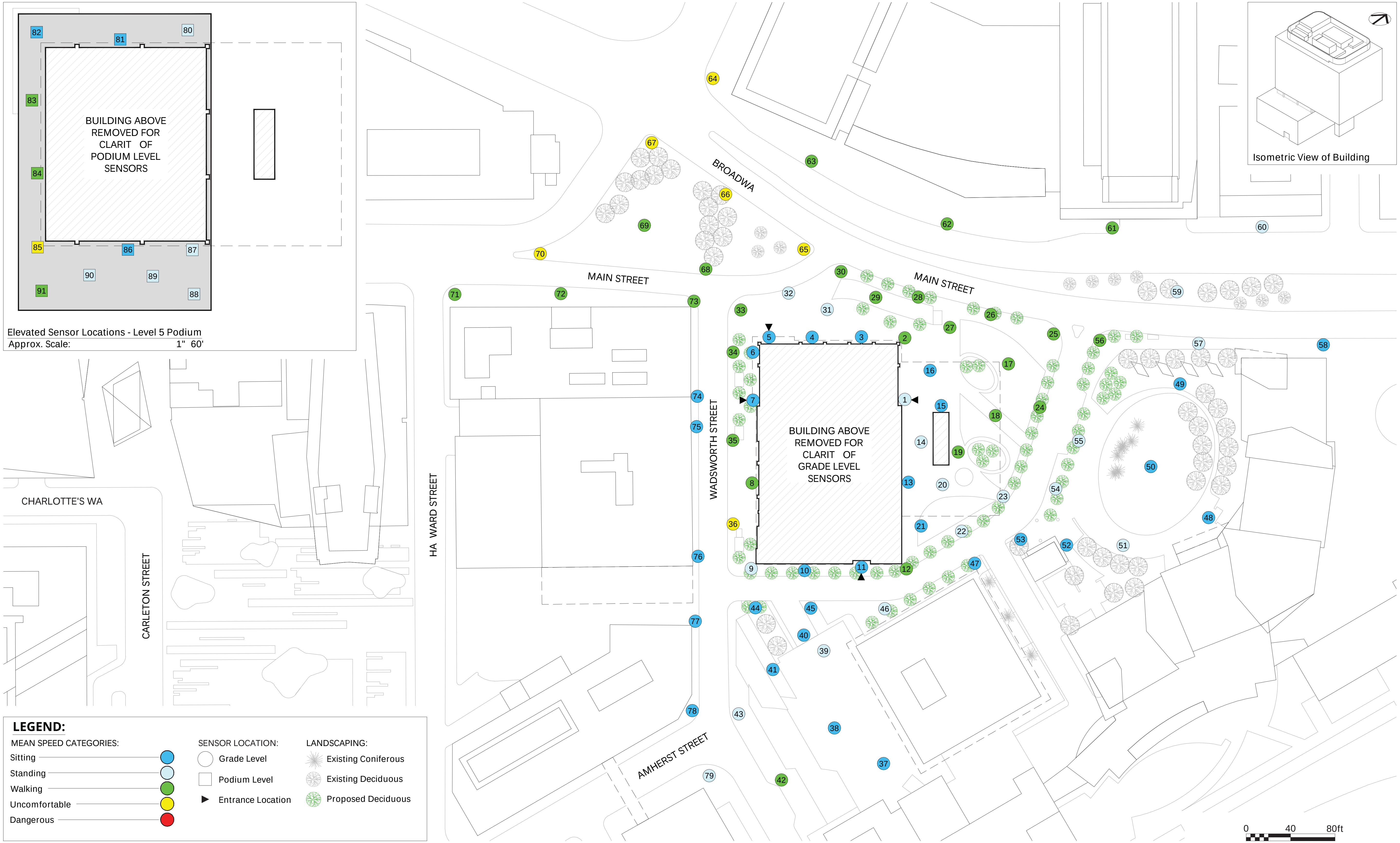
Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project #2000222

Drawn by:	GRE	Figure:	6A
Approx. Scale:	1"=80'		
Date Revised:	Oct. 20, 2021		

Pedestrian Wind Conditions—Mean Speed (Existing, Winter)



Pedestrian Wind Conditions - Mean Speed
Build
Winter (December to February)

Kendall Square SoMa Site 2 - Cambridge, MA

True North

Project 2000222

Drawn by: GRE | Figure: 6B

Approx. Scale: 1" 80'

Date Revised: Oct. 20, 2021

Pedestrian Wind Conditions—Mean Speed (Buildout, Winter)

TABLES

Table 1: Mean Speed and Effective Gust Categories - Annual

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
1	A	Annual	16		Walking	24		Acceptable
	B	Annual	14	-12	Standing	21	-12	Acceptable
2	A	Annual	15		Standing	23		Acceptable
	B	Annual	17	13	Walking	24		Acceptable
3	A	Annual	14		Standing	21		Acceptable
	B	Annual	11	-21	Sitting	17	-19	Acceptable
4	A	Annual	13		Standing	20		Acceptable
	B	Annual	10	-23	Sitting	17	-15	Acceptable
5	A	Annual	14		Standing	21		Acceptable
	B	Annual	9	-36	Sitting	15	-29	Acceptable
6	A	Annual	13		Standing	20		Acceptable
	B	Annual	11	-15	Sitting	17	-15	Acceptable
7	A	Annual	15		Standing	21		Acceptable
	B	Annual	9	-40	Sitting	14	-33	Acceptable
8	A	Annual	18		Walking	25		Acceptable
	B	Annual	16	-11	Walking	23		Acceptable
9	A	Annual	17		Walking	23		Acceptable
	B	Annual	14	-18	Standing	21		Acceptable
10	A	Annual	14		Standing	20		Acceptable
	B	Annual	9	-36	Sitting	15	-25	Acceptable
11	A	Annual	13		Standing	19		Acceptable
	B	Annual	8	-38	Sitting	12	-37	Acceptable
12	A	Annual	12		Sitting	17		Acceptable
	B	Annual	15	25	Standing	20	18	Acceptable
13	A	Annual	16		Walking	21		Acceptable
	B	Annual	12	-25	Sitting	18	-14	Acceptable
14	A	Annual	18		Walking	24		Acceptable
	B	Annual	16	-11	Walking	23		Acceptable
15	A	Annual	16		Walking	23		Acceptable
	B	Annual	9	-44	Sitting	14	-39	Acceptable
16	A	Annual	17		Walking	23		Acceptable
	B	Annual	11	-35	Sitting	18	-22	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Annual

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
17	A	Annual	13		Standing	20		Acceptable
	B	Annual	16	23%	Walking	23	15%	Acceptable
18	A	Annual	13		Standing	20		Acceptable
	B	Annual	18	38%	Walking	25	25%	Acceptable
19	A	Annual	15		Standing	21		Acceptable
	B	Annual	19	27%	Walking	27	29%	Acceptable
20	A	Annual	14		Standing	20		Acceptable
	B	Annual	12	-14%	Sitting	18		Acceptable
21	A	Annual	13		Standing	19		Acceptable
	B	Annual	10	-23%	Sitting	16	-16%	Acceptable
22	A	Annual	11		Sitting	17		Acceptable
	B	Annual	12		Sitting	18		Acceptable
23	A	Annual	11		Sitting	18		Acceptable
	B	Annual	12		Sitting	18		Acceptable
24	A	Annual	11		Sitting	17		Acceptable
	B	Annual	15	36%	Standing	22	29%	Acceptable
25	A	Annual	13		Standing	21		Acceptable
	B	Annual	15	15%	Standing	22		Acceptable
26	A	Annual	13		Standing	20		Acceptable
	B	Annual	14		Standing	22		Acceptable
27	A	Annual	15		Standing	21		Acceptable
	B	Annual	15		Standing	22		Acceptable
28	A	Annual	14		Standing	20		Acceptable
	B	Annual	15		Standing	22		Acceptable
29	A	Annual	16		Walking	23		Acceptable
	B	Annual	16		Walking	23		Acceptable
30	A	Annual	17		Walking	25		Acceptable
	B	Annual	16		Walking	24		Acceptable
31	A	Annual	15		Standing	22		Acceptable
	B	Annual	13	-13%	Standing	20		Acceptable
32	A	Annual	15		Standing	22		Acceptable
	B	Annual	13	-13%	Standing	20		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Annual

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
33	A	Annual	16		Walking	23		Acceptable
	B	Annual	14	-12%	Standing	21		Acceptable
34	A	Annual	14		Standing	21		Acceptable
	B	Annual	16	14%	Walking	23		Acceptable
35	A	Annual	17		Walking	23		Acceptable
	B	Annual	16		Walking	22		Acceptable
36	A	Annual	16		Walking	24		Acceptable
	B	Annual	19	19%	Walking	26		Acceptable
37	A	Annual	11		Sitting	16		Acceptable
	B	Annual	11		Sitting	16		Acceptable
38	A	Annual	12		Sitting	19		Acceptable
	B	Annual	11		Sitting	18		Acceptable
39	A	Annual	15		Standing	21		Acceptable
	B	Annual	12	-20%	Sitting	19		Acceptable
40	A	Annual	15		Standing	21		Acceptable
	B	Annual	11	-27%	Sitting	17	-19%	Acceptable
41	A	Annual	14		Standing	20		Acceptable
	B	Annual	11	-21%	Sitting	18		Acceptable
42	A	Annual	20		Uncomfortable	25		Acceptable
	B	Annual	18		Walking	24		Acceptable
43	A	Annual	18		Walking	24		Acceptable
	B	Annual	15	-17%	Standing	22		Acceptable
44	A	Annual	13		Standing	19		Acceptable
	B	Annual	11	-15%	Sitting	16	-16%	Acceptable
45	A	Annual	14		Standing	20		Acceptable
	B	Annual	10	-29%	Sitting	16	-20%	Acceptable
46	A	Annual	10		Sitting	16		Acceptable
	B	Annual	13	30%	Standing	18	12%	Acceptable
47	A	Annual	9		Sitting	15		Acceptable
	B	Annual	11	22%	Sitting	17	13%	Acceptable
48	A	Annual	8		Sitting	14		Acceptable
	B	Annual	11	38%	Sitting	17	21%	Acceptable

Table 1: Mean Speed and Effective Gust Categories - Annual

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
49	A	Annual	11		Sitting	16		Acceptable
	B	Annual	12		Sitting	18	12%	Acceptable
50	A	Annual	8		Sitting	14		Acceptable
	B	Annual	10	25%	Sitting	15		Acceptable
51	A	Annual	10		Sitting	17		Acceptable
	B	Annual	12	20%	Sitting	19	12%	Acceptable
52	A	Annual	8		Sitting	13		Acceptable
	B	Annual	10	25%	Sitting	15	15%	Acceptable
53	A	Annual	9		Sitting	14		Acceptable
	B	Annual	12	33%	Sitting	18	29%	Acceptable
54	A	Annual	9		Sitting	15		Acceptable
	B	Annual	12	33%	Sitting	18	20%	Acceptable
55	A	Annual	10		Sitting	16		Acceptable
	B	Annual	13	30%	Standing	20	25%	Acceptable
56	A	Annual	13		Standing	21		Acceptable
	B	Annual	15	15%	Standing	23		Acceptable
57	A	Annual	12		Sitting	19		Acceptable
	B	Annual	13		Standing	20		Acceptable
58	A	Annual	10		Sitting	16		Acceptable
	B	Annual	11		Sitting	18	12%	Acceptable
59	A	Annual	13		Standing	21		Acceptable
	B	Annual	13		Standing	21		Acceptable
60	A	Annual	11		Sitting	18		Acceptable
	B	Annual	14	27%	Standing	20	11%	Acceptable
61	A	Annual	14		Standing	21		Acceptable
	B	Annual	16	14%	Walking	24	14%	Acceptable
62	A	Annual	15		Standing	22		Acceptable
	B	Annual	15		Standing	22		Acceptable
63	A	Annual	15		Standing	24		Acceptable
	B	Annual	14		Standing	24		Acceptable
64	A	Annual	19		Walking	25		Acceptable
	B	Annual	19		Walking	26		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Annual

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
65	A	Annual	18		Walking	27		Acceptable
	B	Annual	18		Walking	26		Acceptable
66	A	Annual	19		Walking	26		Acceptable
	B	Annual	19		Walking	26		Acceptable
67	A	Annual	18		Walking	26		Acceptable
	B	Annual	19		Walking	26		Acceptable
68	A	Annual	16		Walking	23		Acceptable
	B	Annual	15		Standing	22		Acceptable
69	A	Annual	16		Walking	24		Acceptable
	B	Annual	18	12%	Walking	26		Acceptable
70	A	Annual	18		Walking	25		Acceptable
	B	Annual	20	11%	Uncomfortable	27		Acceptable
71	A	Annual	15		Standing	22		Acceptable
	B	Annual	17	13%	Walking	24		Acceptable
72	A	Annual	16		Walking	23		Acceptable
	B	Annual	17		Walking	24		Acceptable
73	A	Annual	15		Standing	22		Acceptable
	B	Annual	15		Standing	22		Acceptable
74	A	Annual	11		Sitting	17		Acceptable
	B	Annual	11		Sitting	17		Acceptable
75	A	Annual	11		Sitting	17		Acceptable
	B	Annual	12		Sitting	17		Acceptable
76	A	Annual	11		Sitting	17		Acceptable
	B	Annual	10		Sitting	16		Acceptable
77	A	Annual	10		Sitting	16		Acceptable
	B	Annual	8	-20%	Sitting	14	-12%	Acceptable
78	A	Annual	13		Standing	20		Acceptable
	B	Annual	10	-23%	Sitting	16	-20%	Acceptable
79	A	Annual	12		Sitting	18		Acceptable
	B	Annual	13		Standing	19		Acceptable
80	A	Annual	N/A		--	--		--
	B	Annual	13		Standing	20		Acceptable

Table 1: Mean Speed and Effective Gust Categories - Annual

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
81	A	Annual	N/A		--	--		--
	B	Annual	11		Sitting	17		Acceptable
82	A	Annual	N/A		--	--		--
	B	Annual	10		Sitting	16		Acceptable
83	A	Annual	N/A		--	--		--
	B	Annual	15		Standing	21		Acceptable
84	A	Annual	N/A		--	--		--
	B	Annual	17		Walking	24		Acceptable
85	A	Annual	N/A		--	--		--
	B	Annual	22		Uncomfortable	30		Acceptable
86	A	Annual	N/A		--	--		--
	B	Annual	12		Sitting	18		Acceptable
87	A	Annual	N/A		--	--		--
	B	Annual	12		Sitting	18		Acceptable
88	A	Annual	N/A		--	--		--
	B	Annual	14		Standing	20		Acceptable
89	A	Annual	N/A		--	--		--
	B	Annual	12		Sitting	18		Acceptable
90	A	Annual	N/A		--	--		--
	B	Annual	13		Standing	20		Acceptable
91	A	Annual	N/A		--	--		--
	B	Annual	16		Walking	23		Acceptable

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

Notes

1 Wind Speeds are for a 1% pro a ility of exceedance

2 % Change is ased on comparison with Configuration A

3 % changes less than 10% are excluded

Table 2: Mean Speed and Effective Gust Categories - Seasonal

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
1	A	17	14	16	16	25	22	24	24
	B	15	14	14	13	22	20	21	20
2	A	16	13	15	16	24	20	22	24
	B	17	13	16	18	25	19	23	26
3	A	15	11	13	15	22	17	21	23
	B	12	9	11	12	18	14	17	19
4	A	14	11	13	14	22	17	20	22
	B	11	8	10	11	18	13	17	18
5	A	15	12	14	14	23	19	22	22
	B	9	7	8	9	16	11	14	15
6	A	14	12	13	14	21	18	21	21
	B	11	9	11	12	17	13	16	18
7	A	16	14	15	15	22	18	21	22
	B	9	7	9	10	14	11	13	15
8	A	19	15	17	19	26	20	24	26
	B	16	15	16	17	23	22	23	24
9	A	17	16	16	18	23	21	23	25
	B	15	14	14	14	22	19	20	21
10	A	14	12	13	14	20	18	19	21
	B	9	9	9	10	15	14	15	16
11	A	14	12	13	14	20	17	19	21
	B	8	7	8	8	12	11	12	13
12	A	12	9	12	13	18	14	17	19
	B	16	13	15	16	22	18	20	22
13	A	17	15	16	16	23	20	21	22
	B	12	11	12	12	19	16	18	19
14	A	19	17	18	18	26	22	24	25
	B	17	15	16	15	25	22	24	23
15	A	17	15	16	17	24	20	22	24
	B	9	7	8	9	15	12	14	15
16	A	18	16	16	16	25	21	23	24
	B	11	10	11	12	19	15	18	20

Table 2: Mean Speed and Effective Gust Categories - Seasonal

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
17	A	14	11	13	14	20	17	19	21
	B	17	15	15	16	24	21	23	24
18	A	14	12	13	14	21	17	19	21
	B	19	16	17	18	26	23	25	25
19	A	16	14	15	15	22	18	21	22
	B	20	18	19	18	29	25	27	26
20	A	14	12	14	14	21	17	20	21
	B	13	11	12	13	19	16	19	20
21	A	13	11	13	14	20	15	19	20
	B	11	9	10	10	17	14	16	17
22	A	12	9	11	12	18	14	17	18
	B	13	11	12	13	19	16	18	20
23	A	12	10	11	12	19	15	18	19
	B	13	10	12	13	19	15	18	20
24	A	11	10	11	12	18	15	17	19
	B	16	14	15	16	23	20	22	23
25	A	14	11	13	15	22	16	20	23
	B	15	12	14	16	23	18	21	24
26	A	13	11	12	14	21	16	19	22
	B	15	12	14	16	23	18	21	23
27	A	15	13	14	15	22	19	21	23
	B	15	11	14	17	23	17	21	24
28	A	14	13	13	14	21	18	20	21
	B	15	12	14	16	22	17	21	24
29	A	16	12	14	17	24	18	22	26
	B	16	12	15	18	24	18	22	26
30	A	17	12	15	19	25	19	23	28
	B	16	12	15	18	25	18	22	27
31	A	15	12	14	16	23	17	21	24
	B	13	10	12	14	20	16	19	21
32	A	16	12	14	17	23	17	21	24
	B	13	11	12	14	20	17	19	21

Table 2: Mean Speed and Effective Gust Categories - Seasonal

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
33	A	17	13	16	18	24	18	23	25
	B	15	12	14	16	22	17	21	22
34	A	15	11	14	15	22	17	21	23
	B	17	13	16	18	24	18	22	25
35	A	17	15	16	17	24	20	23	24
	B	16	14	16	17	23	20	22	24
36	A	17	13	16	17	25	20	23	25
	B	20	18	19	20	27	24	25	27
37	A	11	10	11	11	17	15	16	17
	B	11	10	10	11	16	14	15	16
38	A	13	11	12	12	20	17	18	20
	B	12	11	11	11	19	17	18	18
39	A	16	13	15	15	22	19	21	23
	B	12	11	12	13	19	16	18	20
40	A	16	14	15	15	22	19	20	21
	B	11	10	11	11	18	15	17	18
41	A	16	13	14	14	22	19	20	21
	B	12	11	11	11	19	17	17	18
42	A	21	18	19	20	27	24	25	26
	B	20	17	18	18	26	23	24	25
43	A	19	17	17	18	25	22	23	24
	B	17	15	15	15	23	21	21	22
44	A	14	12	13	13	20	17	18	19
	B	12	9	11	12	17	14	16	17
45	A	15	13	14	14	21	18	19	21
	B	10	8	10	11	16	13	15	17
46	A	11	8	10	11	17	13	16	18
	B	14	12	12	14	19	15	17	19
47	A	9	7	9	10	16	12	15	16
	B	12	10	11	11	18	15	17	18
48	A	9	7	8	9	14	11	13	15
	B	11	8	10	12	18	13	15	19

Table 2: Mean Speed and Effective Gust Categories - Seasonal

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
49	A	11	10	11	11	17	15	16	18
	B	12	11	12	12	18	16	17	19
50	A	9	7	8	9	15	12	14	15
	B	10	9	9	10	16	13	15	16
51	A	11	8	10	11	18	14	16	19
	B	13	9	11	13	20	15	18	21
52	A	8	7	8	9	14	11	13	14
	B	10	9	9	10	16	13	15	16
53	A	10	8	9	10	15	12	14	15
	B	13	12	12	12	19	16	18	18
54	A	10	8	9	10	16	12	15	16
	B	13	11	12	13	19	16	18	20
55	A	10	9	10	11	17	13	15	17
	B	14	12	13	14	21	17	19	21
56	A	14	11	12	15	21	16	19	23
	B	16	12	14	17	23	17	21	25
57	A	13	10	11	13	19	15	18	20
	B	13	10	12	14	20	15	18	22
58	A	11	9	10	11	17	13	16	18
	B	12	10	11	12	18	14	17	19
59	A	14	11	13	15	22	16	20	23
	B	13	10	12	15	21	16	19	23
60	A	12	10	11	12	19	17	18	19
	B	14	13	13	14	21	18	20	21
61	A	14	11	13	15	21	17	19	23
	B	17	13	15	18	24	19	22	26
62	A	16	14	14	15	23	20	21	23
	B	16	14	15	16	23	20	22	24
63	A	16	13	14	16	25	21	23	26
	B	15	11	13	16	24	18	22	27
64	A	19	15	18	20	26	21	24	27
	B	19	15	18	21	26	20	24	29

Table 2: Mean Speed and Effective Gust Categories - Seasonal

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
65	A	18	14	17	20	27	20	25	29
	B	18	13	16	20	27	20	24	29
66	A	20	15	18	21	26	20	24	28
	B	20	15	18	21	27	20	25	29
67	A	19	14	18	20	27	20	25	27
	B	19	14	18	20	27	21	25	29
68	A	17	13	16	17	23	18	22	24
	B	16	13	15	16	23	19	22	24
69	A	17	14	16	17	25	21	24	26
	B	18	16	17	19	27	23	26	27
70	A	19	16	18	19	26	22	25	27
	B	20	18	20	21	28	24	27	28
71	A	15	13	15	15	23	19	22	24
	B	17	15	16	18	25	22	24	26
72	A	17	14	16	17	24	19	23	24
	B	18	15	17	18	25	20	24	25
73	A	16	13	15	17	23	18	22	24
	B	16	12	15	16	23	18	21	24
74	A	12	10	12	11	18	15	17	17
	B	12	10	12	12	18	15	17	18
75	A	12	10	11	11	18	15	17	17
	B	12	11	12	12	18	16	17	18
76	A	12	9	11	12	19	13	17	19
	B	11	9	10	11	17	14	16	17
77	A	10	9	10	11	17	14	16	17
	B	9	7	8	9	14	12	14	14
78	A	14	11	13	14	21	17	19	20
	B	11	9	10	11	17	14	16	17
79	A	13	11	12	12	19	17	18	19
	B	14	12	13	13	20	17	18	19
80	A	N A	--	--	--	--	--	--	--
	B	14	10	12	15	20	15	19	21

Table 2: Mean Speed and Effective Gust Categories - Seasonal

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
81	A	N A	--	--	--	--	--	--	--
	B	12	9	11	12	18	13	16	18
82	A	N A	--	--	--	--	--	--	--
	B	10	8	10	11	17	12	15	17
83	A	N A	--	--	--	--	--	--	--
	B	16	12	14	16	22	16	20	23
84	A	N A	--	--	--	--	--	--	--
	B	18	14	16	19	25	19	23	26
85	A	N A	--	--	--	--	--	--	--
	B	24	21	22	23	32	27	30	31
86	A	N A	--	--	--	--	--	--	--
	B	12	11	12	12	18	16	18	18
87	A	N A	--	--	--	--	--	--	--
	B	12	11	12	13	18	16	17	19
88	A	N A	--	--	--	--	--	--	--
	B	14	13	14	14	21	18	20	21
89	A	N A	--	--	--	--	--	--	--
	B	12	11	12	13	19	17	18	19
90	A	N A	--	--	--	--	--	--	--
	B	14	12	13	14	21	18	20	21
91	A	N A	--	--	--	--	--	--	--
	B	17	14	16	18	24	20	23	25

Seasons	Months	Mean Wind Criteria Speed (mph)		Effective Gust Criteria (mph)	
Spring	March - May	_ 12	Comfortable for Sitting	≤ 31	Acceptable
Summer	June - August	13 - 15	Comfortable for Standing	31	Unacceptable
Fall	September - November	16 - 19	Comfortable for Walking		
Winter	December - February	20 - 27	Uncomfortable for Walking		
Annual	January - December	27	Dangerous Conditions		

Configurations

(A) No Build: Existing site and surroundings

(B) Build: Project with existing surroundings

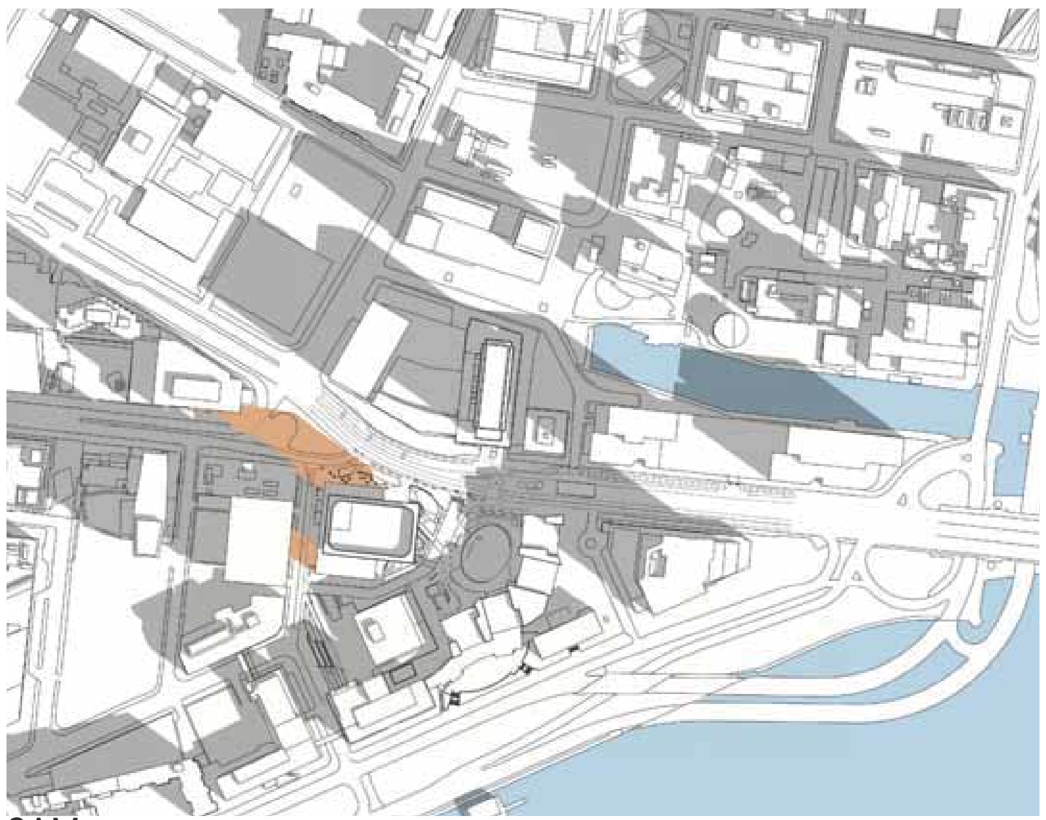
Notes

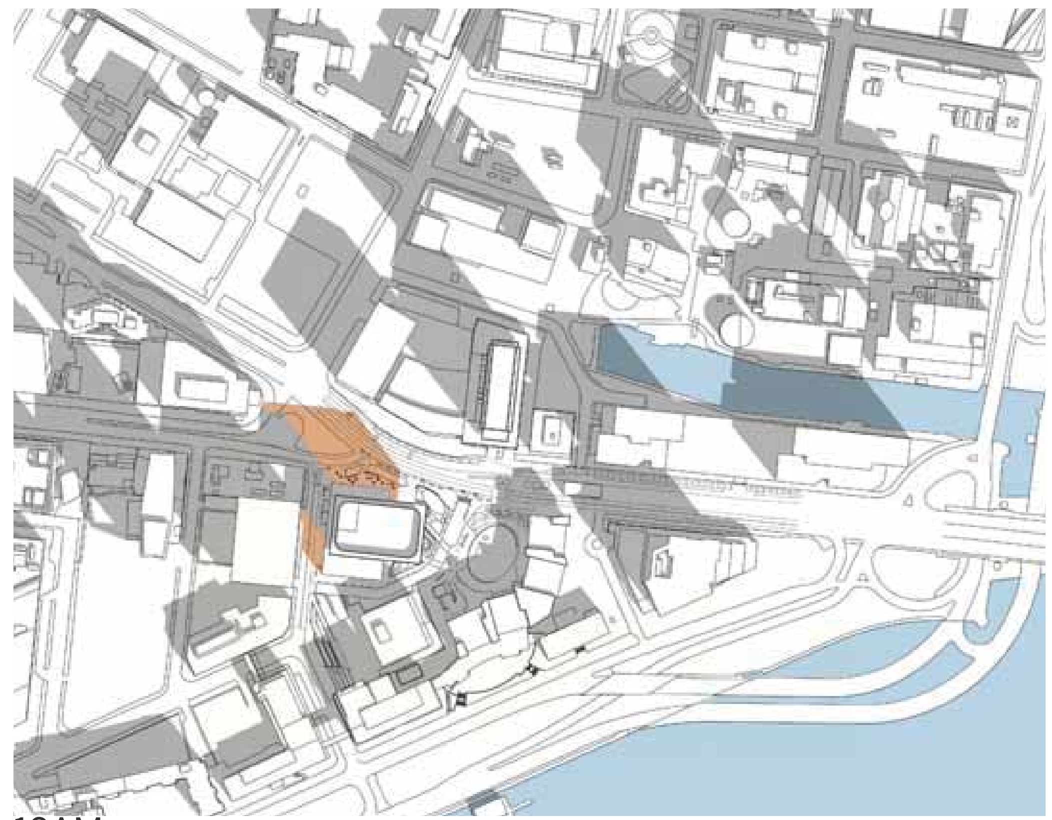
1) Wind Speeds are for a 1% probability of exceedance

6. Shadow Study

March 21st / September 21st
9AM, 10AM, 11AM

NET NEW SHADOWS WITH PROPOSED BUILDING


9AM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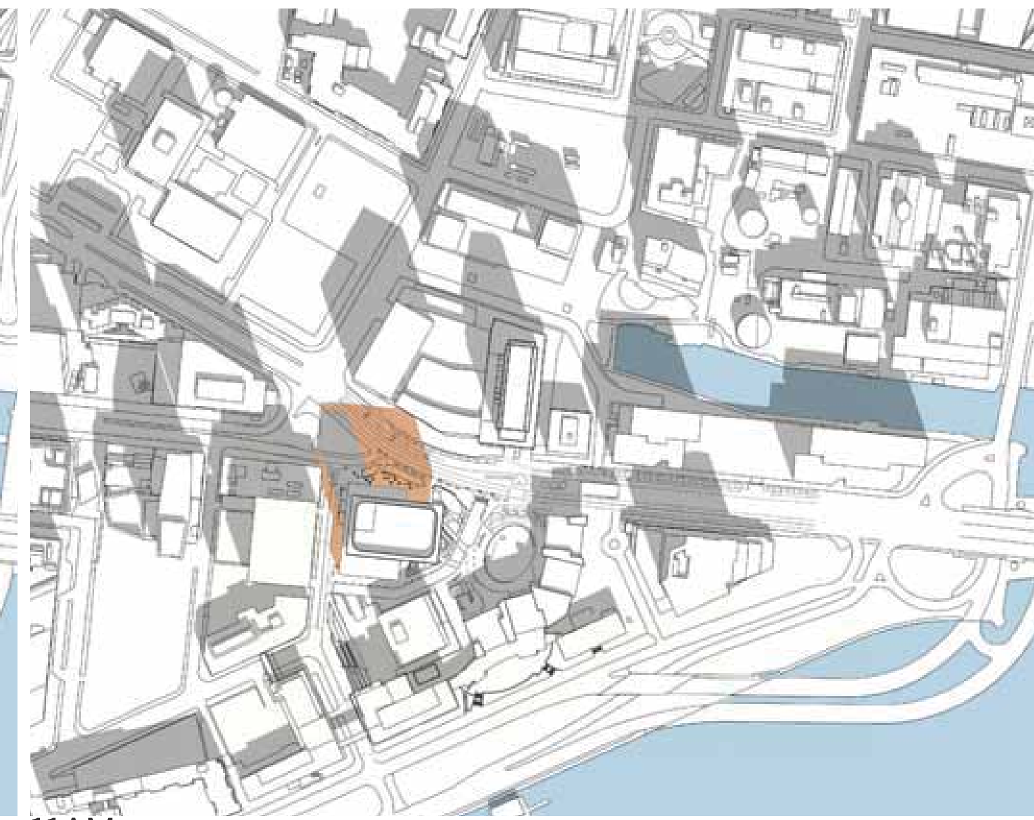
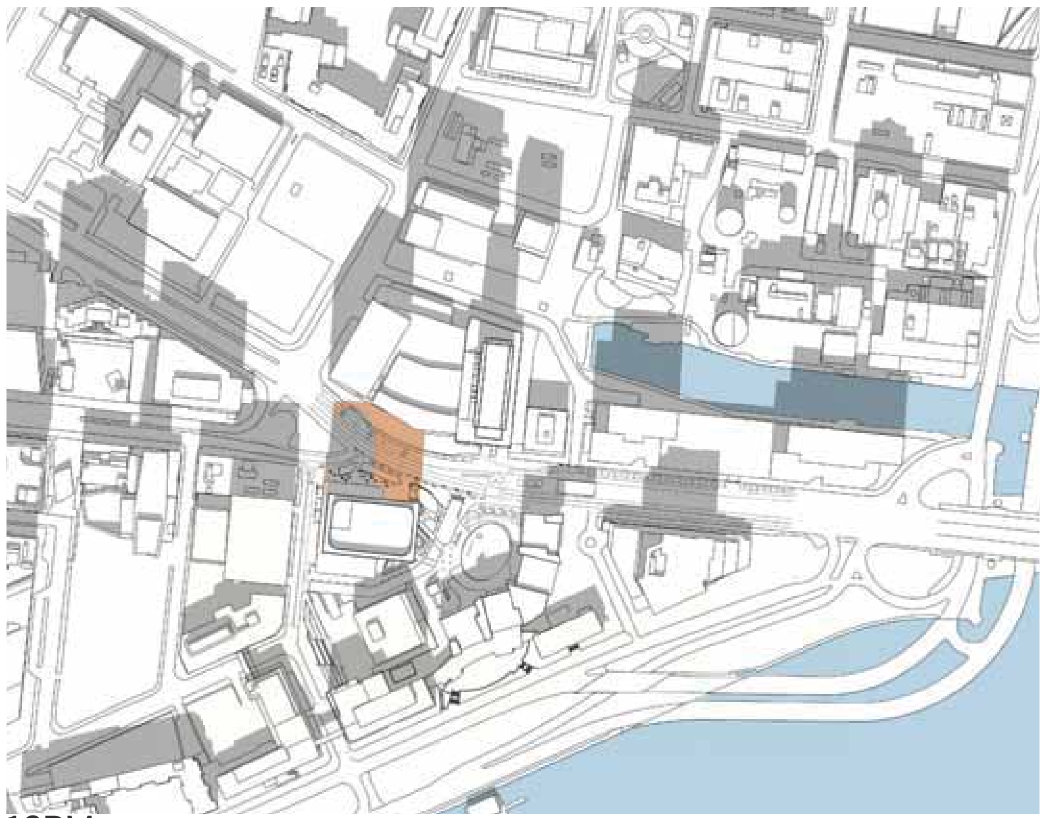
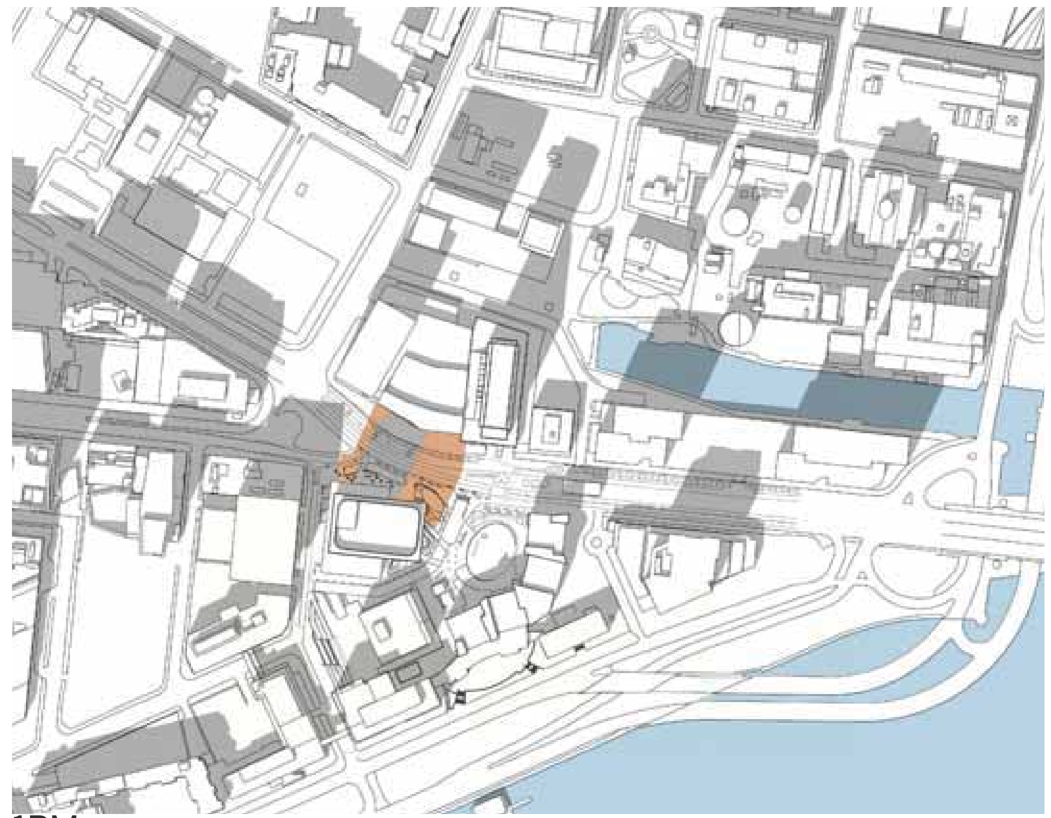

11AM

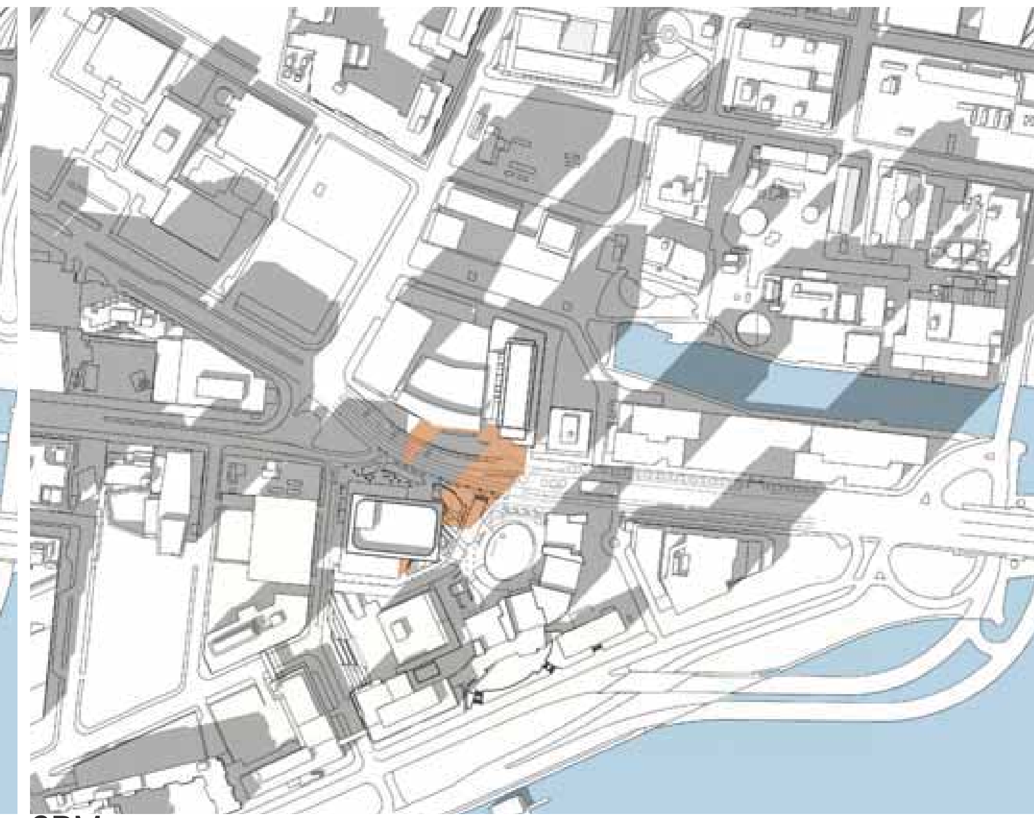
Shadow Study: Net New Shadows—March 21/Sept. 21

March 21st / September 21st
12PM, 1PM, 2PM

NET NEW SHADOWS WITH PROPOSED BUILDING


12PM


1PM


2PM

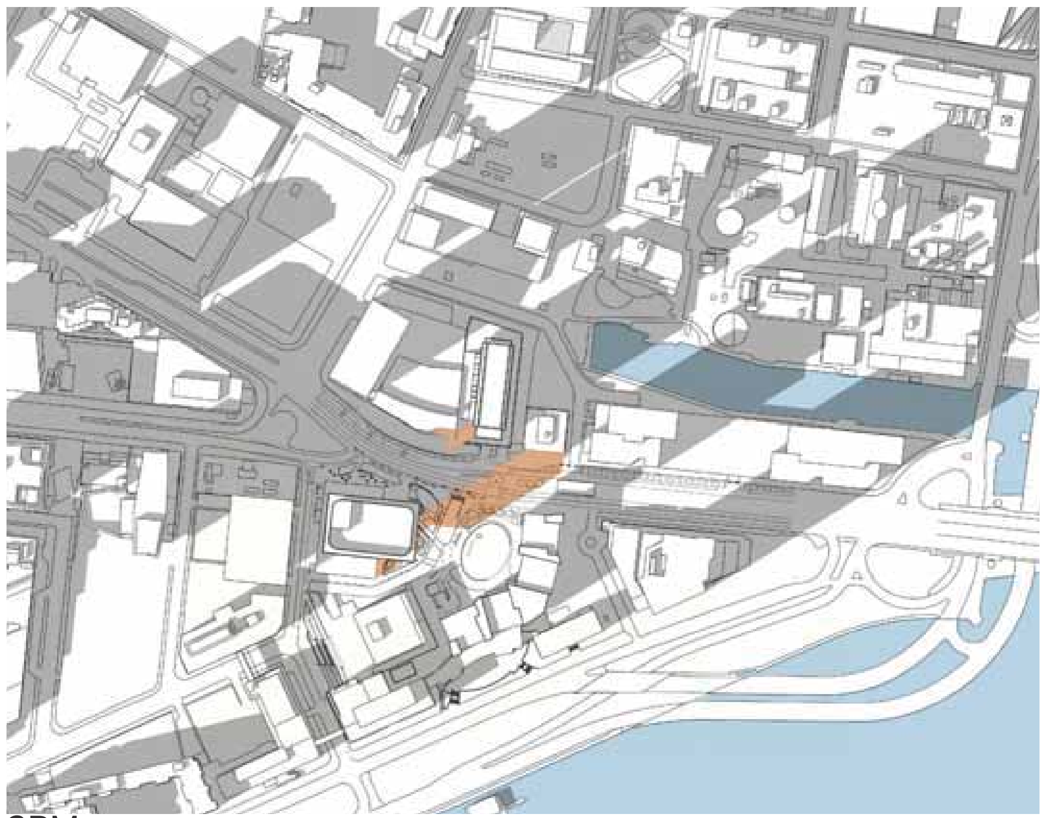
NET NEW SHADOWS

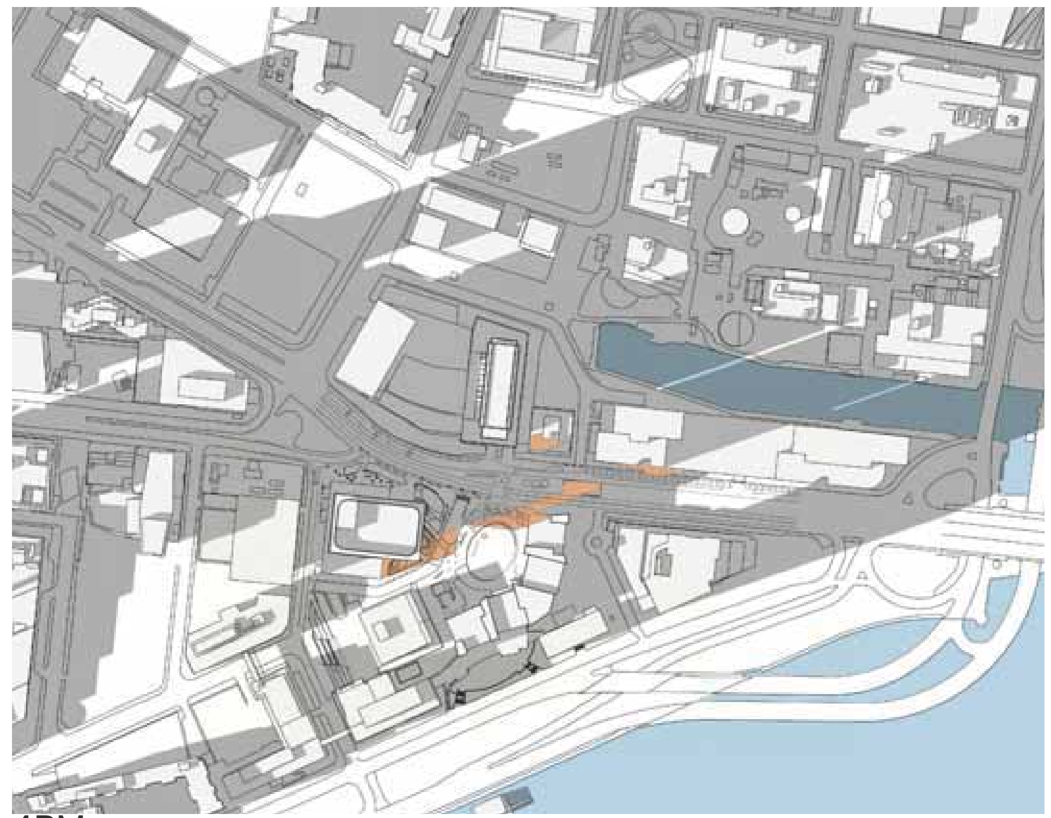
N

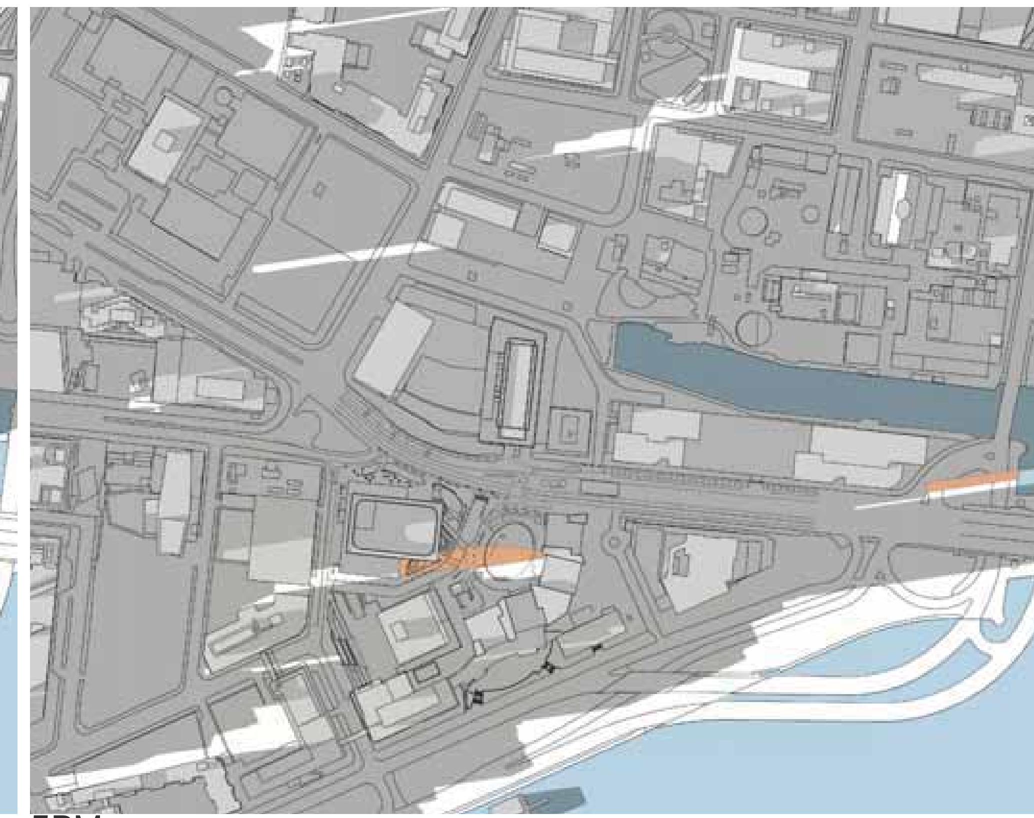
Shadow Study: Net New Shadows–March 21/Sept. 21

March 21st / September 21st
3PM, 4PM, 5PM

NET NEW SHADOWS WITH PROPOSED BUILDING


3PM


4PM


5PM

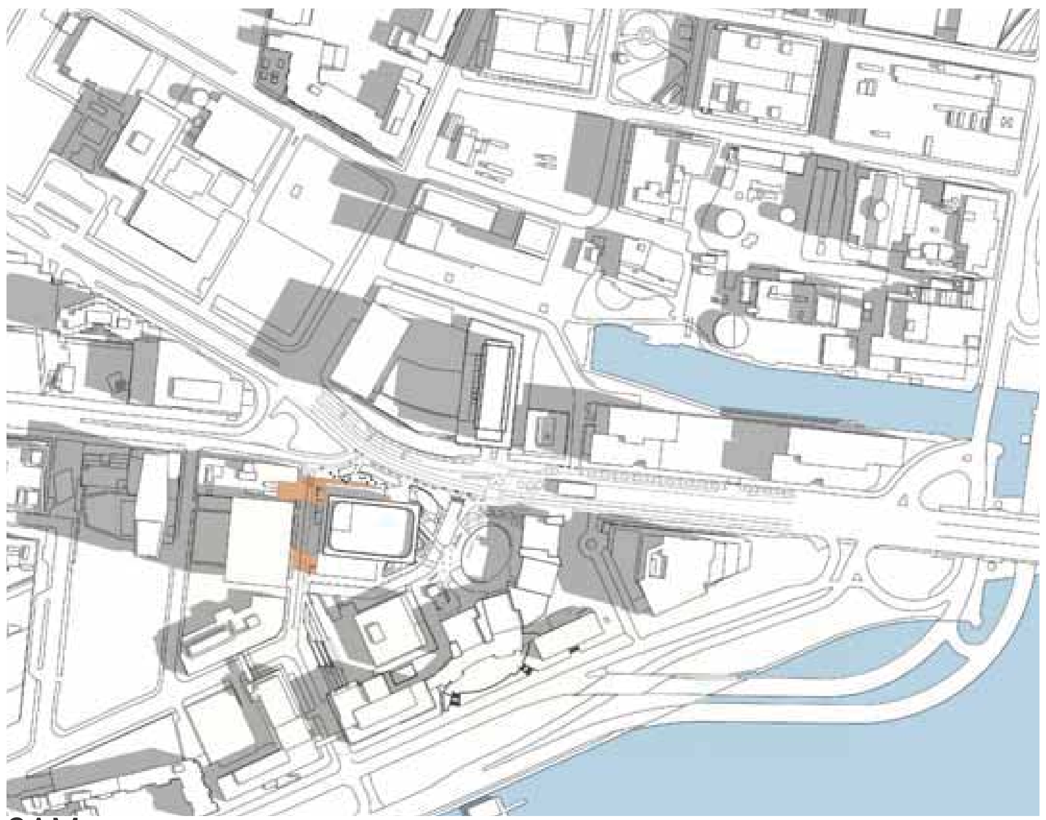
NET NEW SHADOWS

N

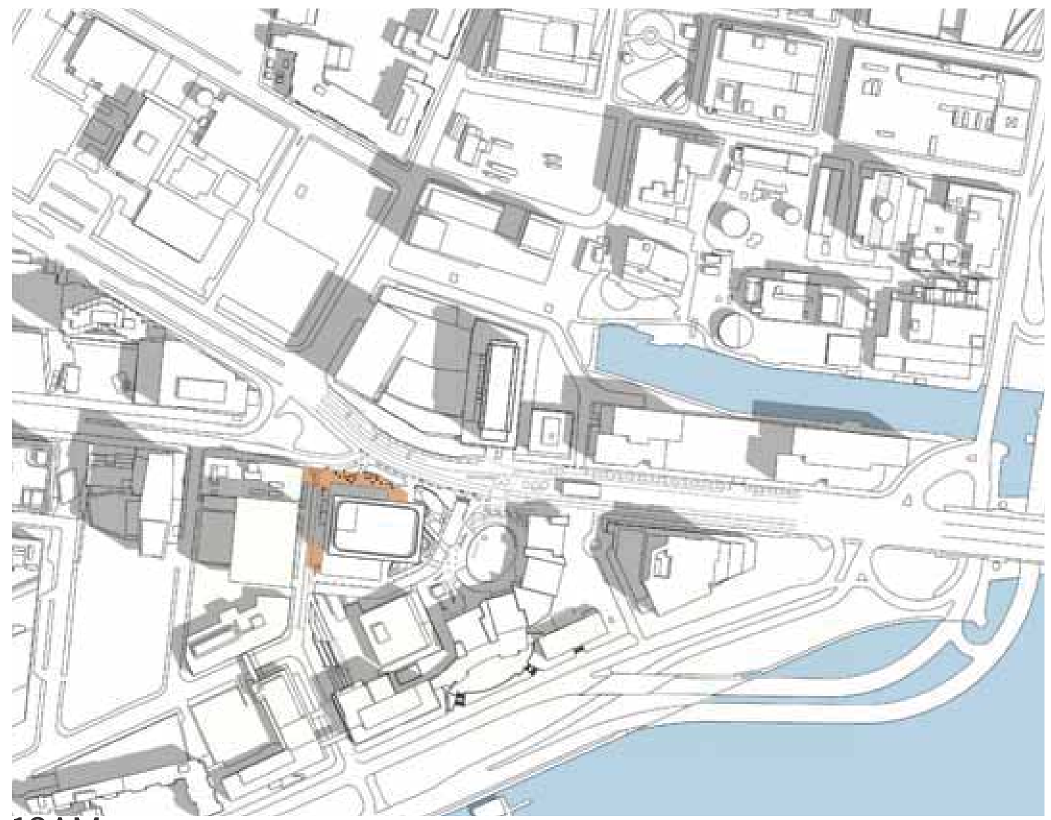
Shadow Study: Net New Shadows–March 21/Sept. 21

JUNE 21st
9AM, 10AM, 11AM

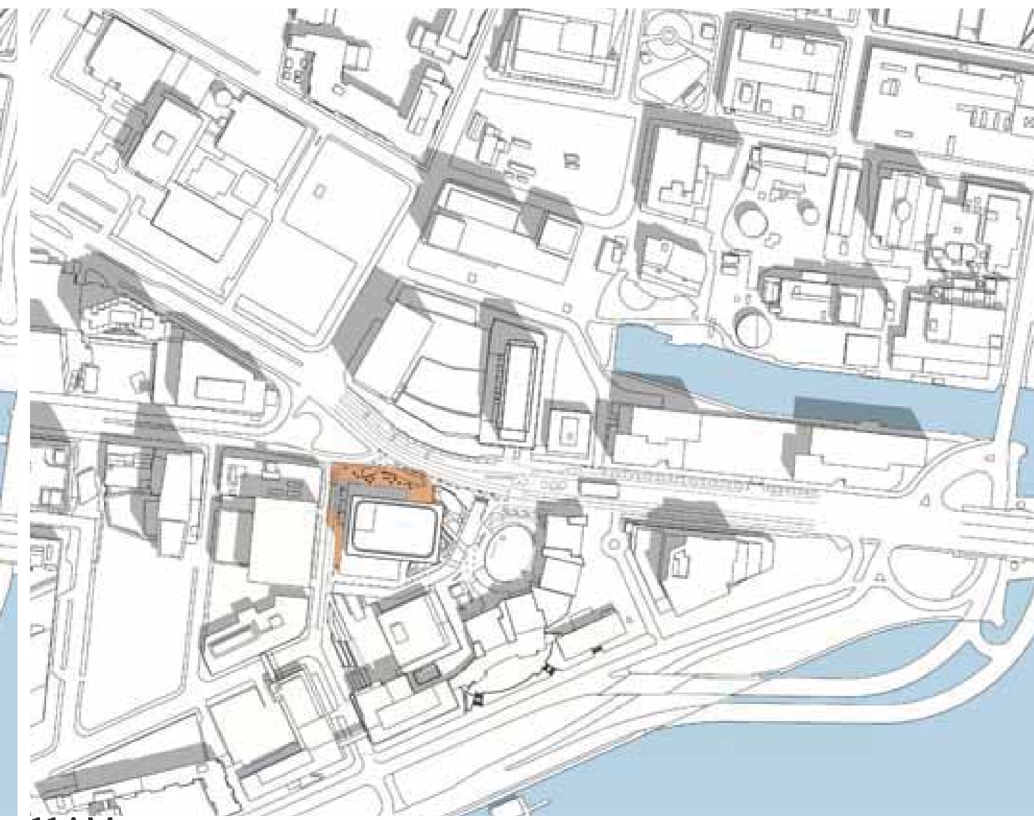
NET NEW SHADOWS WITH PROPOSED BUILDING



9AM



10AM



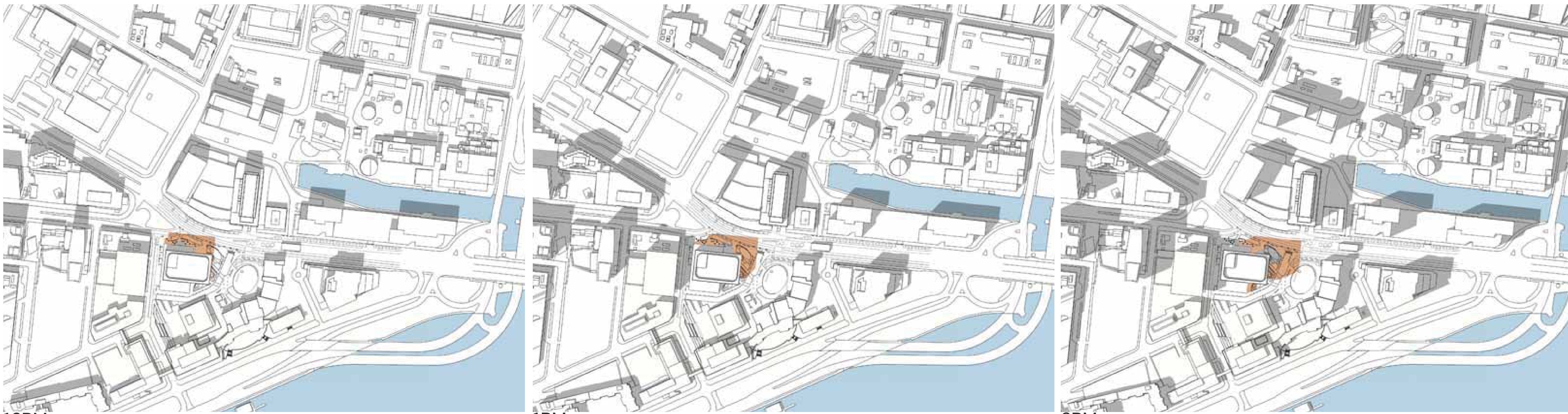
11AM

NET NEW SHADOWS

N

JUNE 21st
12PM, 1PM, 2PM

NET NEW SHADOWS WITH PROPOSED BUILDING

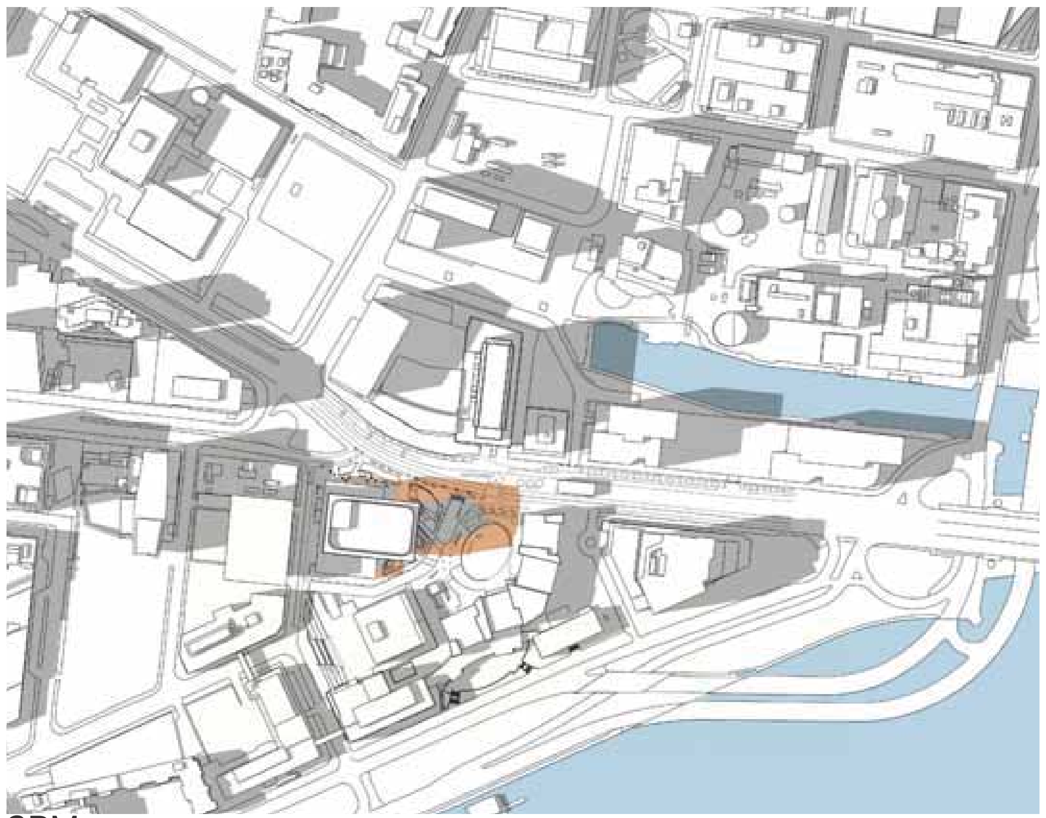


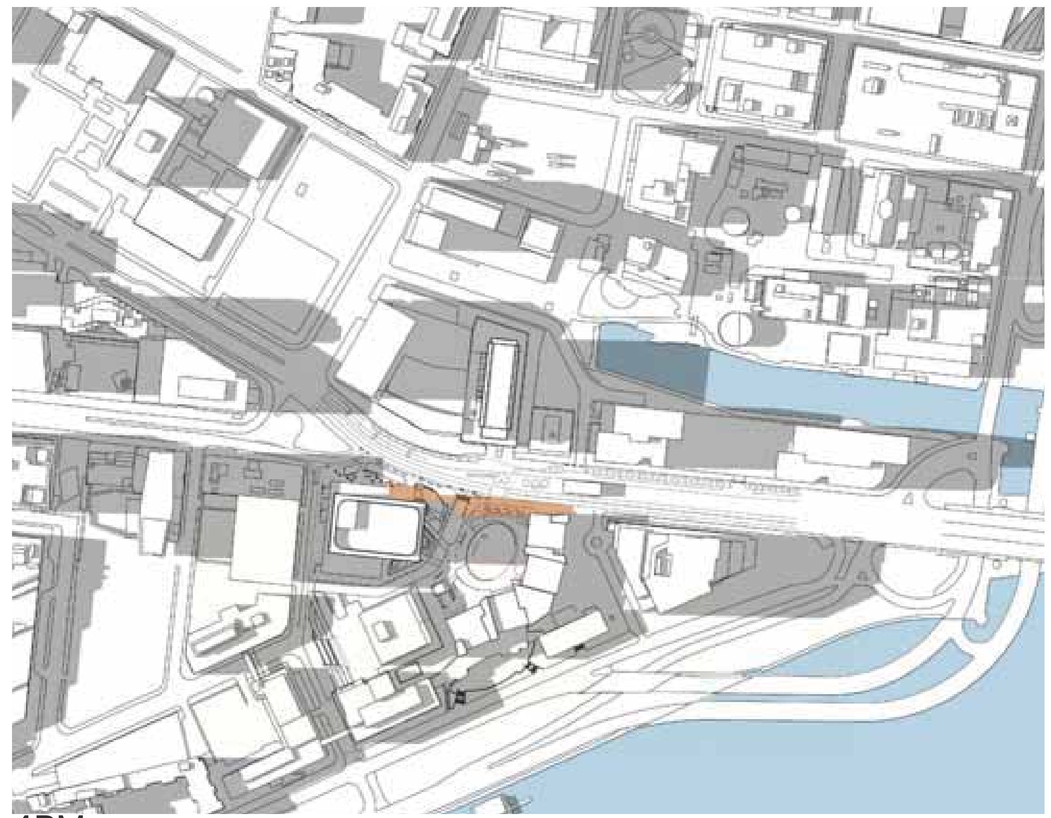
12PM 1PM 2PM

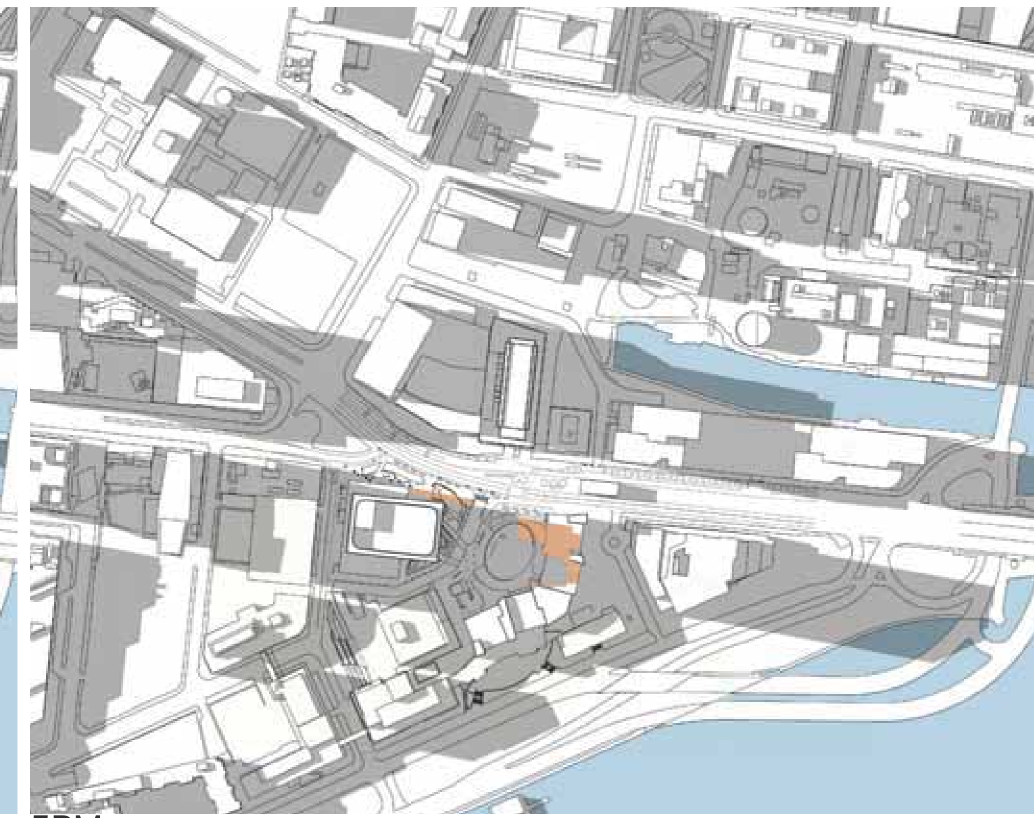
Shadow Study: Net New Shadows–June 21

JUNE 21st
3PM, 4PM, 5PM

NET NEW SHADOWS WITH PROPOSED BUILDING


3PM


4PM

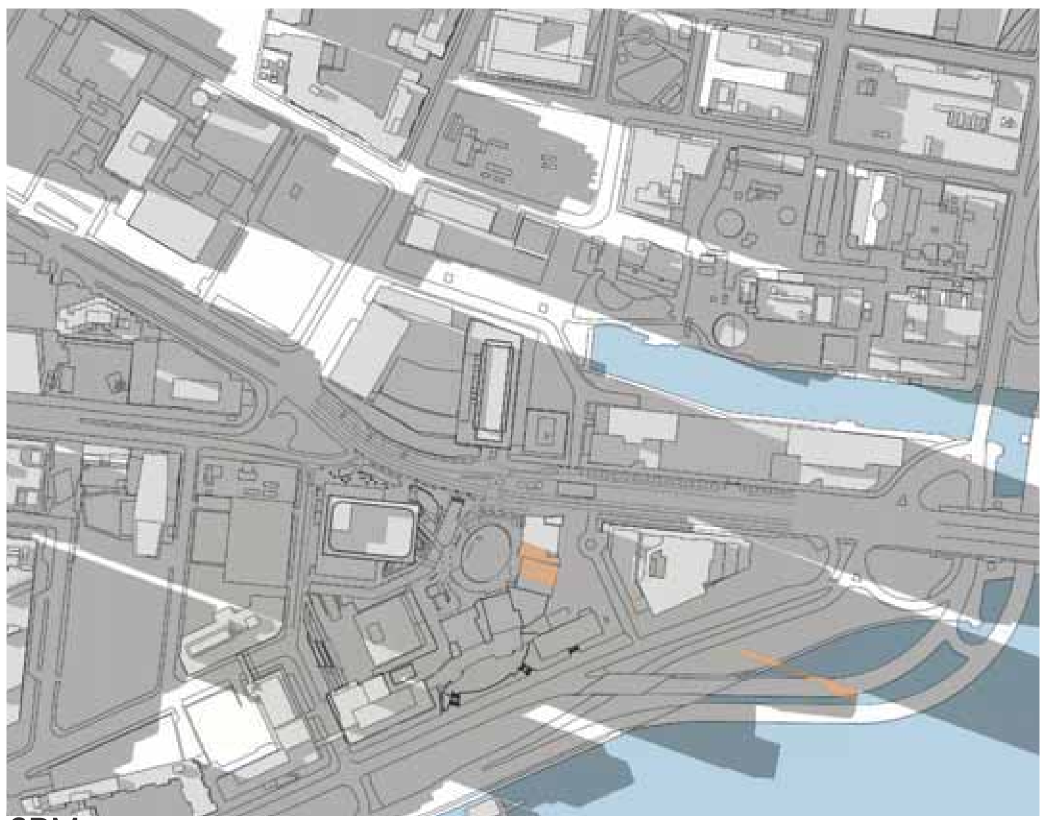

5PM

NET NEW SHADOWS

N

JUNE 21st
6PM

NET NEW SHADOWS WITH PROPOSED BUILDING



6PM

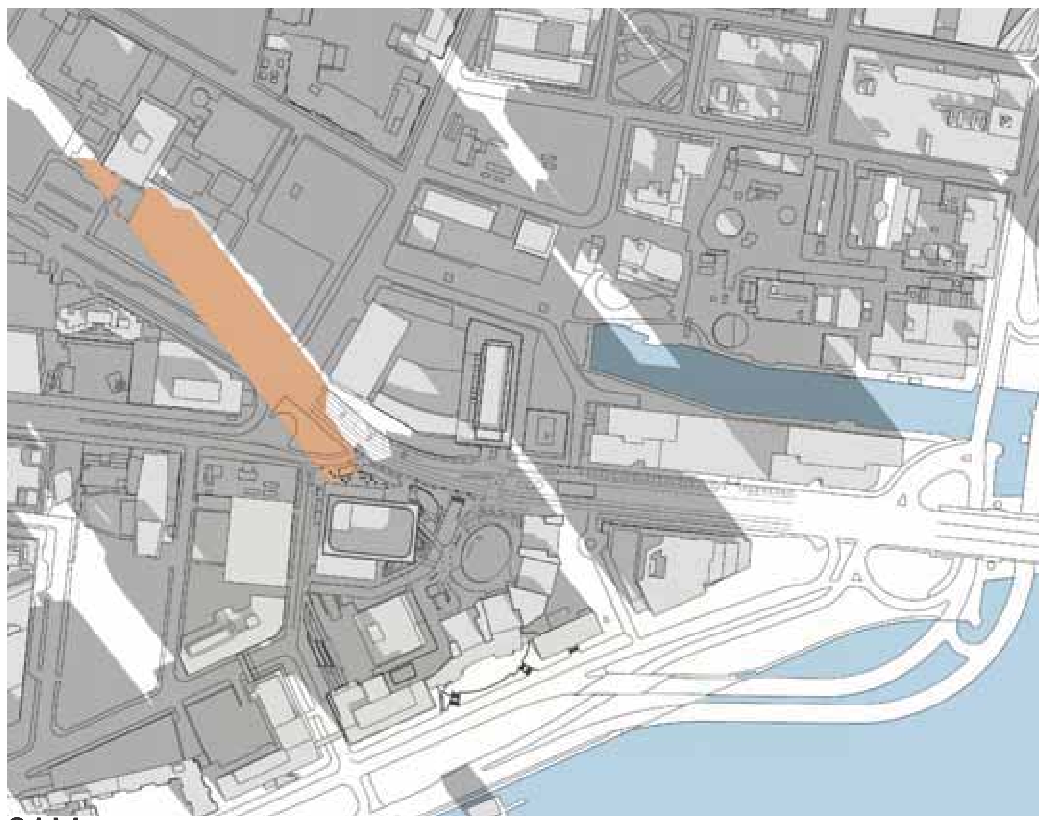
NET NEW SHADOWS

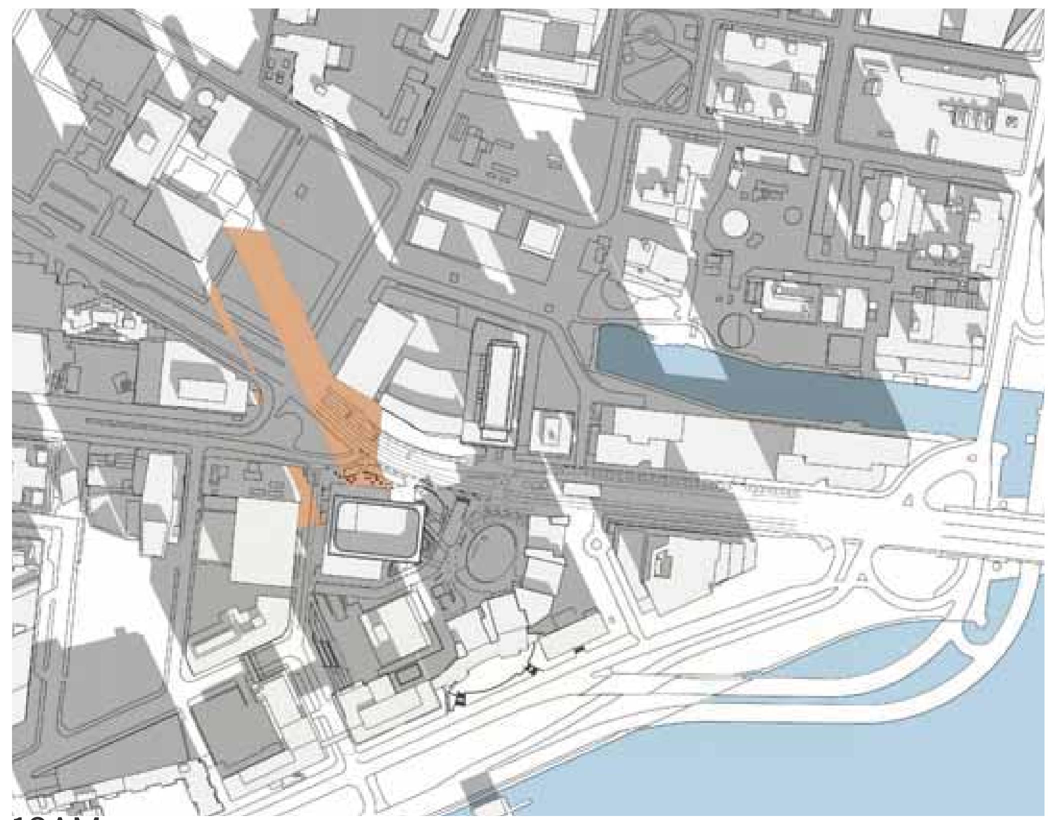
N

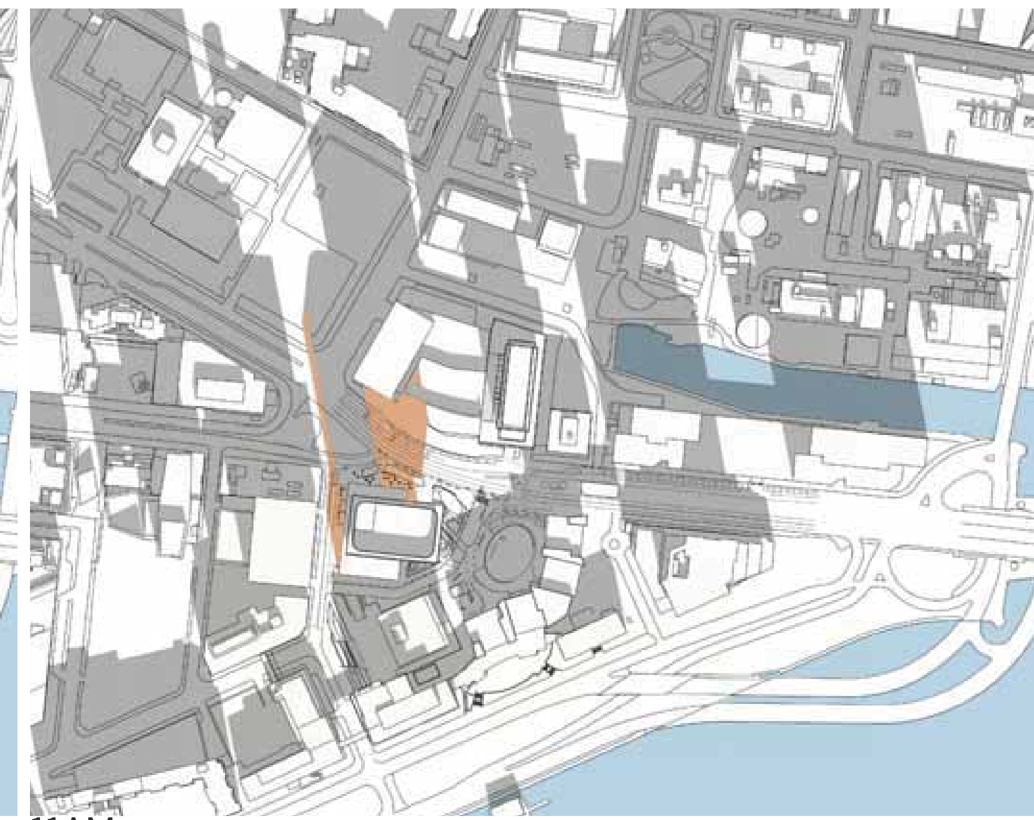
Shadow Study: Net New Shadows–June 21

DECEMBER 21st
9AM, 10AM, 11AM

NET NEW SHADOWS WITH PROPOSED BUILDING


9AM


10AM


11AM

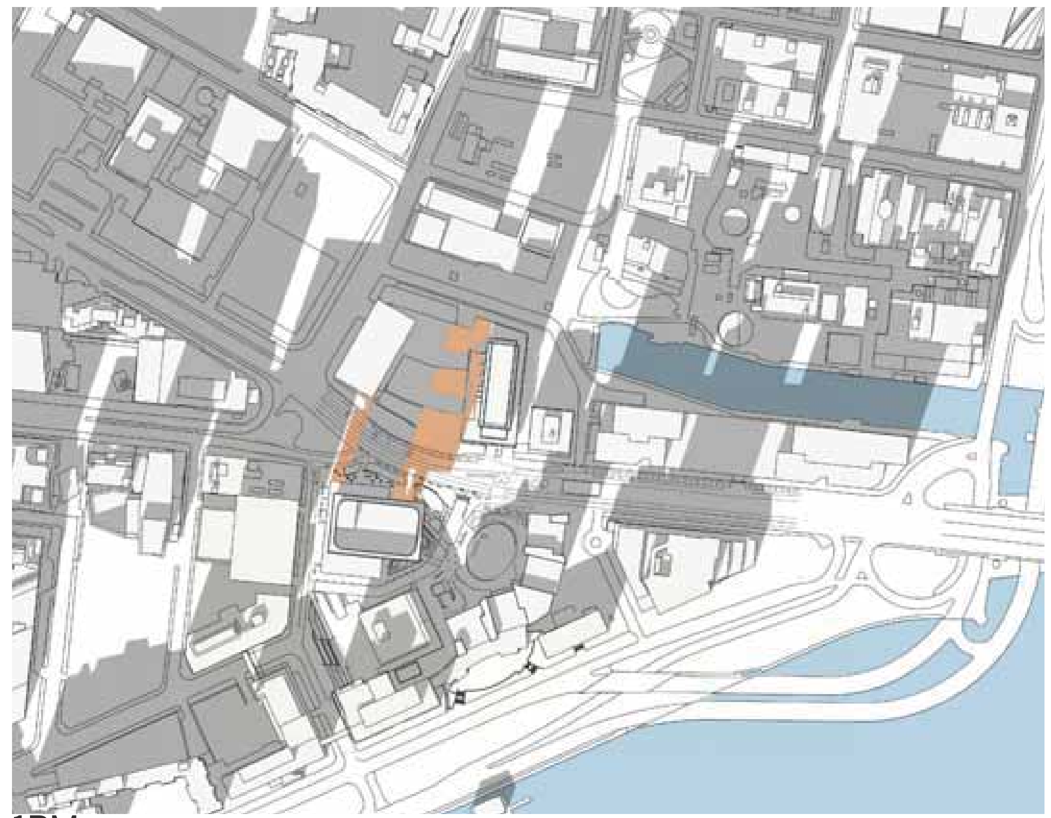
NET NEW SHADOWS

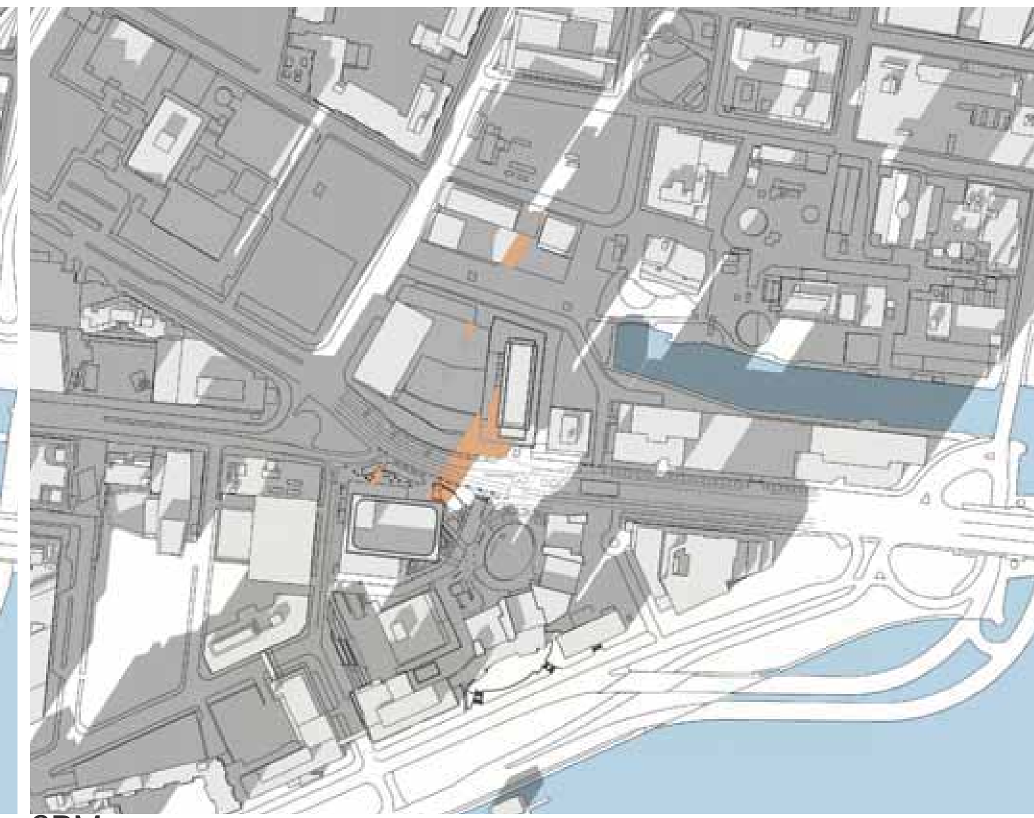
N

DECEMBER 21st
12PM, 1PM, 2PM

NET NEW SHADOWS WITH PROPOSED BUILDING


12PM


1PM


2PM

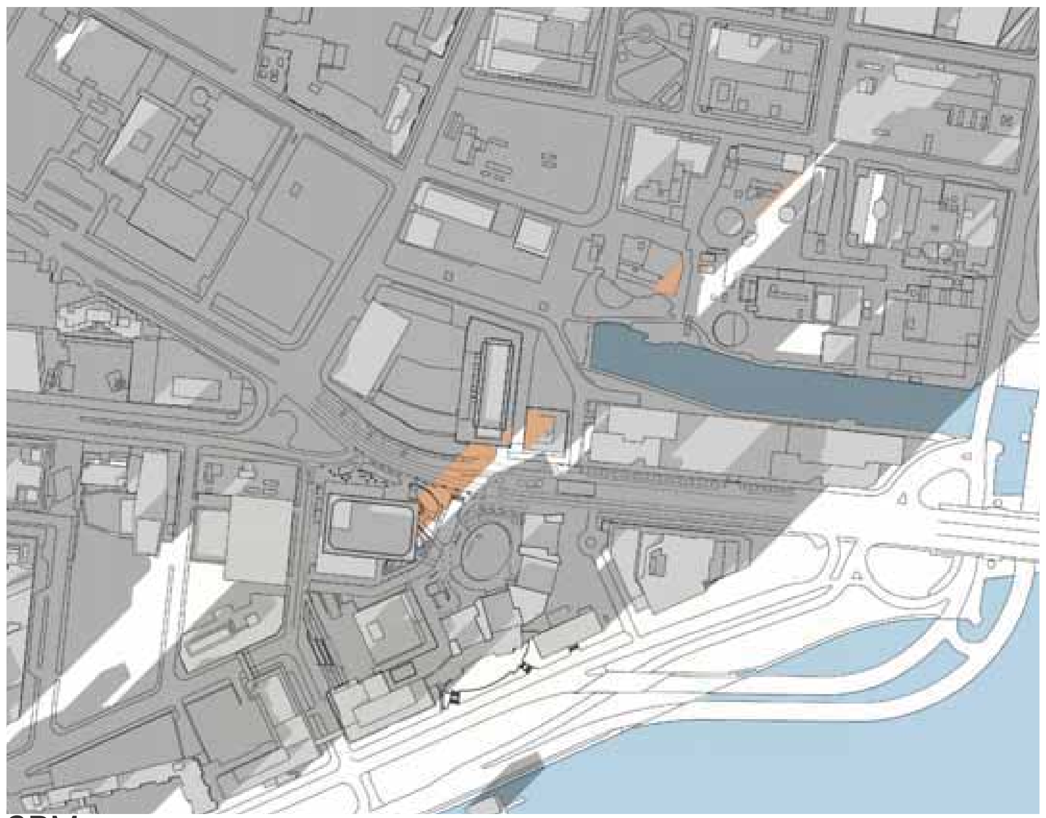
NET NEW SHADOWS

N

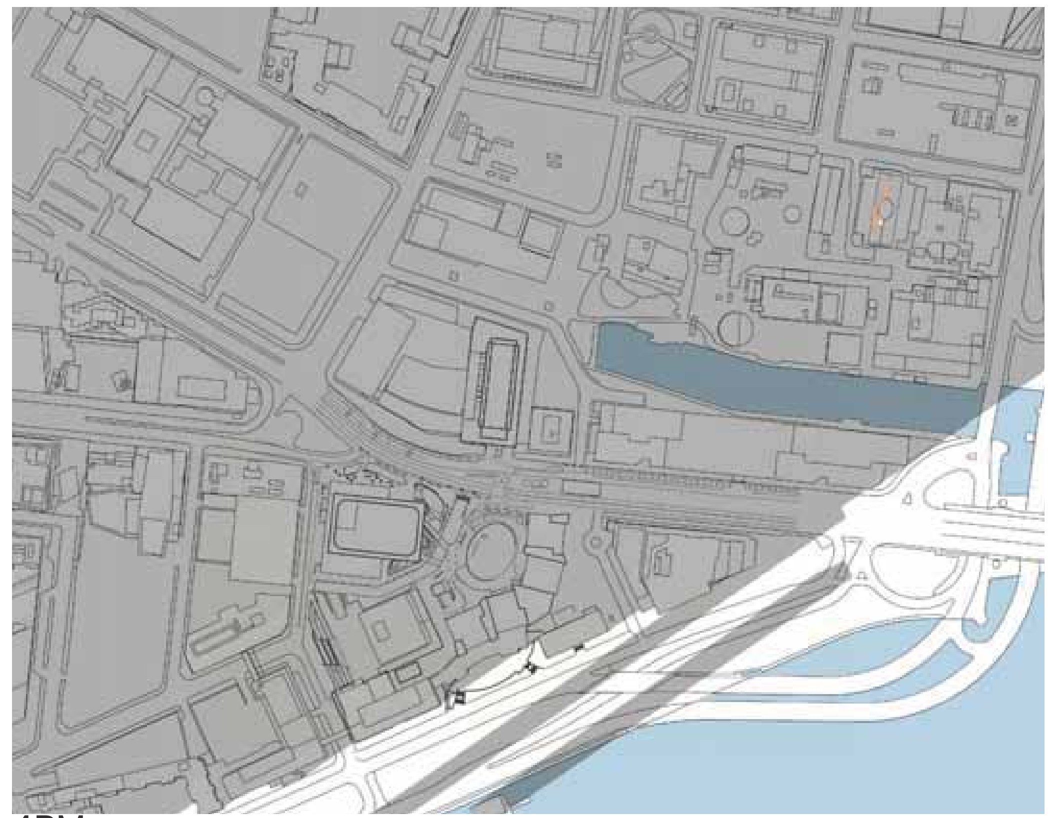
Shadow Study: Net New Shadows—December 21

DECEMBER 21st
3PM, 4PM

NET NEW SHADOWS WITH PROPOSED BUILDING



3PM

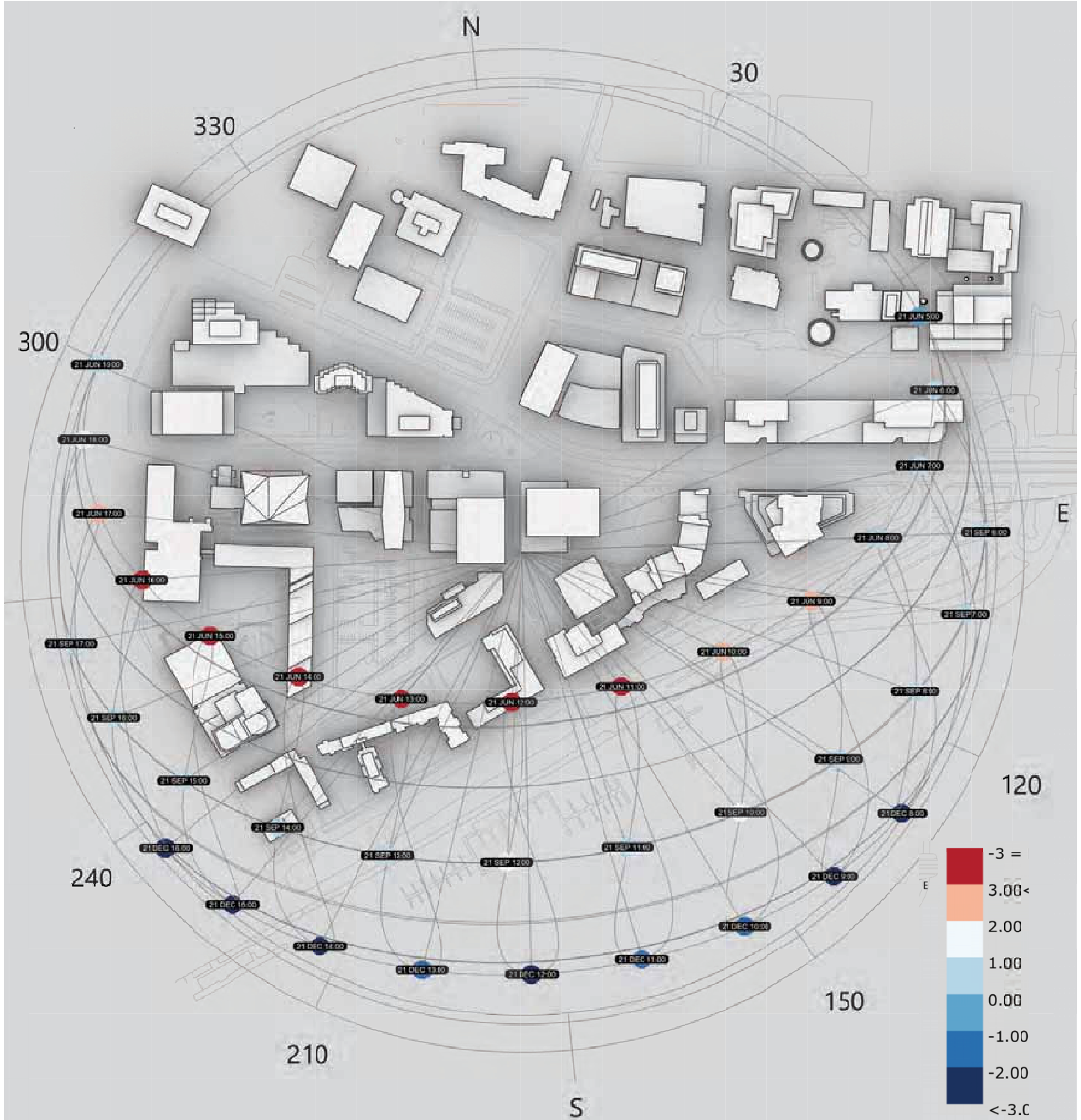


4PM

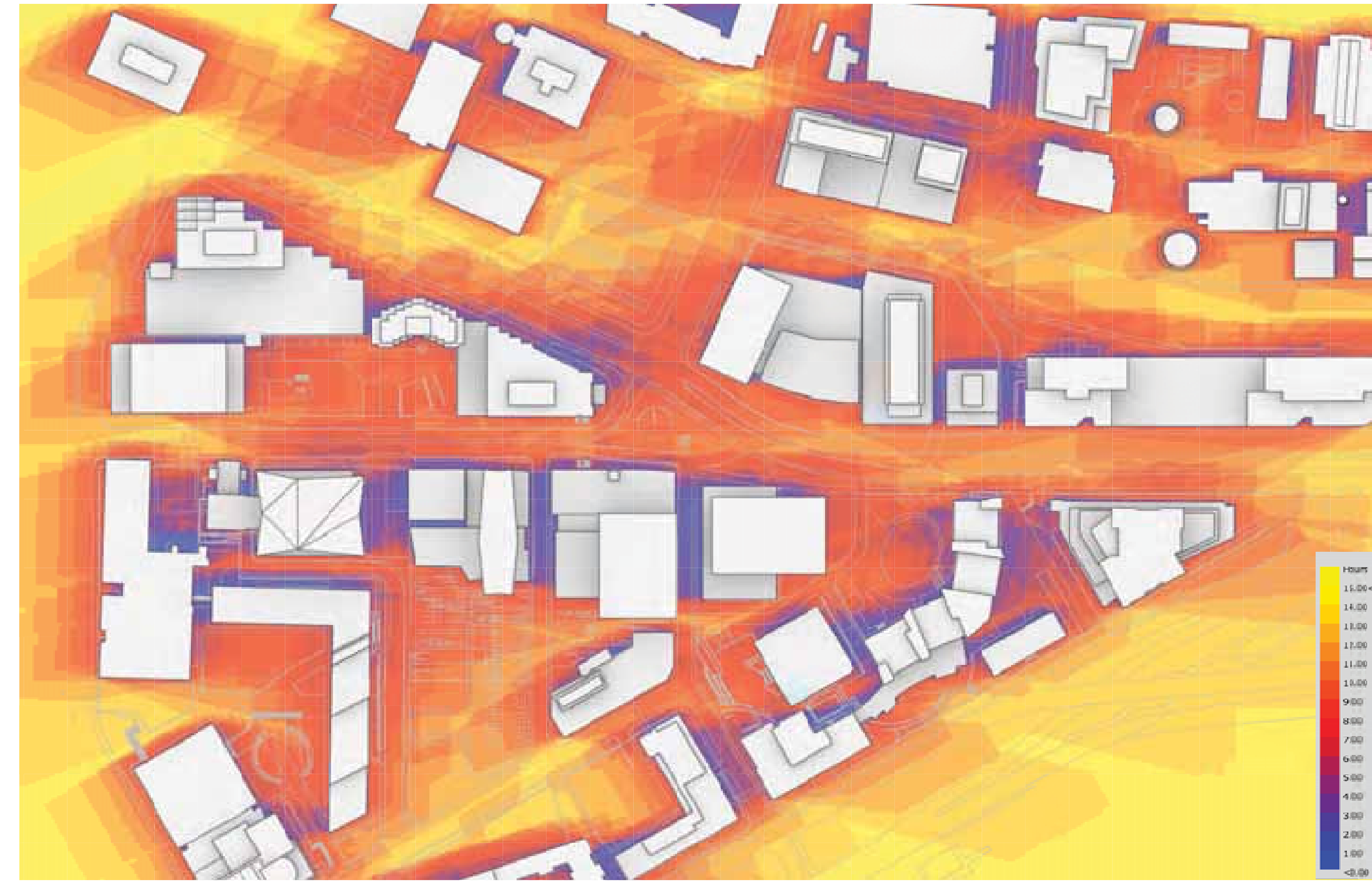
NET NEW SHADOWS

N

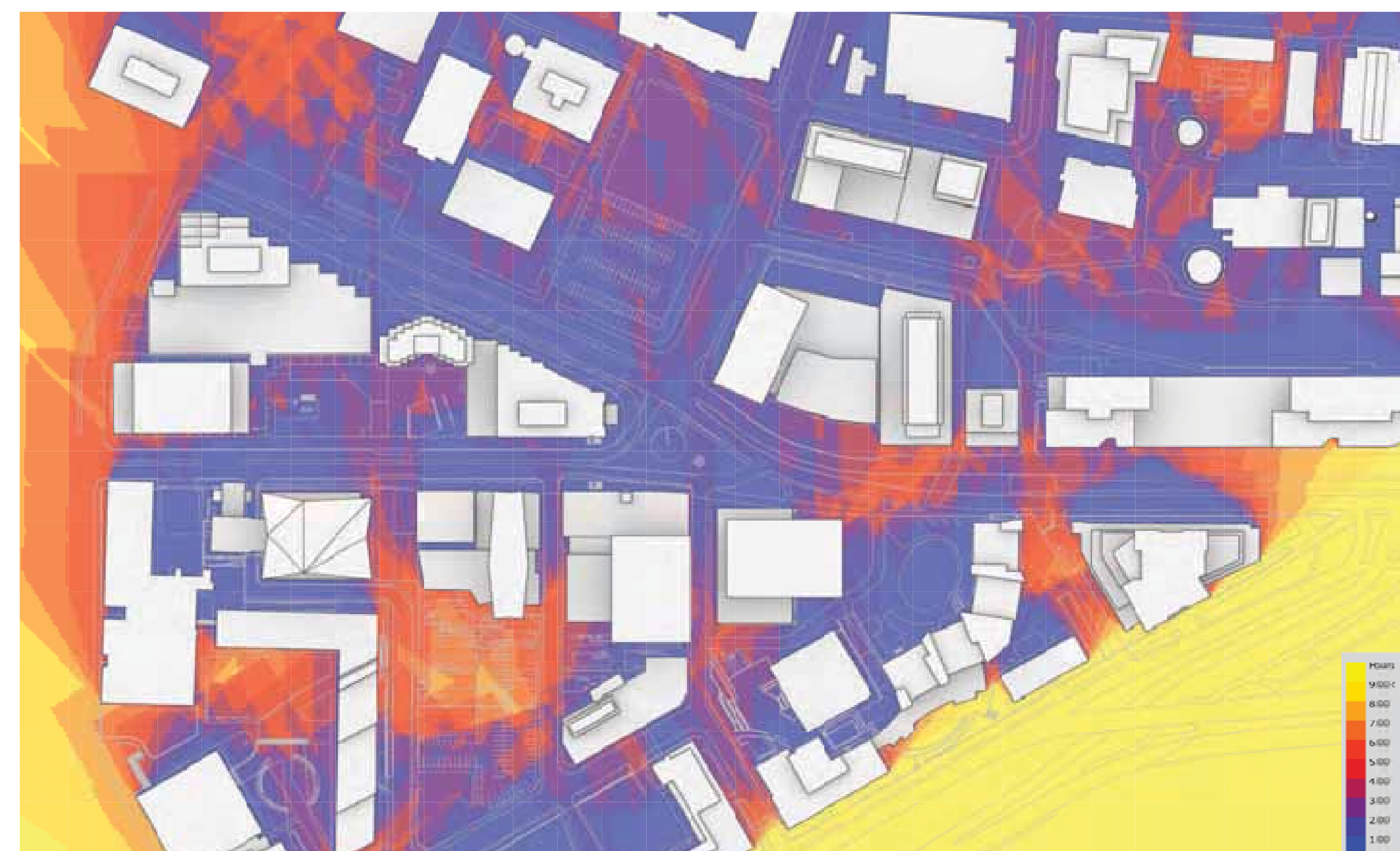
Appendix



SOLAR PATH

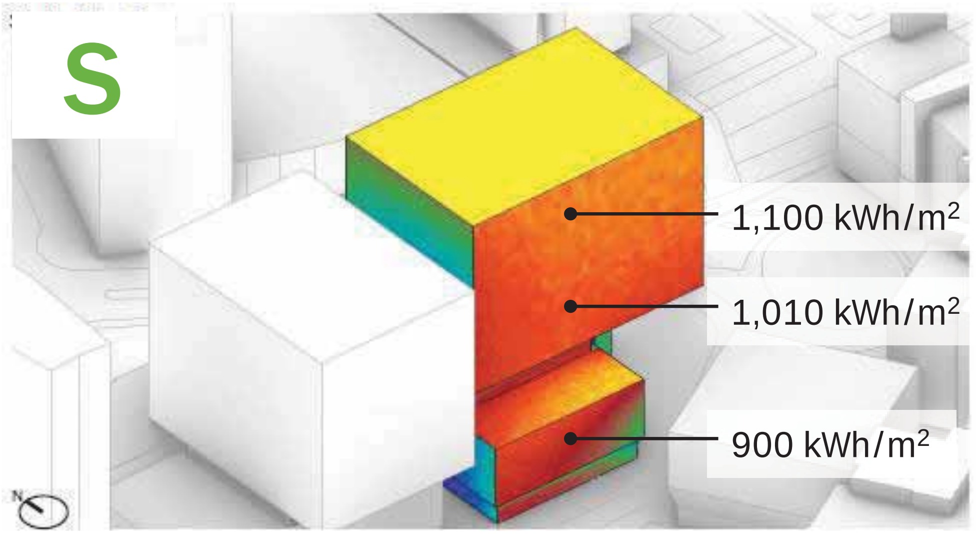


SUMMER SOLSTICE – SHADOW ANALYSIS

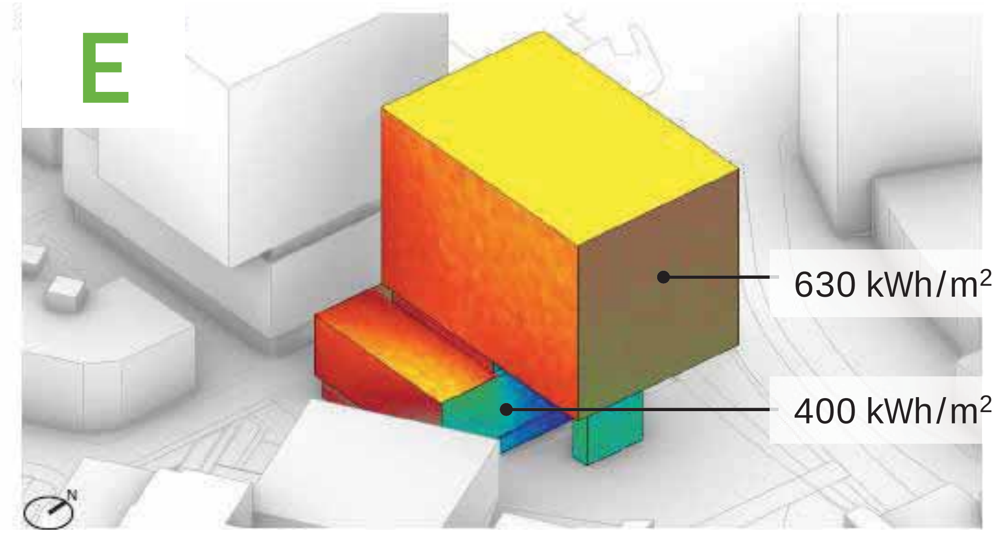


WINTER SOLSTICE – SHADOW ANALYSIS

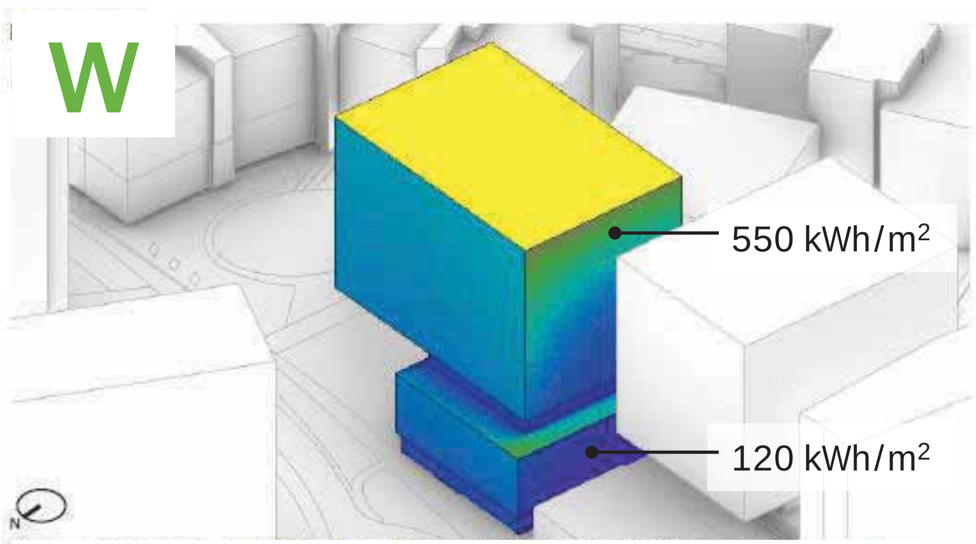
Annual Incident Solar Radiation, 8am to 6pm



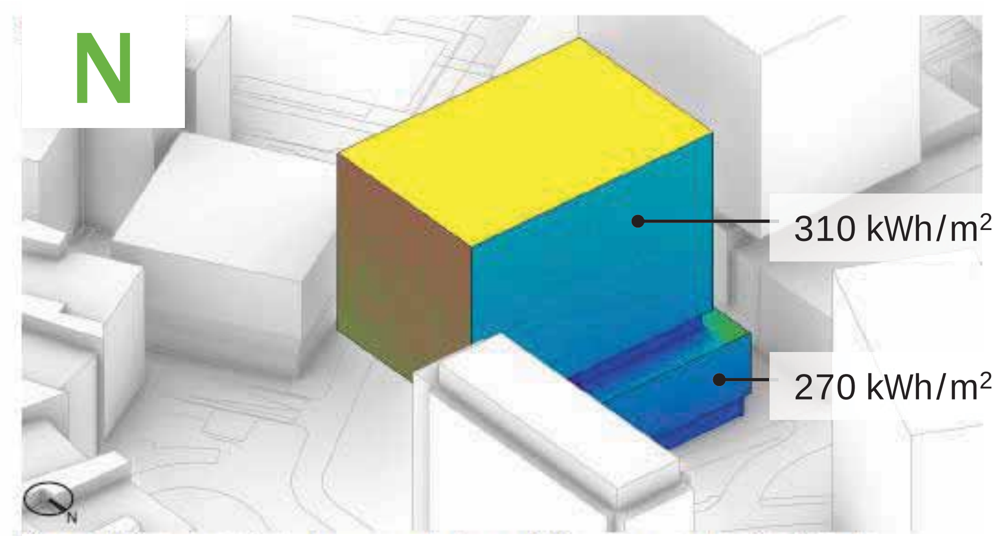
The south façade receives around 900 to 1200 kWh/m^2 annual solar radiation; external shading is recommended to reduce glare and minimize solar heat gain in summer months.



The east façade receives around 600 to 700 kWh/m^2 annual solar radiation; external shading is recommended to reduce glare and minimize solar heat gain in summer months. The podium level receives minimal solar radiation.

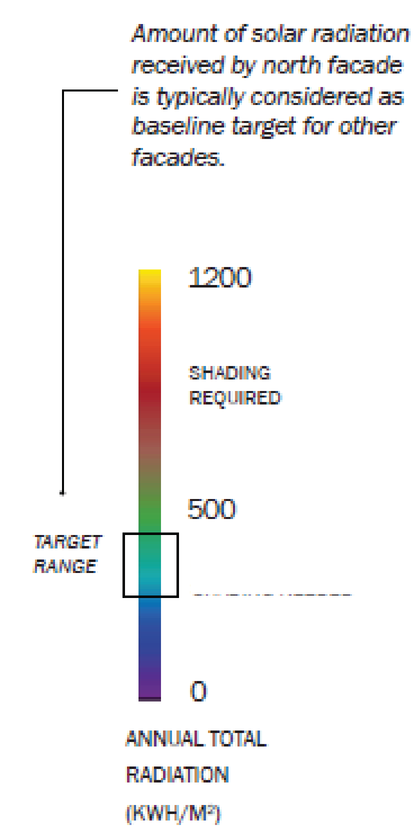


The west façade is shaded by the adjacent building (Site 3). The upper floors receives around 500 to 600 kWh/m^2 annual solar radiation.

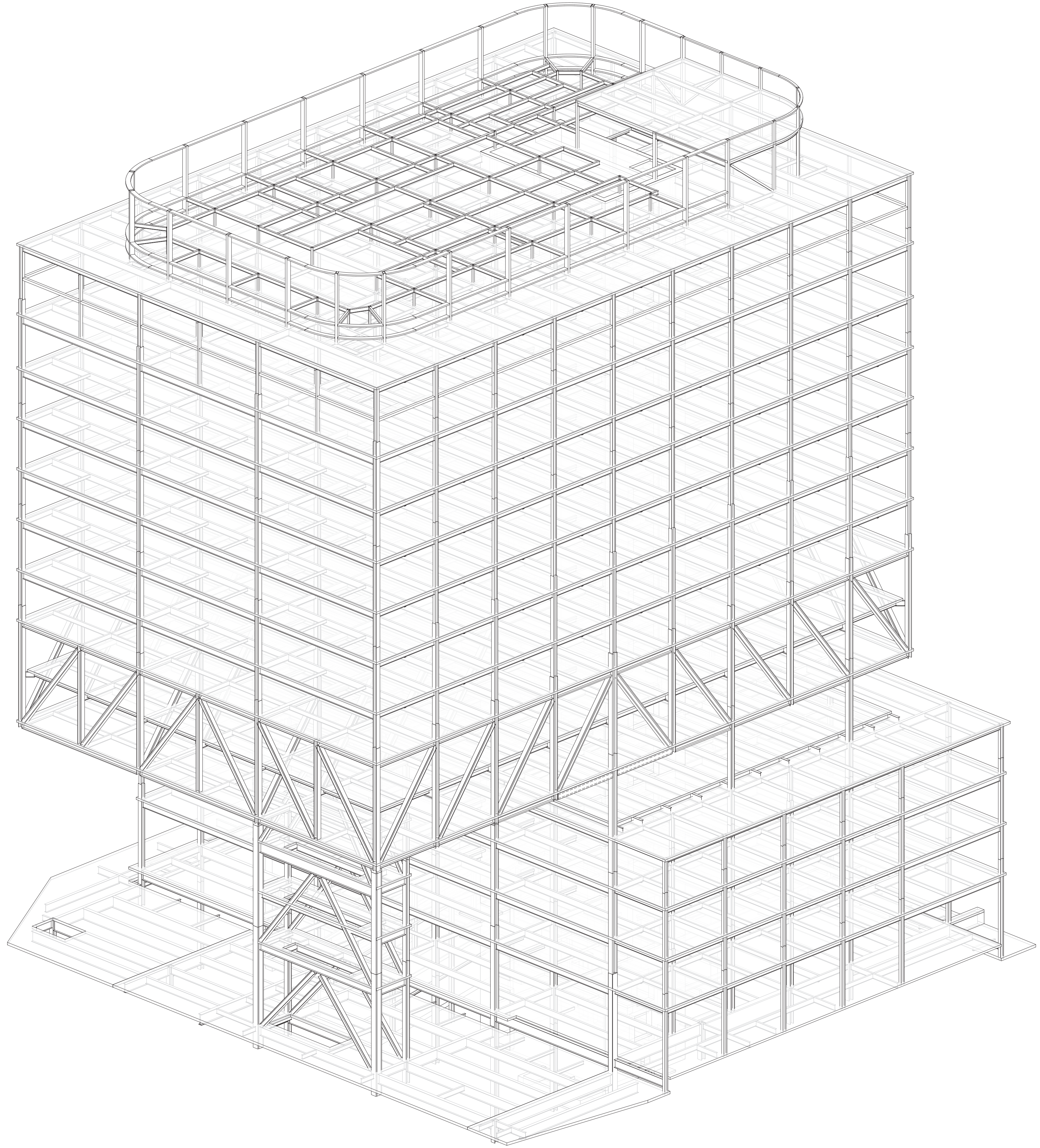


The north façade receives less annual solar radiation compared to other facades (around 300 kWh/m^2)

atelier ten



- The south and east façades would benefit from external shading.
- Shading elements would reduce glare and minimize solar heat gain.
- External shading provides no benefit on the north and west facades.

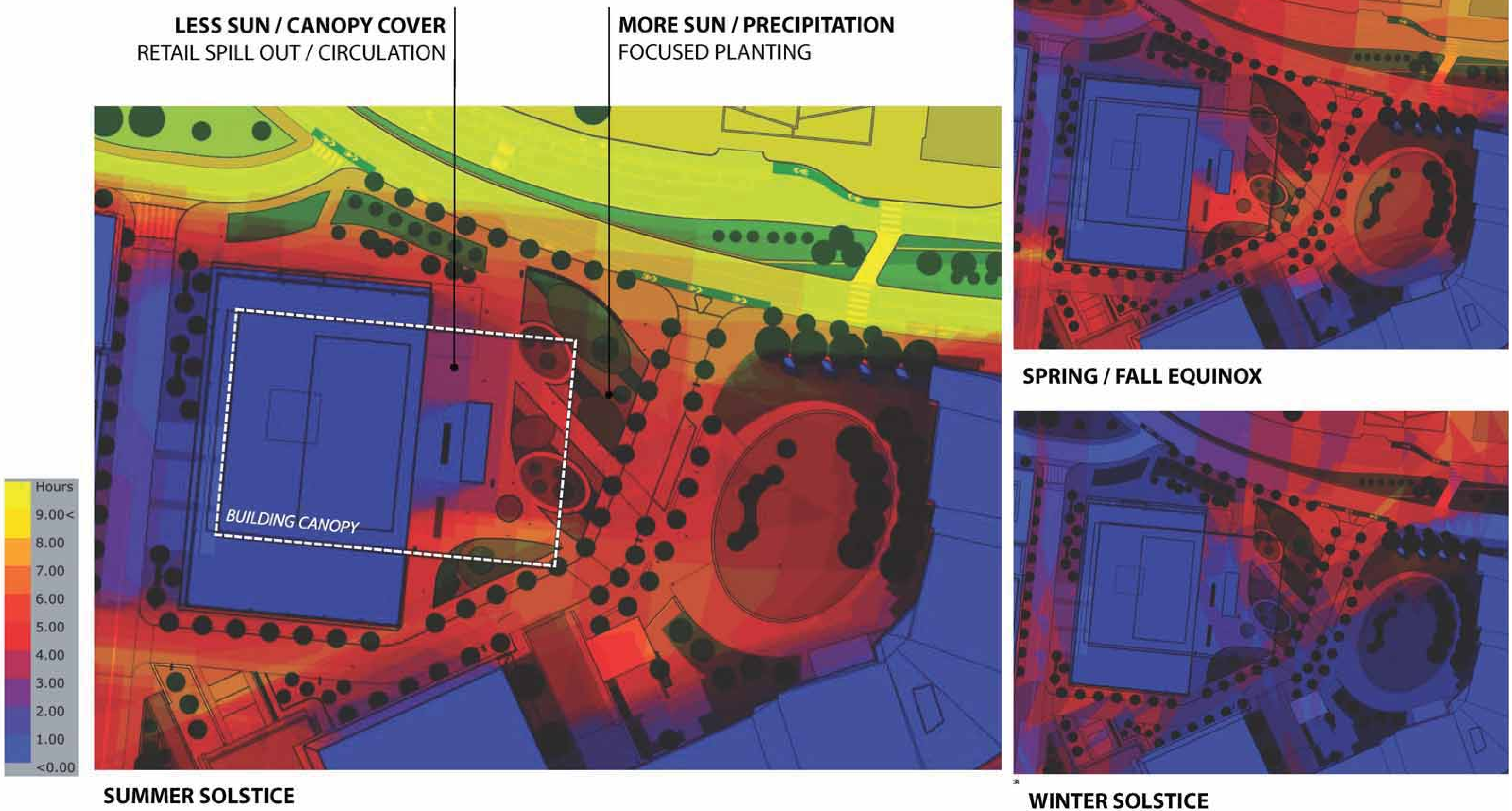


Cantilever Structure

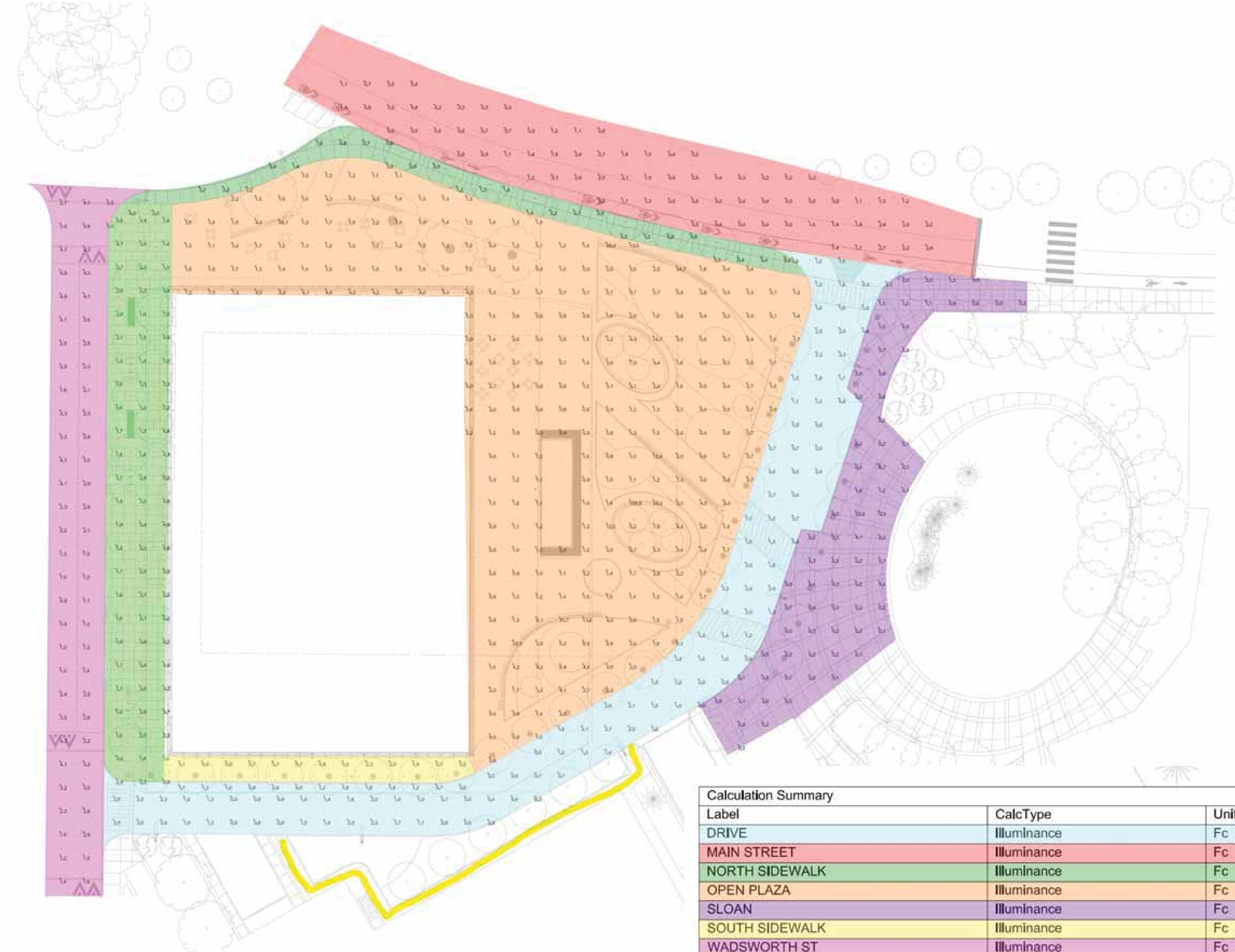
Existing Site Photos

Kendall Open Space Progress

Kendall Open Space Progress



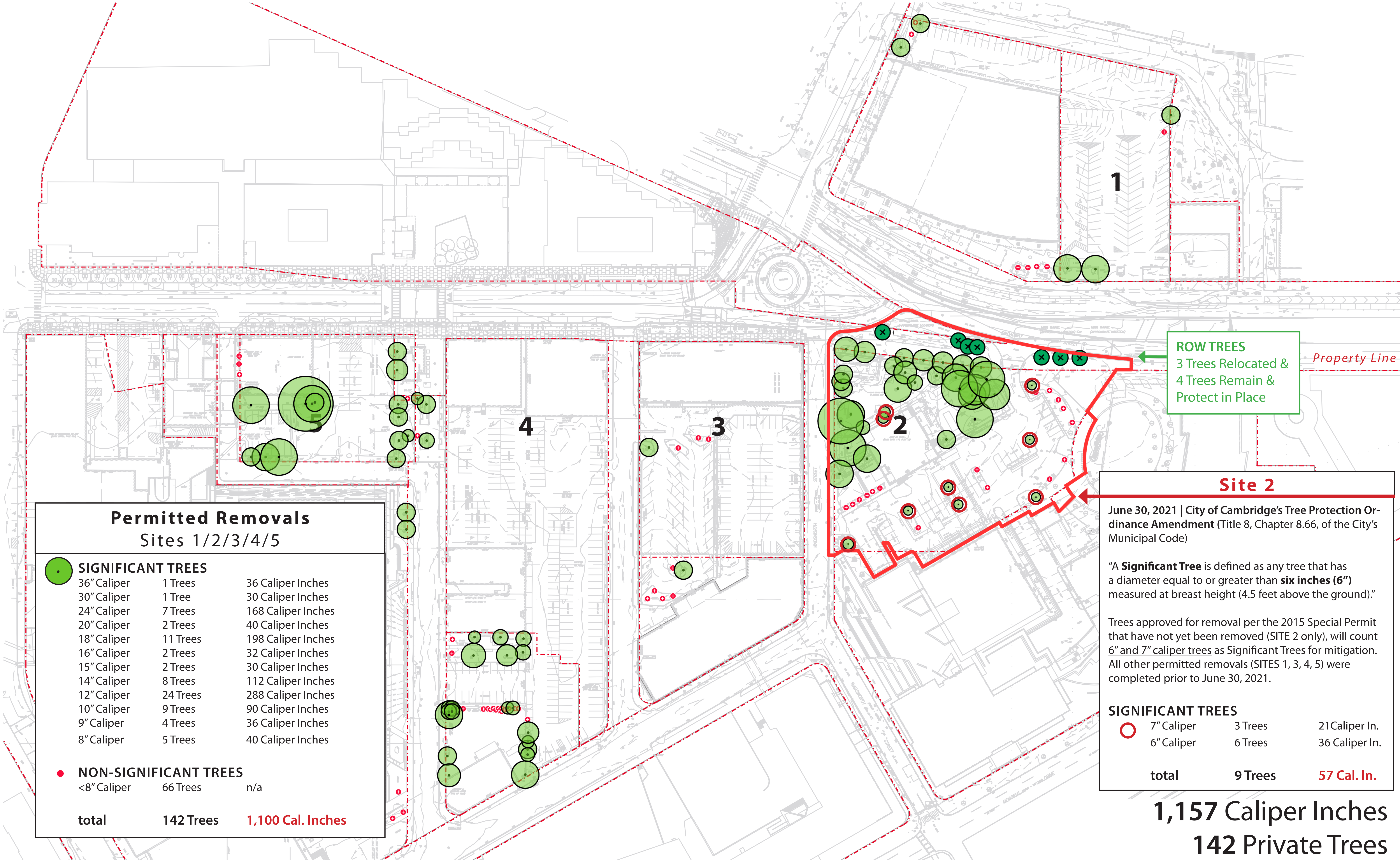
Seasonal Sun & Canopy Cover



Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Avg/Min
DRIVE	Illuminance	Fc	1.34	2.7	0.3	4.47
MAIN STREET	Illuminance	Fc	1.07	2.8	0.2	5.35
NORTH SIDEWALK	Illuminance	Fc	1.65	6.0	0.4	4.13
OPEN PLAZA	Illuminance	Fc	3.37	158.8	0.3	11.23
SLOAN	Illuminance	Fc	1.25	33.9	0.1	12.50
SOUTH SIDEWALK	Illuminance	Fc	1.16	2.9	0.5	2.32
WADSWORTH ST	Illuminance	Fc	2.71	5.9	0.9	3.01
WEST SIDEWALK	Illuminance	Fc	3.08	7.5	1.3	2.37

Notes:
All exterior spaces with illuminance recommendations specified by the IES Lighting Handbook.
Light levels measured at the horizontal ground plane.
A maintenance factor of 0.85 was used.
Occupant ages assumed to range from 25 - 65 +

Open Space Lighting Levels



Permitted Removals
Sites 1/2/3/4/5

SIGNIFICANT TREES		
36" Caliper	1 Trees	36 Caliper Inches
30" Caliper	1 Tree	30 Caliper Inches
24" Caliper	7 Trees	168 Caliper Inches
20" Caliper	2 Trees	40 Caliper Inches
18" Caliper	11 Trees	198 Caliper Inches
16" Caliper	2 Trees	32 Caliper Inches
15" Caliper	2 Trees	30 Caliper Inches
14" Caliper	8 Trees	112 Caliper Inches
12" Caliper	24 Trees	288 Caliper Inches
10" Caliper	9 Trees	90 Caliper Inches
9" Caliper	4 Trees	36 Caliper Inches
8" Caliper	5 Trees	40 Caliper Inches
NON-SIGNIFICANT TREES		
<8" Caliper	66 Trees	n/a
total	**142 Trees**	**1,100 Cal. Inches**

Site 2

June 30, 2021 | City of Cambridge's Tree Protection Ordinance Amendment (Title 8, Chapter 8.66, of the City's Municipal Code)

"A **Significant Tree** is defined as any tree that has a diameter equal to or greater than **six inches (6")** measured at breast height (4.5 feet above the ground)."

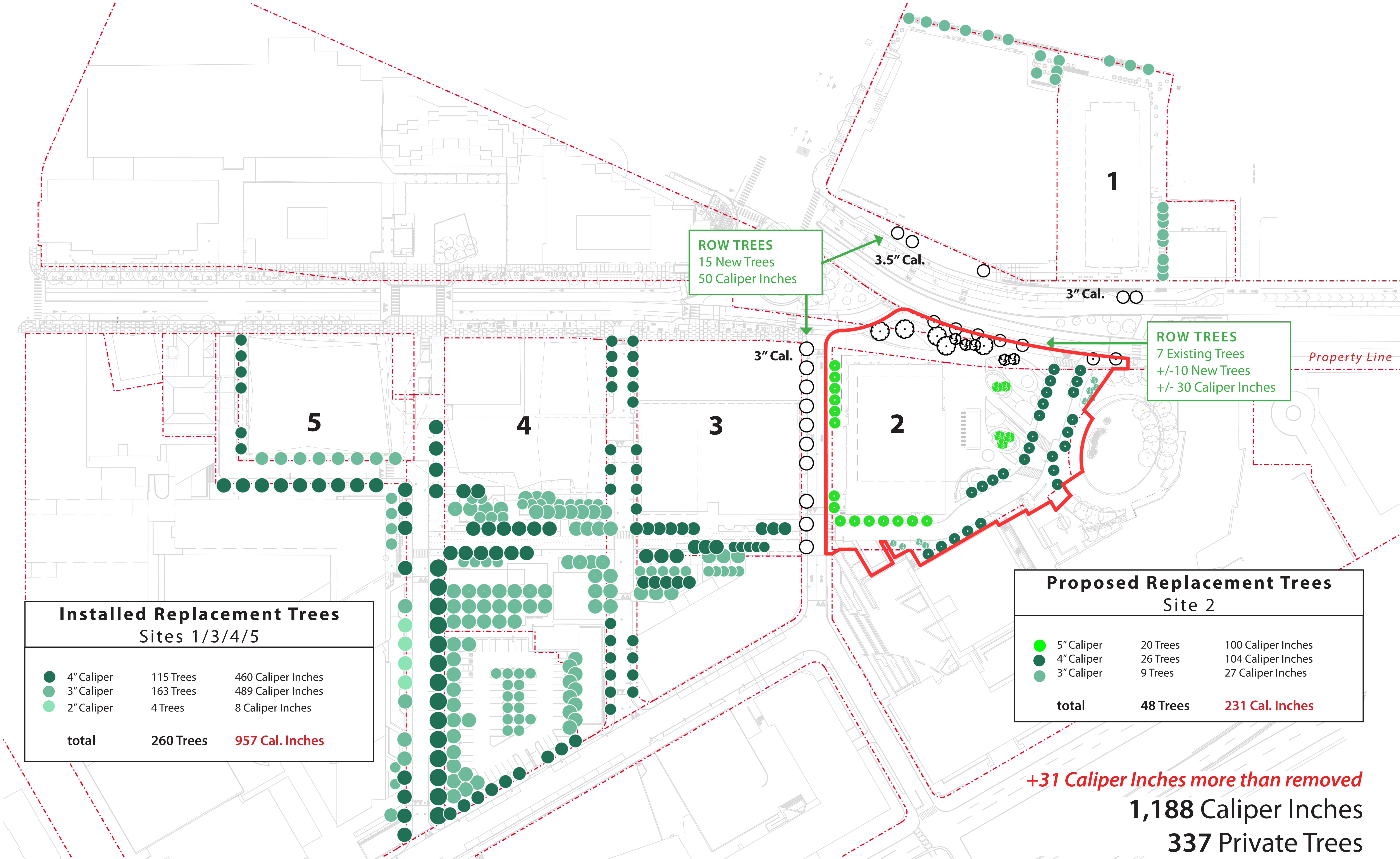
Trees approved for removal per the 2015 Special Permit that have not yet been removed (SITE 2 only), will count 6" and 7" caliper trees as Significant Trees for mitigation. All other permitted removals (SITES 1, 3, 4, 5) were completed prior to June 30, 2021.

SIGNIFICANT TREES		
7" Caliper	3 Trees	21Caliper In.
6" Caliper	6 Trees	36 Caliper In.
total	**9 Trees**	**57 Cal. In.**

1,157 Caliper Inches

142 Private Trees

2015 Special Permit Tree Removals & Update



Installed Replacement Trees
Sites 1/3/4/5

4" Caliper	115 Trees	460 Caliper Inches
3" Caliper	163 Trees	489 Caliper Inches
2" Caliper	4 Trees	8 Caliper Inches
total	**260 Trees**	**957 Cal. Inches**

Proposed Replacement Trees
Site 2

5" Caliper	20 Trees	100 Caliper Inches
4" Caliper	26 Trees	104 Caliper Inches
3" Caliper	9 Trees	27 Caliper Inches
total	**48 Trees**	**231 Cal. Inches**

+31 Caliper Inches more than removed

1,188 Caliper Inches

337 Private Trees

Tree Replacement Status