D.

GREEN BUILDING REPORT

Green Building Requirements

Volpe Redevelopment Green Building Report-Comments on Special Permit Stage

Status: The Community Development Department (CDD) received the final update of the Green Building Report (GBR) for the Special Permit stage of Volpe Planned Urban Development project pursuant to Section 22.25.1 of the Zoning Ordinance on 12/2/2020. The Volpe project, a mixed-use district, would consist of the following (approximately): 1,756,000 sf office/lab; 1,128,000 sf of residential (roughly 1,400 units); 75,000 sf of ground retail; 25,000 sf of entertainment and 20,000 sf Community Center space. The overall master plan would consist of a total gross floor area (GFA) of approximately 2,850,000 square feet on a 10-acre site which also includes a 2.5-acre open space.

CDD staff have reviewed the GBR of the development plan and offer the following Determination, Summary of Compliance and Advisory Comments on the project's sustainability.

CDD Determination: The documentation provided by the Applicant sufficiently demonstrates compliance with the Green Building Requirements of Section 22.24 at the special permit stage of review. Sustainability Plan for the project will be reviewed and approved in the Final Development Proposal. Separate Green Building Reports for each building will be required during design review of individual buildings.

LEED Rating System: LEED v4 BD+C: Core and Shell for commercial buildings; LEED v4 BD+C: New Construction for residential buildings.

LEED Project Summary: This project is subject to the City's Green Building Requirements (Section 22.20, Zoning Ordinance). The Project is currently meeting the minimum requirement by targeting LEED Gold under LEED v4 BD+C: New Construction with 67 projected points for the residential building, and also meeting the minimum requirement by targeting LEED v4 BD+C: Core and Shell Development with 73 projected points for the commercial buildings.

Summary of Compliance and Comments

Green Building Professional Affidavit Certification

- David Manfredi of Elkus Manfredi Architects Ltd. has been identified as the Green Building Professional for the project. The affidavit states that this professional has reviewed all relevant documents for this project and confirm to the best of his/her 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.
- A copy of the professional's credential from Green Building Rating Program has been provided.

Rating System Checklist and Narrative

- The project is pursuing Integrative Process credit.
- The project is pursuing Enhanced Commissioning credit that includes commissioning process for various building systems and assemblies for residential buildings.
- The project is pursuing Enhanced Commissioning credit that includes monitoring- based commissioning process for various building systems and assemblies as well as commissioning for the building's thermal envelope for commercial buildings.

- The project is pursuing Innovation credit with Green Building Education, O+M Starter Kit, and Purchasing-Lamps as innovation strategies and Assessment and Planning for Resilience as pilot strategy. Specific Innovation Credits pursued for each building will be listed in the Green Building Reports of individual buildings during their design review.
- LEED v4 BD+C: New Construction credit points (Residential):
  - Integrative Process – 1 point
  - Location and Transportation – 15 points
  - Sustainable Sites – 7 points
  - Water Efficiency – 5 points
  - Energy and Atmosphere – 14 points
  - Materials and Resources – 4 points
  - Indoor Environmental Quality – 6 points
  - Innovation – 4 points
  - Regional Priority – 3 points
- LEED v4 BD+C: Core and Shell credit points (Commercial):
  - Integrative Process – 1 point
  - Location and Transportation – 19 points
  - Sustainable Sites – 8 points
  - Water Efficiency – 8 points
  - Energy and Atmosphere – 15 points
  - Materials and Resources – 4 points
  - Indoor Environmental Quality – 4 points
  - Innovation – 5 points
  - Regional Priority – 4 points

<u>Net Zero Narrative</u>

- Anticipated building envelope performance comparison between baseline and proposed design indicates the proposed design has better performance with regard to glazing performance, wall assembly, and roof assembly and u-value. For example, the building envelop of commercial building would include a triple-pane glazing system with a u-value in the range of .20 to .25 in a window-to-wall ratio in the range of 40-70%. For the residential building scenario, the scenario is indicating a double-glazing window system with a u-value in the range of .25 to .35 in a window-to-wall ratio in the range of 40-60%. (Note: where practical, staff recommends keeping the window-to-wall ratio to 40 or less. That would be more in keeping with passive house envelop design criteria)

- Proposed total energy use is targeted to be 20% below baseline for individual buildings with residential uses and is targeted to be 16% below baseline for individual buildings with commercial uses. Proposed GHG emissions is targeted to be 16% below baseline for individual buildings with residential uses and is targeted to be 15% below baseline for individual buildings with commercial uses.

- Description of building energy performance integrated into the project's planning, design, and engineering, massing, envelope systems, building mechanical systems, on-site and off-site renewable energy systems, and district-wide energy systems. The following is also integrated as part of the proposed building system:

  - Envelope systems will be designed to incorporate external shading, insulated areas, and natural ventilation where feasible while optimizing for energy performance, daylight, views, visual comfort, and thermal comfort for occupants near perimeter areas.
  - Commercial and residential building programs to identify opportunities for load-sharing, and ultimately, concept design of systems that shift both residential and commercial buildings towards electrification.
  - Reduced LPD and lighting controls.
  - All electric heating and cooling systems in residential buildings.
  - The estimated photovoltaic panel array covering approximately 40,000 square feet of roof area for the entire development is 680 kW in capacity.
  - Electric vehicle charging stations for at least 2% of parking spaces.

- Description of technical framework for transitioning the project to net zero emission in the future, including future net zero emission options for building envelope, HVAC systems, domestic hot water, interior lighting, and on-site and off-site renewable energy sources. The technical framework includes:
  - Chiller plants of commercial buildings augmented with heat pump chillers.
  - Gas boilers replaced with electric boilers.
  - Future conversion to electric hot water system.
  - Future conversion to higher efficiency heat pump systems for building heating and service water heating in the building with residential uses.
  - Installation of photovoltaic panel array on the roof.
- Description of programs offered by local utility companies that are being considered to improve building performance include:
  - Mass Save Programs
  - Applicable programs for the masterplan include Residential High-Rise New Construction and Commercial New Construction and Major Renovations

Advisory Comments by CDD Staff:

Staff urge the design team to keep pursuing additional points especially from impactful categories such as energy and atmosphere, indoor environmental quality and materials and resources. Some of the recommended practices also relevant to this development include the conservation of natural resources and reduction of embodied carbon. Cutting construction waste to the maximum extent possible should be emphasized in the design and construction of the individual buildings. Staff recommend the Applicant to do better in the Material Resources, MR Credit, Construction Waste Management relative to the LEED thresholds as the design process moves forward.

While, the project is currently meeting the minimum Green Building Requirements for the master plan level, staff would encourage the Project Team to continue pursuing the highest level of sustainable and energy-efficient design possible by further pursuing the following:

- Envelope Commissioning for residential buildings.
- Additional points for Optimize Energy Performance, Renewable Energy and Green Power & Carbon Offsets in Energy and Atmosphere category.
- Water use reduction in labs beyond LEED.
- Use principles of WELL & Fitwel certification criteria to complement LEED.
- Green roof and/or vegetative surfaces where feasible on buildings and on site.

- Maximize on and off-site renewable electricity production and pursue opportunities to pair on-site renewable energy with energy storage.
- Focus on social equity in pursuit of additional Innovation credits.
- Elaborate on how embodied carbon will be addressed.
- Use LEED 4.1 (or later edition of LEED) for all categories especially for Energy and Atmosphere credits in order to maximize energy performance. Where possible, use the latest edition of ASHRAE 90.1 (i.e., ASHRAE 90.1-2016) or later to demonstrate maximizing energy performance.
- Provide clarification or additional information for the district energy strategy of heating load sharing and connections between buildings. Specifically elaborate on how that would support development electrification effort.
- Elaborate further on the type of building infrastructure and systems that would be designed to accommodate future electrification at the building pre-design/programming level. Strive to achieve electrification of commercial building base load at time of construction.
- In addition to using recycled blackwater for cooling tower demand, clarify if that recycled blackwater would also be used for landscaped open spaces and buildings' green roof irrigation.
- Consider a lower u value for the vertical glazing.
- Use standard LEED scorecard for Green Buildings Reports of individual buildings and coordinate with the narrative on LEED credits.

Each of the buildings in the development will be subject to review prior to receiving design review approval, Building Permit and Certificate of Occupancy. CDD Staff is available to work with the Applicant through continuing design review and looks forward to receiving updates on design improvements, changes and/or projected building performance enhancements.

MIT VOLPE REDEVELOPMENT PROJECT
GREEN BUILDING REPORT

November 13, 2020

Table of Contents

PROJECT INTRODUCTION

The MIT Volpe Redevelopment Project includes the redevelopment of the approximately 10 acre Volpe Exchange Parcel, which will create a vibrant mixed-use district of high quality general and technical office, residential use, retail and recreation/entertainment activity, with significant components of, open space and space for smaller innovation companies. The development will encourage strong connections between the Kendall Square areas, the East Cambridge Riverfront and neighborhoods of eastern Cambridge including East Cambridge, Wellington-Harrington, and the Port neighborhoods. Additionally, the proposed community center and open space will transform the district into a recognizable center of activity and civic life for the Kendall Square area and surrounding neighborhoods by encouraging and fostering a sense of community, civic engagement, social interaction, economic development and environmental sustainability.

The Project will include approximately 1,756,000 sf of office/lab uses, approximately 1,128,000 sf of residential uses (approximately 1,400 units), approximately 75,000 sf of retail/active ground floor uses, approximately 25,000 sf of entertainment space and an approximately 20,000 sf Community Center.

Sustainability has played a foundational role in the planning of the development.

SUSTAINABILITY EXECUTIVE SUMMARY

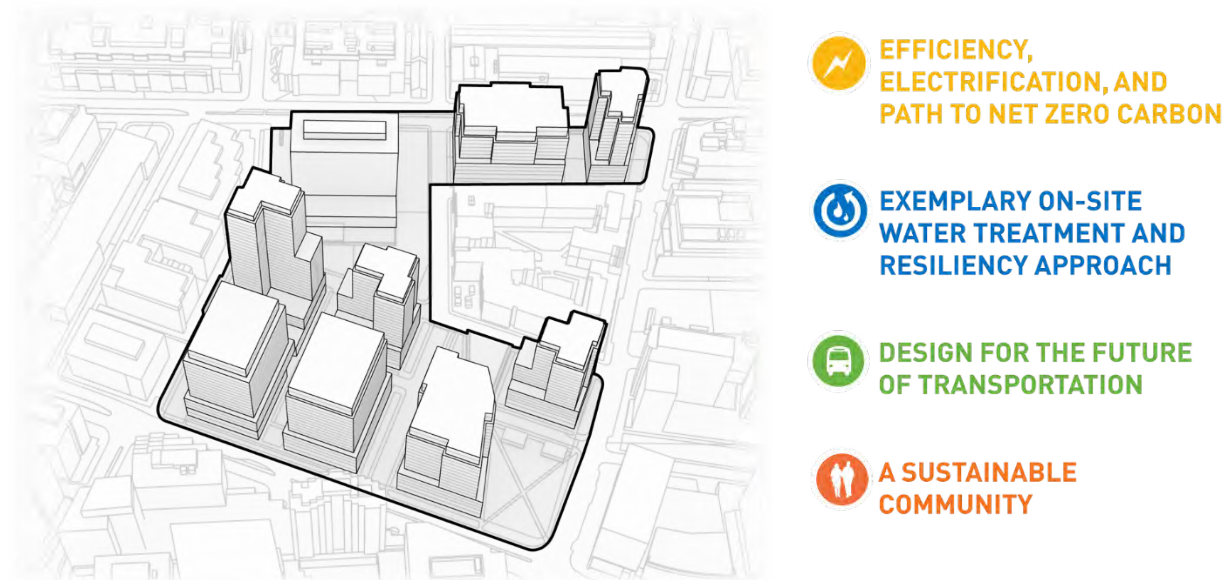


Figure 1. Volpe Masterplan Sustainability Concept Diagram

The Volpe Redevelopment Project applies a comprehensive sustainability approach involving best practices in resiliency, energy and water efficiency, community engagement, and transportation. As a new initiative in MIT's portfolio, the proposed Volpe development establishes a new benchmark in urban sustainable development and pilots innovative solutions to address local and regional environmental design issues.

MIT is committed to developing projects that are at the forefront of sustainability, and with this development, MIT exceeds past precedents in sustainable design by incorporating next generation technologies and approaches to district level systems for resource efficiency.

EXEMPLARY MASTER PLAN

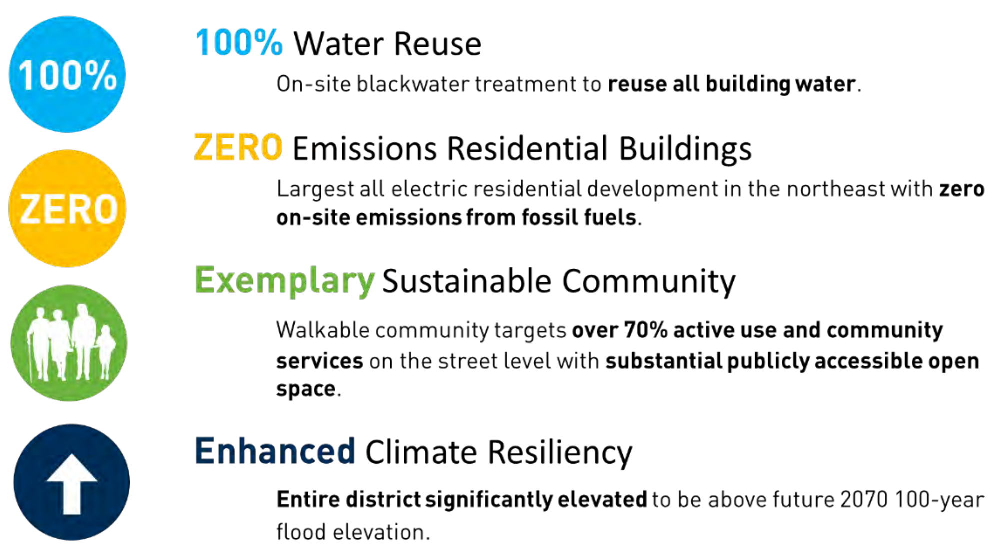


Figure 2. Key strategies of Volpe development

There are several key strategies in Figure 2 that establish the Volpe development as an exemplar of sustainable master plan design. First, the development will include the largest urban district-scale blackwater treatment plant in the northeast to reuse all building water on-site. Additionally, the development will have the largest number of all-electric residential units (40% of the development) in the region with zero on-site emissions to support a net-zero carbon future. The design also strives to enhance community engagement by activating the street level with community services and publicly accessible open space. Together, these exemplary strategies distinguish Volpe from regional peers and build on sustainable commitments for site, transit, resiliency, and healthy building design.

Efficiency, Electrification and Path to Net Zero Carbon

The Volpe development is designed to maximize energy efficiency and support a path for a net-zero carbon future. Residential buildings will be all-electric, and commercial buildings will be designed with a path to electrification that will integrate with the long-term vision for a low-carbon New England power grid. MIT is anticipating future reductions in grid emissions as additional renewable energy sources are brought online and committing to designing buildings that transition with the grid, leading peers with a supplemental investment to position the Volpe buildings to be ready for an electric future. Load sharing between complementary building programs will be explored to maximize heat exchange and optimize energy performance of the development. Furthermore, proposed on-site rooftop photovoltaic (PV) arrays, supplemented by procurement of off-site renewable energy, can help offset the development's electricity use. Electrified residential buildings alongside commercial buildings designed with a path to electrification chart a net zero carbon future.

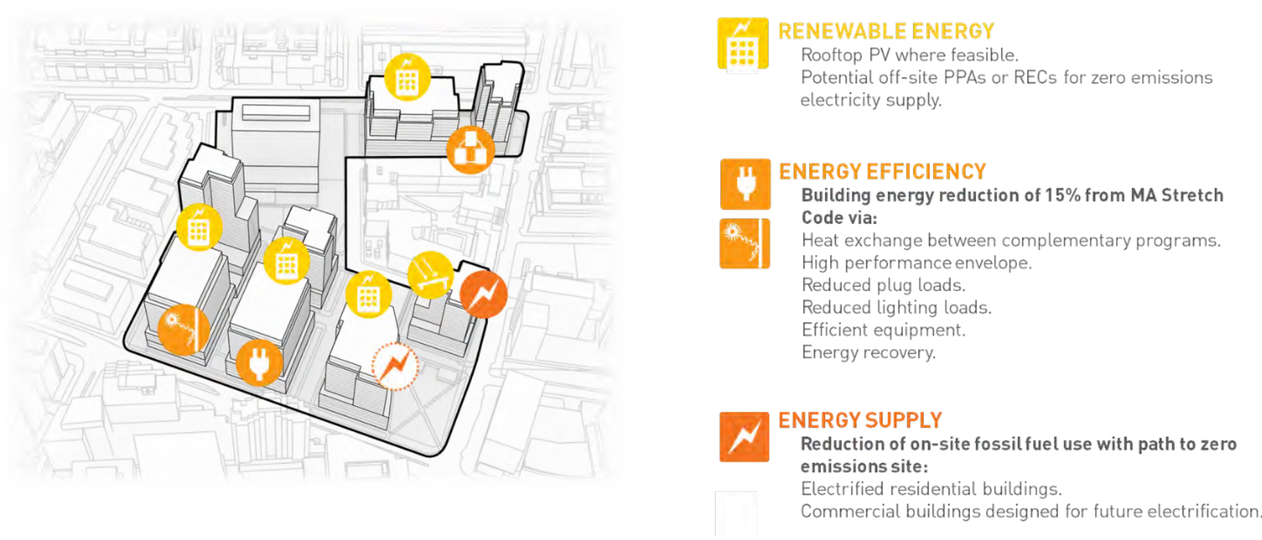


Figure 3. Path to Net Zero

Exemplary On-site Water Treatment and Resilience Approach

The development will include the largest urban district-scale blackwater treatment plant in the northeast to reuse all building water on-site. Collection, treatment, and reuse of all available greywater and blackwater in district blackwater treatment plants will minimize potable water consumption, improve self-sufficiency of the district, and mitigate the impact of the development on regional sewer systems. By investing in blackwater treatment, the development can increase density from the existing condition without significant flow increases to the City's sewer systems.

To respond to the changing climate and prepare for projected increases in precipitation, the project will embrace resilient design strategies including elevating critical equipment, residential units, and all building ground floors above the 100-year flood elevation. Further, by incorporating stormwater mitigation strategies in concert with the planned phases of development; and providing standby power for critical equipment resiliency is at the forefront of design for this development. To minimize risks associated with projected temperature increases, the development will reduce urban heat island effect through high-albedo roofing and paving and minimize cooling loads by insulating and shading building facades.

Figure 4. On-site water treatment and resiliency

Design for the Future of Transportation

MIT recognizes that improving bicycle facilities is a priority for the City, and the development supports low-carbon mobility, with bicycle facilities and a bicycle network, electric vehicle charging stations, connections to public transit, rideshare pick-up points, and a walkable site. A significant early design decision to break up the existing super block enhances permeability, connectivity, and likelihood of success for alternative transportation strategies. The pedestrian experience is enhanced through walkable site strategies. The development is planned to evolve and adapt for the next generation of modality, both on the site and below grade.

Figure 5. Transportation and walkable site strategies

Benchmarking to Measure Performance
Continuing MIT's commitment to sustainable development in the Kendall Square area, the Volpe district will be one of the largest LEED developments in the Cambridge and Boston areas. MIT is committed to adopting the next generation of sustainable building benchmarking. Each building is committed to achieving a minimum LEED Gold rating under the LEED version 4 system. (See the Green Building Checklist, LEED narratives, and Green Building Professional Affidavit for LEED compliance commitment).

Sustainable Community
As a mixed-use project, the development promotes social sustainability in the urban context to support a thriving community of workers, residents, and visitors. By providing connections with Cambridge neighborhoods and varied amenities on-site, the development transforms the Kendall area into a destination that serves as an educational and regional model of how sustainable master plans can integrate into existing urban contexts and promote collaboration, engagement, and diversity.

SUPPORT A THRIVING COMMUNITY
Provide community amenities and facilities, including Community Center.
Invite community participation in programming.
Create a retail mix that supports local business.
Promote local job opportunities through the Job Connector.
Housing mix includes affordable and larger family apartments.

PROMOTE SUSTAINABILITY AWARENESS
LEED v4 Gold buildings.
Design visible sustainability features.
Encourage community programming for sustainable living.
Provide energy dashboards and sustainability signage.
Sustainable community center to advance sustainability awareness.

DESIGN FOR HEALTH AND WELLBEING
Provide access to active public community spaces with multigenerational uses.
Design for green spaces of respite with visual connections to vegetation.
Select materials for health and transparency in manufacturing.
Universal design and active design to promote physical mobility.

Figure 6. Community development strategies

INTEGRATED DESIGN PROCESS
Sustainability is an integral part of the Volpe masterplanning process. MIT is committed to developing buildings that are energy efficient, environmentally conscious, positioned to utilize advancements in technology, and healthy for the occupants and visitors.

MIT specifically selected team members accustomed to working across disciplines to brainstorm strategies and collaborate on analysis to ensure the environmental performance goals of the project would be met. Atelier Ten, Elkus Manfredi Architects, VHB, Reed Hilderbrand and Buro Happold engaged in robust conversations on sustainability, challenging concepts of what makes a development sustainable now and in the future. Design elements and concepts were continually evaluated through the lens of sustainability. Beyond the biweekly team discussions incorporating sustainability concepts, the design process included numerous workshops centered on sustainability.

- Sustainability Visioning Session – June 26, 2019
- Sustainability Work Session – June 26, 2019
- Sustainability Brainstorm Scatterplot Workshop – August 7, 2019
- Initial MEP Collaboration Meeting – October 1, 2019

- Sustainability Packages Presentation – October 10, 2019
- Water Reuse Strategy Meeting – February 4, 2020
- Site + Civil Workshops – March 4, 2020, March 18, 2020, March 25, 2020
- Sustainability Update Presentation – April 15, 2020
- Site + Transportation Innovation working group – biweekly April through June 2020
- Sustainability Big Ideas Evaluation Process/Meetings – April through July 2020
- Emissions + Energy Supply Meetings – July 2020

Each new building in the PUD-7 District will employ an integrated design approach in the building design process and incorporate best practices for meeting sustainability goals.

GREEN BUILDING REPORT

This document provides an overview of the sustainability efforts and decisions related to the planning of the Volpe site. The site design team has addressed the City of Cambridge's Sustainability requirements and guidelines throughout the design process, as detailed in the following.

- Consistency with PUD-7 Zoning Requirements
    - 13.96.4 - Sustainability Zoning Requirements
- Consistency with Article 22 Sustainability Guidelines

The project plans to achieve its sustainability goals and meet the designated targets addressed in the requirements above by employing the outlined strategies. Furthermore, some of the sustainability priorities of the development, including cutting edge technology and healthy building design, fall outside of the current city requirements but are included in the Green Building Report to round out the holistic approach to sustainability the integrated design team has proposed.

A detailed breakdown of the decision-making process for the primary sustainability guidelines is outlined below, including how the design investigated and incorporated strategies or where the investigation demonstrated a more efficient or feasible opportunity. This submission encompasses all buildings proposed in the Volpe masterplan, and further detail on sustainability performance will be included in individual buildings' future Design Review submissions.

EVOLVING STANDARDS

As the masterplan for the district has progressed, the design team has continued to evaluate the site, stormwater, and energy performance against new guidelines and standards. The team will continue to evaluate all opportunities and technologies. The current design approach at the planning level takes a holistic look at sustainability to maximize and optimize community benefits, activation, and environmental performance, while balancing competing interests and conflicts. The team will continue to refine how sustainability elements fit together to demonstrate the most we can do with what we know today while positioning the future design of buildings to use advancements in technologies for more efficient and enhanced environmental performance.

MIT and the design team members continue to be engaged with the City's initiatives and environmental design expectations for the design and operation of the buildings. MIT and the design teams look forward to continued collaboration with the City and Cambridge community to develop a sustainable destination in the Volpe District.

ZONING COMPLIANCE

This section provides an overview of the project team's holistic approach to environmental performance, including sustainability priorities and strategies employed to meet or exceed the City of Cambridge sustainability requirements and initiatives.

Consistent with City of Cambridge zoning and sustainability initiatives, the project is designed in accordance with Section 13.96.4 of the Planned Unit Development 7 District. The project will meet or exceed requirements outlined in Article 22 of the Cambridge Zoning Ordinance.

As required under the PUD-7 Zoning Regulations from the City of Cambridge, Massachusetts, the buildings shall achieve a minimum of Leadership in Energy and Environmental Design (LEED) Gold. As a part of the Volpe Masterplan design process, MIT is exploring district energy heating and cooling systems as well as individual building and site level energy conservation measures. The district system analysis includes the evaluation of potential on-site energy generation within the PUD-7 District.

In addition, MIT continues to enthusiastically engage in the City's numerous ongoing sustainability initiatives such as the City of Cambridge Net Zero Action Plan. The Volpe Project's approach to energy and resilience is consistent with the goals and objectives of the City of Cambridge.

As an active and engaged member in City committees and initiatives, MIT is committed to exceeding local energy standards where possible by incorporating a whole system, integrated approach and to continually reevaluate design strategies to stay at the forefront of technical developments and improve environmental performance. Energy efficiency and resource conservation are at the heart of the sustainability framework developed for the Volpe site and will remain a focus for the entire team as the project develops.

ENERGY + EMISSIONS

ENERGY SUPPLY

The development is committed to reductions in greenhouse gas emissions and the design team has studied a wide range of design strategies. As the project continues to evolve, the project team will continue to study energy system opportunities, including district energy systems, shared heating and cooling systems and peak load reductions through energy storage. District energy opportunities studied to date, such as steam, on-site cogeneration, on-site geothermal, and condenser water loops, were evaluated against the following criteria: efficiency improvements, carbon emissions, feasibility, parcel flexibility, construction and operating costs. The team will continue to consider all viable strategies for carbon reduction in energy supply and investigate and embrace advances in technologies that may provide district solutions.

The team considered alternative energy supply strategies. We assessed the feasibility of connecting to district steam systems, implementing development-wide building connections, district ground source heat pumps, , and installing renewables for energy generation.

District Energy

The team explored the following district energy strategies during the planning process and evaluated them against operational energy savings, emissions reductions and contributions to the net zero initiative, first cost, feasibility, and regulatory concerns:

- Redistributed heating loads
- Vicinity steam
- Centralized cogeneration
- Ground Source Heat Pumps
- All-Electric benefits

Redistributed Heating Loads

A district or semi-district approach to energy supply could potentially reduce emissions associated with operations. To maximize energy savings and take advantage of complementary loads between different programs or building types, the design team will continue to explore, at planning and building phases, shared connections, either as a district or phased pairs of buildings to redistribute heat. This innovative approach aligns with electrification of the development while optimizing load sharing across buildings. Potential building connections for heat exchange will need to be better understood during the design of each building as efficiencies for internal heat recovery improve. This approach, if found to be beneficial from an energy, carbon, and operations perspective, could be phased and integrated into the current plan.

Vicinity Steam

The team conducted a series of meetings with Vicinity and follow-up analysis to understand the benefits and limitations of connecting to the local steam network. The steam currently available from Vicinity is primarily a by-product of burning natural gas to generate electricity (which Vicinity feeds into the MA energy grid). Vicinity discussed that the plant will continue to operate as a fossil-fuel-fired plant to meet grid energy demand for the foreseeable future. With long-term decarbonization as a priority for MIT and the city, MIT has strong reservations in entering a long-term contract for steam based on the generation of electricity via fossil fuels.

Moreover, as grid emissions improve through additional renewables, Vicinity anticipates that the plant will be increasingly a load following plant[1], thus reducing output of electricity and thus steam. Vicinity articulated that they plan to move towards a model where they generate steam for their customers from electricity as shown in Figure 7. Compared to this future scenario, the Volpe development would be able to generate heat on-site with greater efficiency than an electrified Vicinity plant. As shown in Figure 8 with efficient electric heat pumps, the development can generate heat on-site with a COP of 3.0 (with supplemental electric boilers) in comparison to an electric steam generator plant (in a potential future Vicinity steam model) with a COP of 0.95 plus distribution losses to the Volpe site.

Day 1/ Short Term

- Steam as a by-product from CHP electricity generation.

Day 2 / Near Term

- CHP steam + electric powered steam generation.

Day 3 / Long Term

- Challenge to electrify the plant; steam is no longer a by-product.
- Less efficient and less flexible way to all-electric heating.

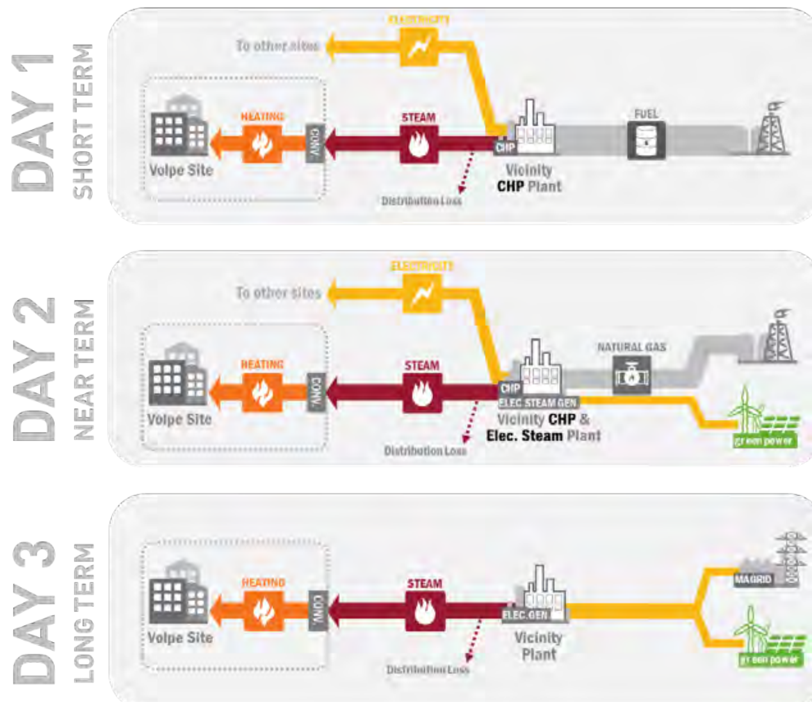


Figure 7. Vicinity future electrification pathway

[1] Plant would operate based on customer demand for steam rather than electricity (with steam as a byproduct) due to more customers purchasing electricity from the greener MA grid.

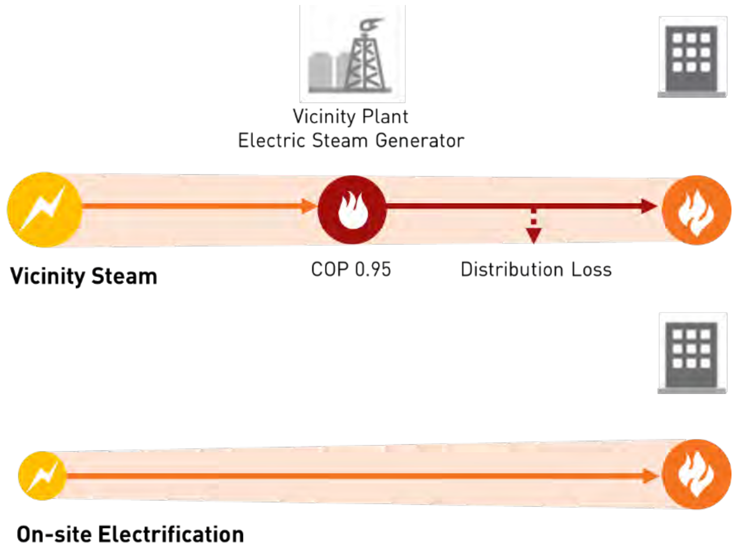


Figure 8. Comparison between Vicinity plant electrification and on-site electrification

Because of MIT's desire to more aggressively decarbonize and the concerns noted above, the team has decided not to move forward with the district steam connection.

<u>Centralized Cogeneration</u>

More traditional district systems typically employ fossil fuel fired cogeneration equipment and would likewise tie the development to fossil fuel energy sources for the long term. Similar to the Kendall Square district energy study that compared on-site cogeneration with steam and/or stand-alone heating and cooling plant options, district cogeneration systems on the Volpe site would increase site emissions compared to electric-based district opportunities. Cogeneration systems also pose a challenge due to current regulatory constraints on providing electrical energy across parcels depending on ownership – thermal energy transfer is generally possible. Cogeneration could be a short-term solution for increased efficiency until the grid improves; however, it does not support MIT's vision of decarbonization. While cogeneration systems provide redundancy and resilience in potential outages of the electric grid, there are other possible approaches to providing backup power and heating to lab buildings – including additional generator capacity (upsizing backup power generators).

The team will continue to review on-site generation of electricity for redundancy in emergency situations; however, for normal operations, electrification of building systems, building efficiency improvements, and potential district heat exchange would be more beneficial with respect to emissions and operational energy costs when compared to cogeneration. Furthermore, fossil fuel reliance is counter to the long-term MIT and Cambridge carbon-free vision.

<u>Ground Source Heat Pumps</u>

The team investigated opportunities for geothermal, or ground source heat pumps (GSHPs). When evaluating the potential for GSHPs, we considered competing sustainability factors that demand space below grade. Active open space with significant tree planting and enhanced stormwater management conflict with space and location needs for GSHPs. In order to transition from existing surface parking to a more pedestrian oriented and connected open space, the design provides parking below grade in a garage that extends through the majority of the site. Likewise, site surface area and below grade space outside of the garage footprint is essential for enhanced stormwater management, phosphorous removal and infiltration for ground water recharge.

GSHPs allow buildings to reject heat to the ground during summer months and remove heat from the ground for heating during cooler months through wells drilled vertically into the ground. The wells require significant spacing to avoid any interaction between wells underground to maintain efficiency. Moreover, GSHPs must be reasonably accessible for potential long-term maintenance or repair, making placement below buildings or garages undesirable. Placing GSHPs in site areas that have no below grade or building structures was found to be infeasible when comparing the GSHP requirements with the benefits of the tree plantings, active open space and stormwater management.

As a result, the design prioritizes open space to support the stormwater management and infiltration goals, promote healthy sustainable trees and vegetation growth over the very limited energy benefit of GSHPs in the open space.

See Appendix A for preliminary GSHP study.

ELECTRIFICATION

> In looking to the future, MIT anticipates future improvements in grid emissions as renewable energy sources are added and will develop buildings with systems that can take advantage of reduced grid emissions through electrification. In demonstration of MIT's alignment with the City of Cambridge vision for all-electric buildings, we are exploring district and building-level strategies involving electric based systems.

Approach

The team explored future scenarios with respect to energy supply and decarbonization, particularly with anticipated improvements from the grid electricity sources. The makeup of the Massachusetts energy grid is anticipated to shift more towards renewable energy sources in the coming decades. Thus, the emissions associated with the electricity consumed by the site would reduce as the emissions factors improve, setting a path for future decarbonization.

The project is currently evaluating a Day-1 all electric approach for the buildings against more traditional energy systems, comparing across overall energy consumption, emissions, and cost. Both energy resilience and redundancy are critical factors when determining systems to best serve both residential and commercial programs. Considering the available technologies, electrification of residential buildings is a big first step towards districtwide electrification. Electric grid reliability, especially during peak heating conditions, continues to be a concern for supporting heating for lab processes and tenants, and may require appropriately sized natural gas-based systems for redundancy.

During the masterplan development, buildings have been designed with guidelines for future electrification in mind, carrying allowance for penthouse and mechanical space and capacity to transition mechanical systems from fossil-fuel based systems to all-electric (gas boilers replaced with electric resistance or air source heat pumps). The Volpe development leads the market in anticipating the shift towards electrification with an approach that combines all-electric residential buildings on Day-1 with high performance commercial buildings that strive to minimize consumption of fossil fuels with future adaptability (Figures 10, 11).

Figure 9 illustrates the development baseline, or proposed Day-1 design, followed by two alternatives, Figures 10 and 11, demonstrating transition to electrified commercial buildings and ultimately net zero operational carbon with offsite renewable energy generation.

COMMERCIAL PROPOSED:

- Standard heating plant approach
- Potential to buy green electricity

RESIDENTIAL PROPOSED:

- Electric heating and cooling
- Potential to buy green electricity

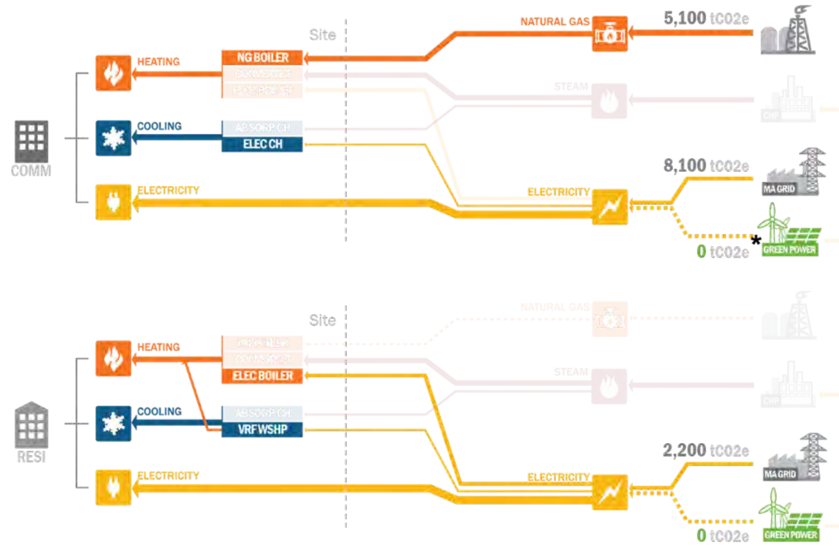


Figure 9. Development Proposal Baseline Commercial and All-electric Residential

COMMERCIAL PROPOSED:

- Natural Gas for peak heating
- Electric boiler for base heating
- Electric chiller for base cooling
- Potential to buy green electricity

RESIDENTIAL PROPOSED:

- Electric heating and cooling
- Potential to buy green electricity

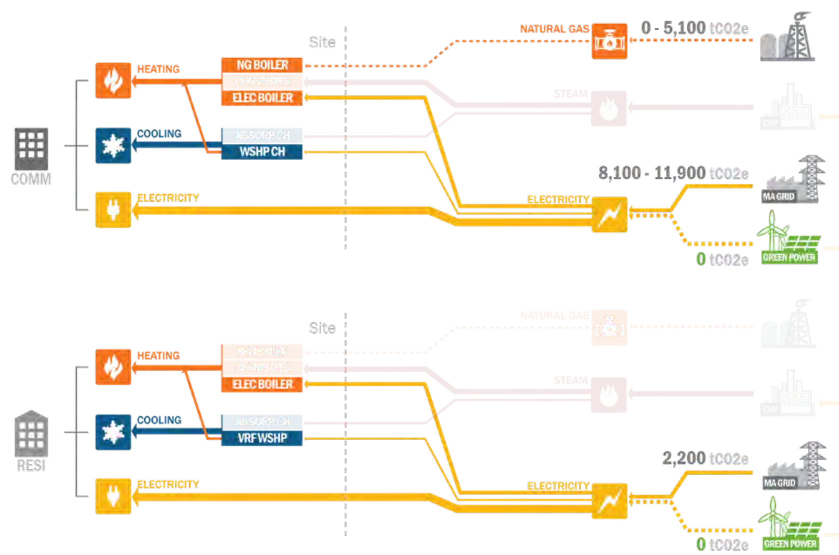


Figure 10. Potential Electric-ready Commercial and All-electric Residential Pathway, Pending Grid Reliability. Grid emissions projected at current level but expected to decrease over time. To be further evaluated when buildings enter design.

COMMERCIAL PROPOSED:

- Electric heating and cooling
- Potential to buy green electricity

RESIDENTIAL PROPOSED:

- Electric heating and cooling
- Potential to buy green electricity

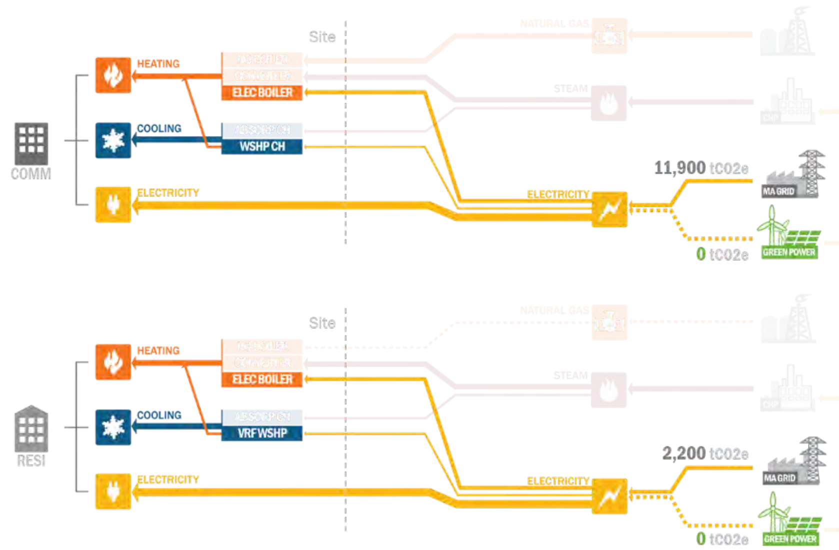


Figure 11. Proposed Future All-electric Commercial and Residential – Path to Net Zero Carbon. Grid emissions projected at current level but expected to decrease over time. Green Power represents opportunity to offset grid emissions.

Flexibility for Future Commercial Building Transition to All-Electric

In planning for future electrification of the commercial buildings for the path to net-zero, the team identified flexibility that would be required in the design on Day-1 to allow for a future transition to electrification. Furthermore, the team studied feasibility of mechanical equipment upgrades for net-zero transition while the buildings are occupied to understand the disruption to building tenants.

The following table outlines a conceptual study of equipment and estimated mechanical space requirements to transition to electric commercial buildings. Allowances to be revisited per building in design and studied in multiple dimensions for feasibility. Flexibility for these allowances would be designed Day-1 into individual buildings.

Heating Options	**(Option 1)** Electric Boilers	**(Option 2)** Heat Pumps
Elec. Equipment Capacity	• Upsize in transformer and electric bus capacity	• No change
Elec. Equipment Cost	• Increase	• No change
Elec. Room Space	• No change	• No change
Mech. Room Space	• No change	• Additional roof space for ASHPs (approx. minimum of 1,500 sf) • Additional penthouse space for AHUs, and removal of Gas Boilers (net approx. minimum of 500 sf; Approx. 1,500 sf for AHUs minus approx. 1,000 sf for Gas Boilers)

The switch to all-electric could be completed during a scheduled shutdown, preferably off-season. For example, air source heat pumps could be installed during the cooling season and start running when heat input is required. The centrifugal chillers could be pulled offline in the heating season. The equipment must be installed without impact to tenants – shutdowns could only occur when making the actual piping/electrical connections and then for start-up, commissioning, and balancing. Likewise, the study found that no significant changes would be anticipated for utility service spaces and equipment.

Figure 13 demonstrates how electrification of the commercial buildings could extend to load sharing between residential and commercial programs.

Through this investigation of transition requirements, MIT is confident that commercial buildings could be transitioned to all-electric systems in the future once grid reliability improves and electrification on such a scale is a viable technology.

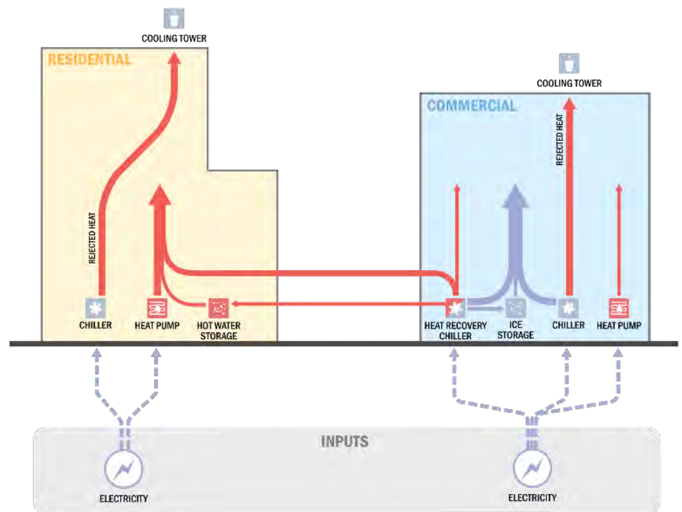


Figure 12. Concept diagram of shared loads and electrification

RENEWABLE ENERGY

MIT will continue to evaluate feasibility of rooftop photovoltaic systems to generate electricity and other available larger scale off-site opportunities such as PPAs. Demonstration opportunities will be considered for their educational benefits.

Renewable energy is a critical component of net-zero carbon design to make up for energy consumed as part of the development. However, it can be challenging to generate significant energy on-site in a dense urban environment. A successful path to net-zero carbon should include some component of on-site renewables where feasible along with more significant off-site strategies.

On-Site

The team studied potential for energy generation on the site and rooftop areas. Comparing Volpe future building designs to other office and laboratory buildings in the Cambridge city limits, it can be expected that mechanical systems can take anywhere from 50-75% of roof area, leaving limited space for other uses. Flexibility for future all-electric equipment components requiring additional space for air source heat pumps on the roof might further limit usable area for renewables. Studies show that only a minimal amount of energy can be generated on the remaining areas of the Volpe roofscape, around 1-2% of the development's total projected energy consumption.

Each building will study installation of PVs on roof areas through the design process. Where possible, canopy or site feature demonstration PV installations meaningfully connect pedestrians to on-site energy generation, while scalable off-site strategies such as PPAs can substantially reduce carbon impacts of the development.

Off-Site

While the development transitions away from fossil fuels towards electric energy supply, the path to net-zero carbon evolves from purchasing of RECs to offset operational carbon towards electricity consumption via green power purchases. MIT has studied current available mechanisms to incorporate off-site renewable energy, including unbundled RECs, utility supplied green energy purchases, community choice aggregation (potential to participate in Cambridge's Community Electricity program), and direct purchase options, such as power purchase agreements.

The renewable energy marketplace will continue to evolve through the time the Volpe buildings come online. With the ever-changing RECs and PPA markets and potential for local regulatory impacts on green energy purchase requirements as they apply to net-zero targets, the Volpe Development will continue to evaluate how best to incorporate a green energy strategy in long term operations.

MIT will continue to balance on-site energy generation strategies that support community education demonstrations, with exploration of off-site mechanisms to provide the greatest impact in carbon reductions.

Figure 13. Example off-site PV installation

ENERGY STORAGE + RESILIENCE

Energy storage is being evaluated at the district level for feasibility.

Potential for ice storage or other phase change materials will continue to be explored as part of the building design, including how they may be incorporated in a holistic all-electric system. Energy storage systems, especially battery type storage, could be phased into excess below grade spaces as the demand for automobile parking decreases. As energy storage technologies improve, opportunities may arise as program needs and uses change in buildings or within the site.

Ideally, incorporating energy storage could also pair with advancements in solar renewable technologies to generate clean energy to be stored. The team continues to evaluate infrastructure needs to accommodate future flexibility in below grade spaces.

While the future of building systems relies on electrification to meet collective climate goals, fossil fuel energy sources will still be needed to provide critical backup power during major utility disruptions. Maintaining connection to natural gas utilities for commercial buildings will help provide resilience for disruptions in electricity supply, either at a back-up level or sized to raise capacity from electrified base load systems to peak loads. During the planning stage, the team explored district microgrid strategies to potentially island, or temporarily disconnect the development from the electricity grid and generate electricity on-site, in the event of a utility disruption. To a lesser extreme, modestly sized power generation systems were studied to provide redundant power for use only during major grid disruptions. Likewise, future advances in energy storage can be leveraged where feasible for resilience in times of grid disruptions.

Currently, building systems resilience will come from individual systems designed for backup power.

BUILDING EFFICIENCY

The design team recognizes that reducing building energy consumption and associated climate emissions is critical to mitigate climate change. The team has and will continue to evaluate collective strategies to enhance building performance and reduce energy consumption. The buildings, when designed, will include high performance strategies for envelope, mechanical systems, and internal heat recovery. During building design, the team will identify opportunities to employ potential building load sharing and the latest technologies to mitigate energy use. The projects will employ strategies to reduce energy consumption, greenhouse gas emissions, and buildings' impact on the grid.

Planning for All-Electric Future

Buildings will be able to take advantage of grid improvements as the electricity sources shift over to renewables. In designing for the all-electric future by building distribution systems that integrate with electric energy supply, the buildings will plan to shift from natural gas-based heating to electric systems. Residential buildings will be all-electric on Day 1 with VRF or water source heat pumps and heat recovery chillers to reduce building energy consumption and achieve an all-electric energy supply. As the commercial buildings are designed, state-of-the-art systems will be selected to reduce energy consumption with built-in flexibility to transition over time to all-electric, with a potential for only backup systems to rely on fossil fuels, if the option to build all-electric is not feasible Day-1.

Building Energy Benchmarking

Energy demands of the future buildings were studied in order to determine, at a planning scale, how best to supply the buildings and meet MIT's path to net zero emissions ambitions. First and foremost, the design teams focused on reducing the energy demand of the site and buildings through the integration of the following strategies:

- High-performance building envelope – Exceed current code-required high-performance fenestration and opaque wall assembly targets.
- Reduced lighting power consumption –Enforce reduced lighting power densities in tenant spaces as well as designing base building lighting to exceed a 30% reduction from the ASHRAE baseline.
- Highly efficient mechanical, electrical and plumbing systems
- Optimized heat recovery
- Advanced controls – Drive innovation in building controls for both commercial and residential properties.
- Occupant education programs – Relay real time data to inform occupants to encourage efficient behaviors.

Buildings will be evaluated in accordance with the LEED v4 Energy Performance prerequisite and credit based on ASHRAE 90.1-2010 to determine the projected points for individual building LEED scorecards.

In addition, the design will incorporate Stretch Code performance requirements for envelope and systems and exceed the minimum required 10% reduction from the Stretch Code baseline (Figure 14). Design teams will continue to track both the LEED v4 and Stretch Code energy model baselines.

This goal will continue to be aligned with any applicable stretch code updates. MIT is tracking potential upcoming code changes and ensuring building designs respond to the rising bar in performance and, most importantly, are on track to achieve MIT's path to net zero goals.

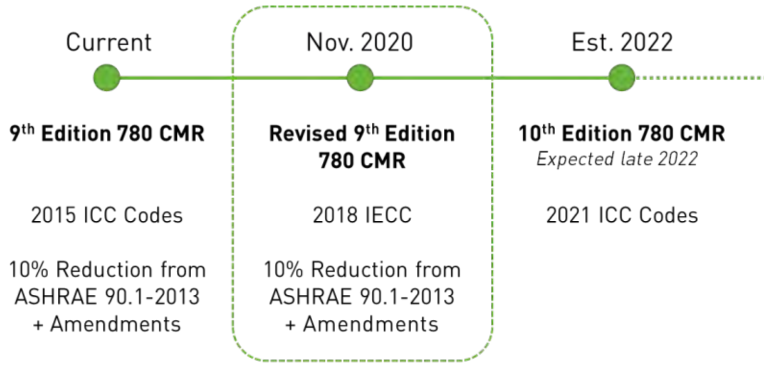


Figure 14. Mass Stretch Code mapping through the masterplan process

Preliminary assessments in the masterplanning phase anticipate the following performance against the Stretch Code (Rev. 9th Edition 780 CMR). All buildings will continue to comply with all current applicable building codes and feasibility to significantly exceed the Stretch Code will be determined by individual building designs with opportunities and technologies available at that time. Likewise, energy efficiency measures factored into the baseline and proposed building designs will be determined individually by building to comply with code requirements.

Initial studies for performance of a typical core and shell lab/office building in the northeast climate estimates over a 15% reduction against the Stretch Code baseline. With a future transition to all-electric systems when technically feasible, the sample commercial building projects a 40% reduction from the current Stretch Code baseline as shown in Figure 15.

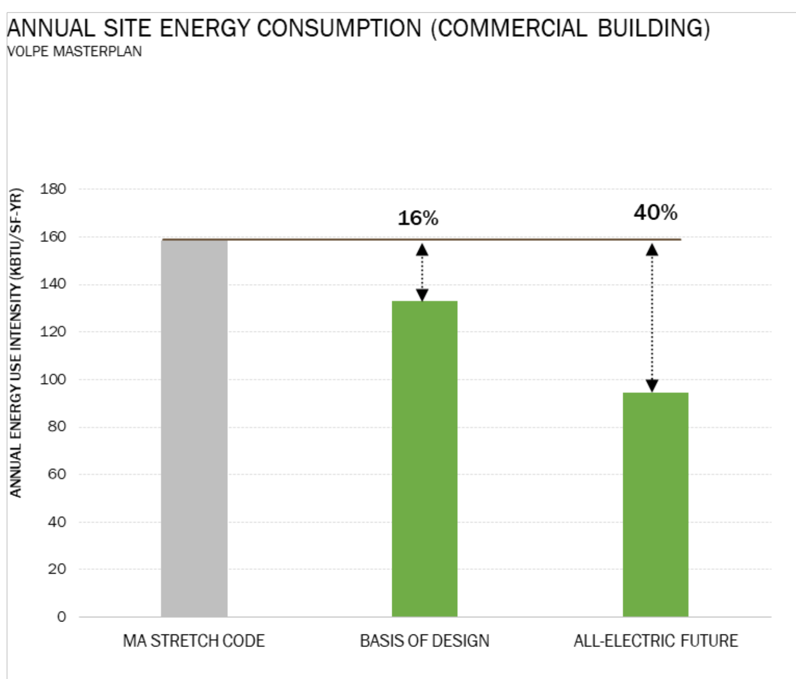


Figure 15. Commercial Building Mass Stretch Code comparison

Making up 40% of the development, residential buildings are anticipated to achieve at least a 20% reduction from the Stretch Code baseline with a Day-1 all-electric design as shown in Figure 16.

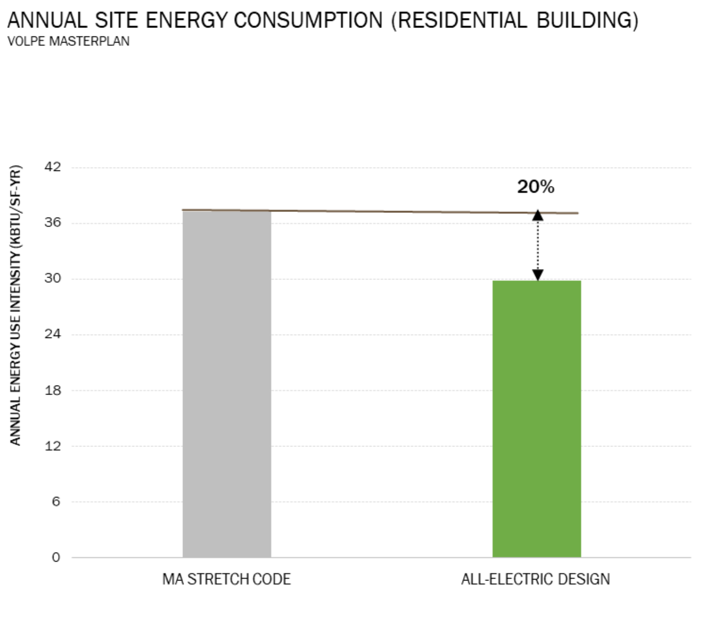


Figure 16. Residential Building Mass Stretch Code comparison

Envelope

While the specific buildings on the Volpe site have not been designed, preliminary energy studies provide a direction for their development.

When designed, building envelope systems will be optimized for energy performance, thermal comfort, daylight, and visual comfort. By combining insulated wall and spandrel areas with triple glazing, the buildings will align with Passive House's insulated envelope strategies, while balancing performance goals for daylighting, views, and visual comfort.

Sensitivity studies of envelope performance and impact on overall building energy consumption were conducted for a representative residential building and a commercial building. These studies helped identify the recommended performance values to exceed code and maximize energy savings to meet MIT's ambitious energy goals while comparing energy saving opportunities to more prescriptive benchmarking systems like the Passive House standard, as shown in Table 1.

Table 1. Envelope Requirement Comparisons

	LEED v4 Baseline (ASHRAE 90.1-2010)	Stretch Code (IECC 2018)	Passive House
Roofs	R-20 c.i.	R-30 c.i.	R-60-70
Walls, above Grade	R-13.0 + R-5.6 c.i.	R-13 + R-13 c.i.	R-31-43
Slab on Grade Floors	R-10 for 24" below	R-10 for 24" below	R-20
Vertical Glazing	U-0.45 SHGC-0.40	U-0.38 SHGC-0.38 (0.51 for North façade)	U≤0.14 SHGC≥0.50
Window to Wall Ratio	-	-	30%

MIT supports the intent of the Passive House standard and will incorporate elements of the standard in building designs. MIT is cognizant that Passive House was developed initially for single family residential projects. There are limitations in comparing high density residential urban developments to the Passive House benchmarks. There is an efficiency in urban housing that is not captured in the representative benchmark Energy Use Intensities (EUIs) in Passive House requirements. Urban housing allows for a more efficient or dense allocation of residences with energy uses and equipment such as refrigerators, stovetops, and elevators at a greater density. With increased density, it is impossible to pursue Passive House in a normal way without exceptions. Yet, greater density urban development provides for a more efficient use of space and resources. Similarly, Passive House looks at only EUI and not carbon reduction, which is driving energy reduction performance of the development.

Moreover, Passive House does not account for adjacent energy uses outside of the building such as daily transportation benefits of being in a connected urban setting versus suburban or rural areas for a typical single-family home. These urban lifestyle differences from suburban lifestyles account for significant emissions reductions over time, contributing to a net-zero emissions and climate resilient future.

Ultimately, high performance envelope design is important for building energy performance as well as optimization for daylighting, views, thermal comfort, and visual comfort. Using sensitivity studies for envelope insulation and glazing performance, proposed design performance compares within the range of Passive House standards.

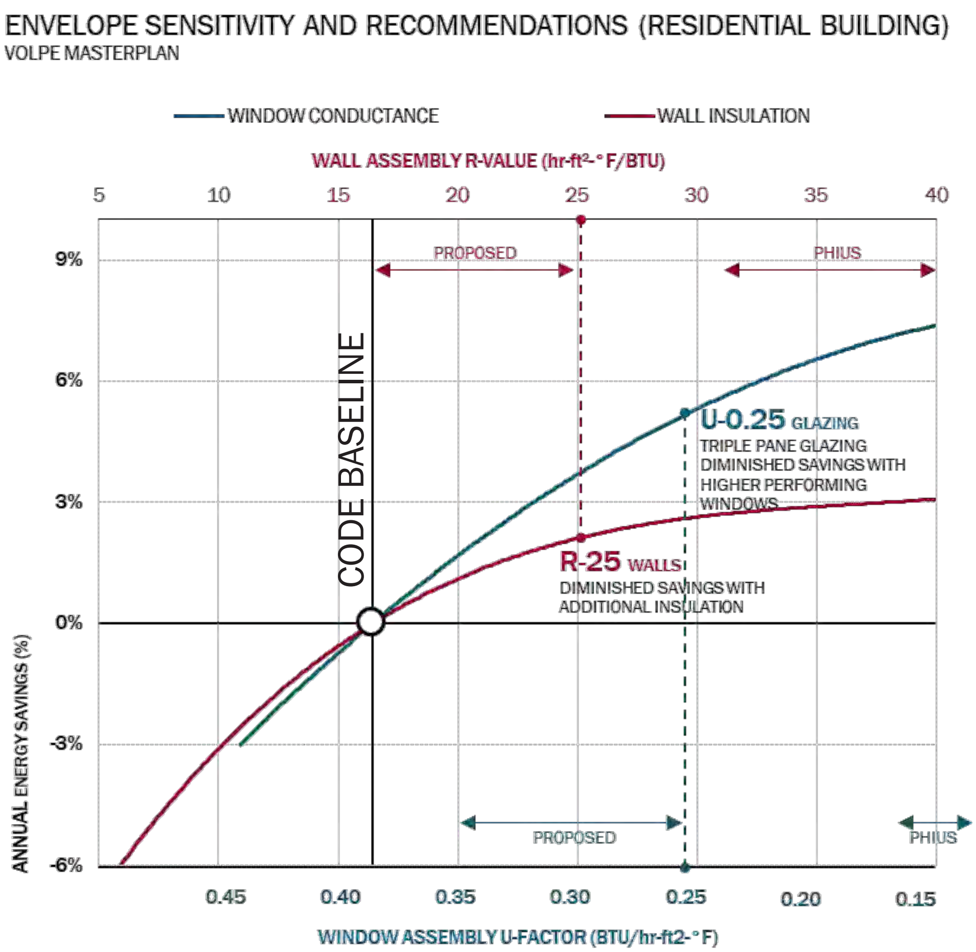


Figure 17. Residential building envelope sensitivity – proposed performance beyond code

Figure 17 illustrates the sensitivity in annual energy savings compared to wall assembly R-value and window assembly U-factor. The study shows minimal additional performance benefit for a residential building beyond R-25 walls. Insulation beyond R-25 to achieve a Passive House standard would only achieve up to 1% reduction in energy use. Triple pane glazing will be explored to maximize energy savings. During the individual building design process, other envelope performance criteria such as infiltration rate, frame assembly design, and window-to-wall ratio (WWR) will be studied for enhanced energy performance.

Building envelopes will be designed for reduced energy consumption, aligning with Passive House envelope initiatives.

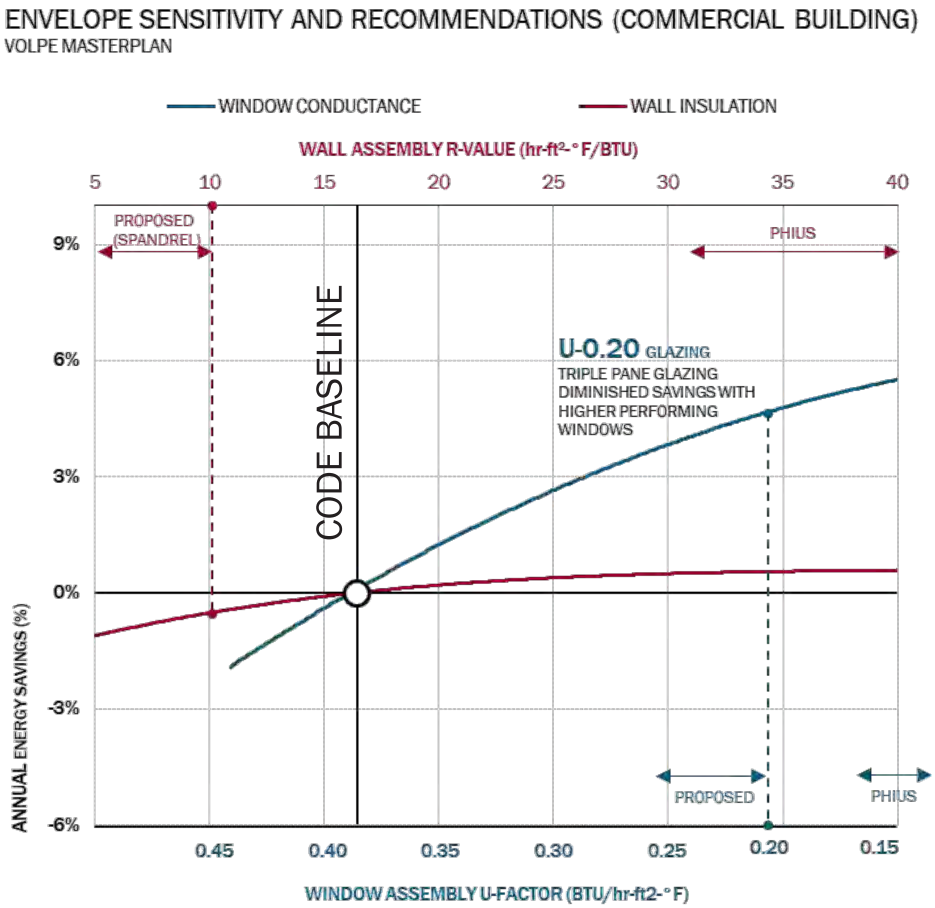


Figure 18. Commercial building envelope sensitivity – proposed performance beyond code

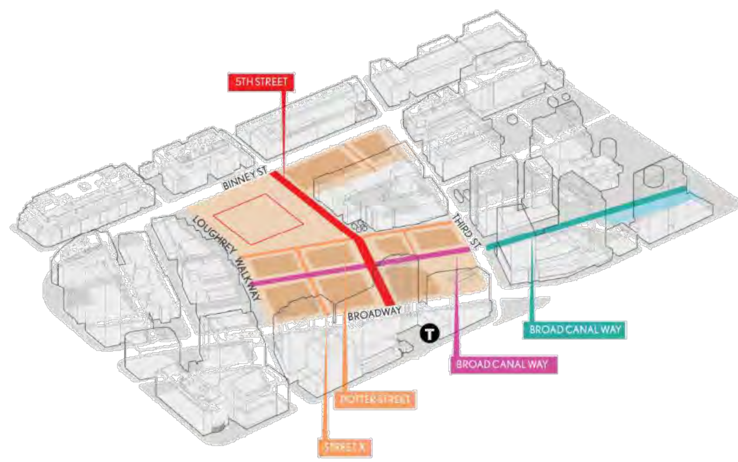
Energy efficiency for the commercial buildings is most sensitive to glazing performance and less driven by wall assembly insulation. The flattened red curve in Figure 18 shows less than 1% additional energy savings between a proposed highly insulated triple glazed spandrel assembly and opaque area designed to meet Passive House standards. Furthermore, the range of proposed glazing performance for a typical commercial building shows up to 5% energy savings while glazing that meets the Passive House standard shows up to only 6% overall savings.

The above preliminary envelope sensitivity studies will inform early design studies for individual buildings as the architecture evolves.

Based on the analysis of all criteria, the masterplan team has established envelope performance targets for individual building's overall R-value, minimum glazing performance, and WWR targets in order to benchmark and study impacts of envelope, systems, and district strategies on energy performance. A summary of these baseline values and target performance ranges can be found in the Net Zero narrative template.

Building Massing and Passive Strategies

Building footprints are dictated by the urban street grid. As a priority, the street layout breaks up the original superblock to enhance connectivity in the neighborhood. Building setbacks have been established to increase daylight availability at street level. Informed by solar radiation studies, buildings have been located to maximize daylight access to the open space.



In response to the building massing and programming, passive strategies will be explored in each building's design process. Based on their typologies and predicted energy loads, the residential and commercial buildings will benefit from different passive design approaches.

High performance envelopes for commercial buildings will be optimized with insulated opaque area and triple glazing to maximize daylight and enhance occupant thermal comfort. In residential buildings, insulated envelopes can more significantly reduce heating and cooling loads from heat gains or losses, while glazed areas can be used strategically for daylighting, views, and connections to the outdoors.

All building types can benefit from external shading designed to reduce excessive summer solar gains while allowing passive heating in winter months. Horizontal louvers or overhangs are optimal on the south facades while also function to block late morning or early afternoon heat gains on east or west facades. Vertical fins or perforated screens can help reduce east or west exposure to heat gains or low angle sun glare potential. Shading strategies will be developed further through each building's design process.

Finally, operable windows in residential spaces can provide natural ventilation, also critical to passive survivability during power outages.

Lighting, Equipment, + Tenant Operations

The project will establish targets for lighting power reduction and equipment efficiencies for base building design while encouraging tenants to reduce energy consumption through tenant guidelines.

Building tenants will be encouraged through tenant guidelines to achieve a 20-40% reduction in energy consumption for lighting and equipment (printers/copiers, IT/Tech equipment, misc. equipment). Office tenants will be encouraged to achieve a 40% reduction in lighting and 20% reduction for equipment while lab tenants will be encouraged to target a 40% reduction in lighting energy.

Efficiency Improvements - As equipment efficiency and controls continuously improve, a reduction in energy use of the future fit-out for tenant energy use beyond even today's best performing buildings is expected at the time of occupancy.

EMISSIONS

Operational Carbon

The development is anticipated to reduce emissions on Day-1 by 16% from a code complaint development, with a reduction of 2,950 metric tons of greenhouse gas emissions[2] per year. The annual carbon savings equates to removing approximately 670 cars from the road each year. High performance building systems and envelopes, and meaningful construction material selections for low embodied energy contribute to reducing emissions at the development scale. A hybrid approach to the electrification of residential buildings on Day 1 along with the purchase of green electricity for residential and commercial projects has the potential to reduce carbon emissions by nearly two thirds from a code compliant development.

Transitioning buildings to all-electric systems prepares the development for an all-electric future aligned with the greening of the grid and goals of local, state and national agencies. Site-level renewables act as demonstrations to the public to raise awareness of green energy's contribution to the development while larger off-site renewable energy sources are allocated to reducing emissions form energy supply to the development.

Embodied Carbon

During the planning stages, the team acknowledged the importance of embodied emissions expended through construction and manufacturing of building materials. During each building's design process, design teams will identify opportunities to reduce embodied carbon impacts through specification of low-embodied carbon materials – from concrete mix designs and enclosure components through how building materials are manufactured and procured locally where feasible (Figure 19).

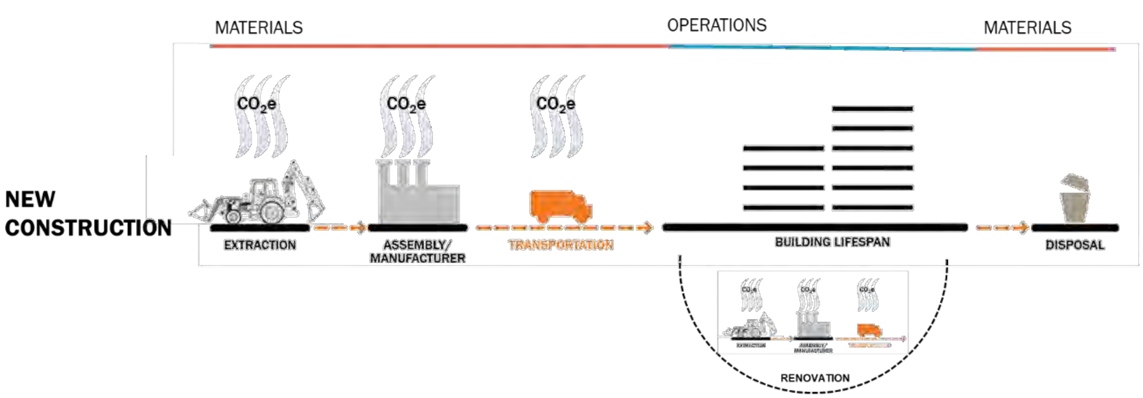


Figure 19. Embodied carbon emissions throughout a building lifecycle

Looking at other project precedents and building material life cycle analysis where applicable, the design team will identify construction materials to prioritize for embodied energy reductions. Applying previous lessons learned at the masterplanning stage of the Volpe project, the team indicated areas where future optimization

---

[2] Code baseline building emissions totaling approx. 18,300 metric tons of CO2 per year (dependent on program ratio of commercial buildings).

of embodied energy could be beneficial. Using data from a sample northeast regional project currently in design, Figure 20 illustrates potential future study opportunity during the building design phase to identify building elements driving embodied carbon emissions.

Ultimately, MIT is committed to holistically reducing operational carbon and embodied carbon in building design and construction.

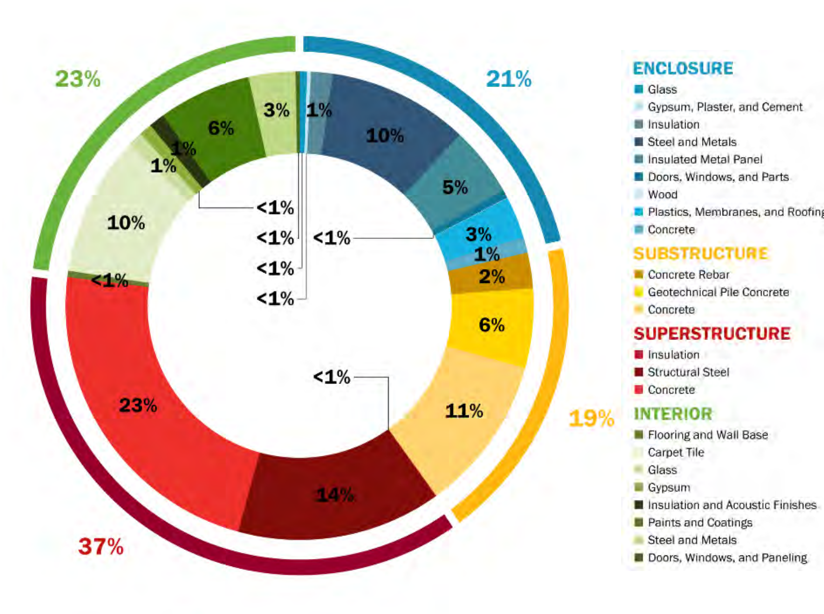


Figure 20. Sample Life Cycle Analysis of Building Materials based on Construction Components from a typical Core + Shell building.

MONITORING

Site consumption of water and energy will be metered holistically for the site for ongoing operations tracking and comply with the Cambridge Building Energy Use Disclosure Ordinance. Monitoring will allow building operations to be continuously evaluated over time, evolving to improve performance, increase efficiency, and reduce energy consumptions. Building metering is in line with the LEED v4 requirements.

Building commissioning will be conducted in line with LEED's Enhanced Commissioning requirements. Lessons learned at MIT's Kendall Square Initiative show the value in pursuing envelope commissioning as part of the LEED Enhanced Commissioning pathway to ensure high performance assemblies perform as designed to maximize energy savings.

WATER + RESILIENCE

WATER EFFICIENCY

Beyond energy efficiency, water resource management is a pillar of sustainability and conservation. The development will reduce water demand through efficient fixtures and implement the largest urban blackwater treatment plant of its scale in the Northeast. Building water will be captured, filtered, and reused for flushing and cooling tower operations, maximizing reuse of available water resources on-site and significantly reducing water sent to municipal sewers.

Efficient fixtures will be specified for flow and flush fixtures across the development. Each building will implement high-efficient low-flow fixtures to reduce indoor water consumption by at least 30%.

For commercial buildings, tenant guidelines will specify low flow/flush fixture requirements for indoor water use reduction. Reuse strategies for process water will help maximize water reductions. LEED v4 takes a holistic approach to building water consumption, including not just building fixtures but also process water. Ice machines, pre-rinse spray valves, and washing machines will all meet the EnergyStar or minimum flow rate requirements respectively.

The landscape plan includes utilizing indigenous or adapted vegetation to reduce irrigation demands. With efficient irrigation systems, outdoor potable water use will be reduced significantly.

WATER REUSE

A truly significant contribution to water efficiency is the development's exemplary demonstration of blackwater reuse on a district scale. A blackwater treatment plant installed in phases will be located in the below-grade space (similar to Figure 21) to serve the development to maximize reuse of building water.

Unlike stormwater reuse, building water resources are consistent seasonally and day-to-day across the development. With the continuous commercial cooling loads and complementary flushing demands for the commercial and residential buildings, there will nearly always be a demand and supply for non-potable water reuse. The blackwater system will have the capacity to reduce the overall project water use by approx. 60%, offsetting 100% of toilet flush demand and 60% of cooling tower make-up.

The design team is exploring opportunities for blackwater reuse for irrigation to further minimize potable water consumption, but primary reuse will be anticipated cooling tower water demand.

Figure 21. Image of blackwater treatment system in NYC project – Courtesy of Natural Systems Utilities

STORMWATER MANAGEMENT

The project site will implement landscape strategies and green infrastructure to reduce runoff of rainwater. Each building will be designed to collect and store stormwater for filtration and infiltration. Stormwater will be collected from roof areas and diverted to infiltration systems for ground water recharge via gravity.

The project will meet the City's 65% Phosphorus load reduction requirements and will be designed for at least the projected 100-year 2070 flood elevation. The most effective way to reduce the Phosphorous load is through significant below-grade infiltration of site stormwater runoff, which will primarily take place below the southeast corner's open space.

A district water rainwater management approach achieves a reduction in site runoff. The design will manage the difference of 2-year 24-hour pre-construction and 25-year 24-hr post-construction rain events. The design explores opportunities for site-wide stormwater reuse for irrigation and infiltration. Roadway surface runoff will be treated via porous pavement and/or infiltration catch basins according to the City of Cambridge's standards.

FLOOD RISK RESILIENCE

The project will embrace climate resilient strategies including elevating critical equipment and residential units above flood elevation, incorporating stormwater mitigation strategies, and providing standby power for critical equipment. The team will continue to evaluate feasibility of district-level strategies for enhanced resilience (Figure 22).

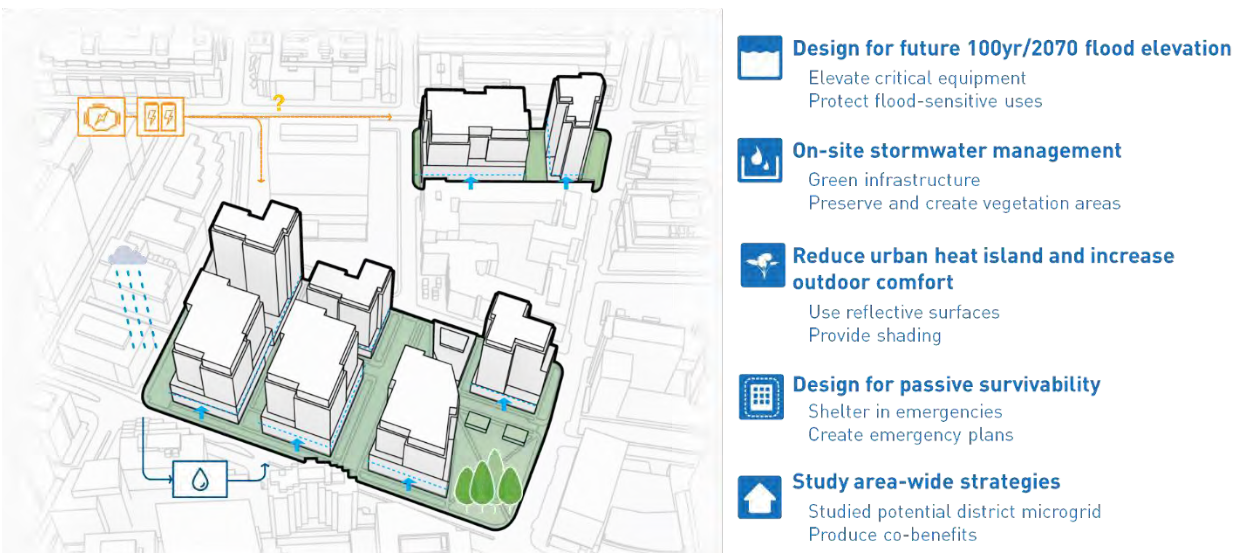


Figure 22. Resilient site early concept diagram

The Volpe site is vulnerable to increasing flood elevations, increasing heat for site and buildings, and potential for grid disruptions.

To evaluate the potential for future flood risk, the team studied the projected extent of future flooding in the region utilizing the Cambridge Flood Viewer Tool (2019). The tool assesses 10% and 1% Probability Long-Term Flood Elevation (10%-LTFE and 1%-LTFE) based on 2070 projections of annual flood risk. The analysis shows that 10%-LTFE doesn't reach the project site, which makes the project naturally meet the minimum City requirement.

The project team is designing all buildings in the Volpe site to be elevated above the 1%-LTFE to achieve an even higher level of resiliency. In that way, all buildings will be protected such that flood waters cannot penetrate to occupied and critical areas. This elevation of the site is most visible along Broadway at the southwest of the site (Figure 23), where the sidewalk splits to feature a raised porch for retail and café spaces elevated above the 100-year (2070) flood level.

Figure 23. Elevated building finished floor and porch, section and rendering

The team is also considering design measures to withstand projected flooding, such as flood gate barriers at garage entrances to be deployed as needed in extreme weather events (Figure 24). These potential measures can be applied in strategic areas where increased flood protection is desirable beyond the 100-year storm event (Figure 25).

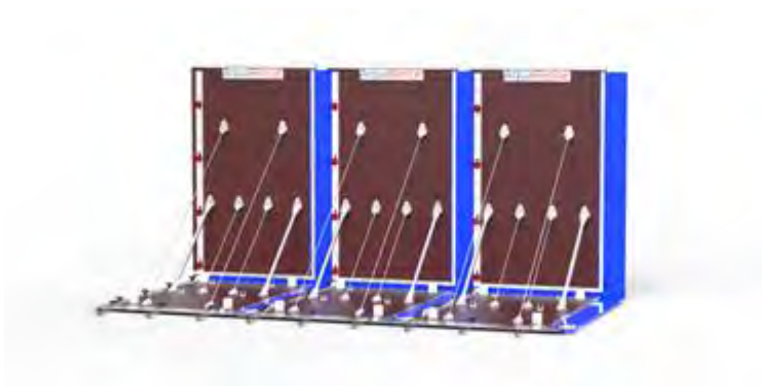


Figure 24. An example of potential active flood barriers (AquaFence)

The site's infiltration strategy, particularly below the large open space area with constructed detention storage tanks, reduces flooding potential and strain on local sewer systems. In addition to the grey infrastructure, green infrastructure such as green roofs, will be used where possible to manage stormwater on-site. The design team will evaluate surface flows through the open space to maximize the runoff capture potential for peak rain events seen recently with short, high volume rain events. The primary design goal is to capture stormwater and rainwater on-site and avoid shedding water on the neighboring streets.

Figure 25. Cambridge Flood Viewer - 2070-100 Year SLR/SS and Precipitation Flooding

HEAT RISK RESILIENCE

Residential buildings will be designed to adapt to the warming climate and potential disruptions in standard operations. Operable windows combined with improved insulation in building envelopes enhances occupant comfort in the event of power outages. By designing resilient envelopes to minimize impact of temperature swings on residences, these buildings will form the foundation of the community that proves to be occupiable and resilient. The passive resilience strategies will produce co-benefits with other environmental benefits, such as reducing energy demand and greenhouse gas emissions.

Shade trees (Figure 26) and canopies will mitigate heat gains on sidewalks and pedestrians while increased ground vegetation and light-colored surfaces reduce overall heat island effects, aligning with key strategies for climate resiliency to withstand and recovery from extreme events.

With combinations of these heat resiliency strategies, we expect the Volpe site will achieve the targets currently being developed by the Cambridge Climate Resilient Zoning Task Force (CRZTF).

Figure 26. Landscape plan with tree canopies

SITE + LANDSCAPE

PUBLIC SPACE + VEGETATION

> The Volpe site will revitalize publicly beneficial open space and create a landscape that provides habitat and pedestrian tree canopy cover, active outdoor recreation areas, incorporating stormwater management and reuse strategies.

The landscape vision increases the amount of publicly beneficial open space. The landscape plan utilizes native or adapted species to create a vibrant and engaging urban landscape and canopy, increasing plantings at establishment over the existing conditions, creating comfortable microclimates and shaded spaces to encourage outdoor activities throughout the seasons.

By coordinating site design over a masterplan scale, the team identified a more efficient use of outdoor space to create more functional experiences in the landscape. The siting of the open space allows the greatest access to daylight and activation of the largest designated open space area.

Beyond the programming in the open space, the streetscape in between buildings has been reimagined to include areas for stormwater management, infiltration, enhanced transportation connectivity, and pedestrian amenities (Figure 27).

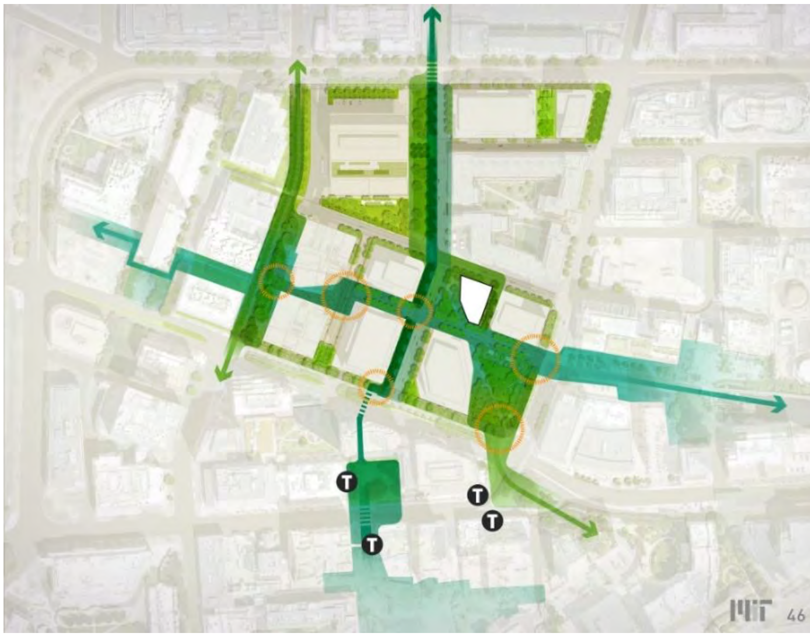


Figure 27. Connectivity and green space diagram

The design will incorporate native/tolerant high carbon sequestering vegetation which reduces water consumption for irrigation and promotes biodiversity. The landscape design includes a projected net increase of 82 trees, creating a more diverse and resilient tree canopy (Figure 28).

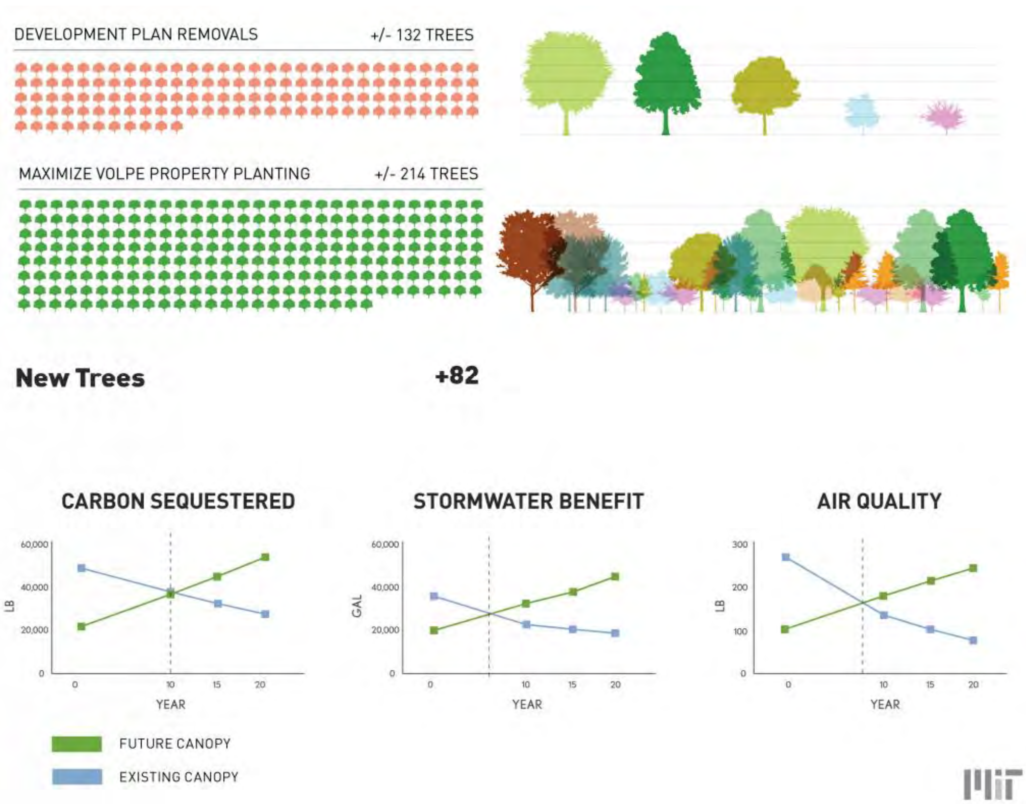


Figure 28. Tree removal breakdown and benefits of diverse planting

URBAN HEAT ISLAND MITIGATION

Roof and site strategies will mitigate urban heat island effects, improving pedestrian comfort and reducing heat impact on the district and surrounding areas.

Initial shadow and architectural studies of solar radiation help indicate where urban heat island mitigation strategies would be most beneficial. The study in Figure 29 shows the incident radiation falling on roof surfaces as compared to vertical building facades.

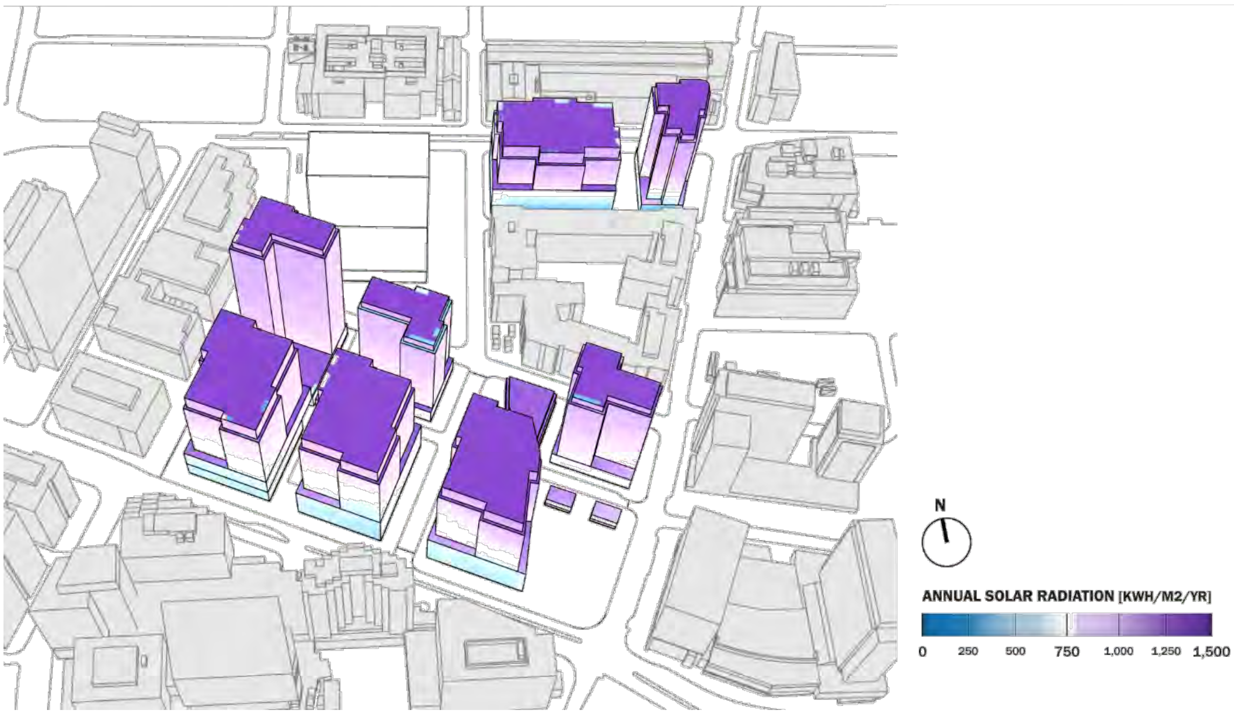


Figure 29. Study for Optimization of Heat Island Mitigation - Buildings

Urban heat island effects will be mitigated with a hybrid approach. All new buildings will employ high albedo, green roof, blue roof, or solar panels as applicable, in accordance with the PUD-7 zoning requirement.

Site hardscape materials will be chosen for high SR/SRI values. The project will incorporate outdoor spaces with vegetation such as canopy trees, pergolas, trellises, green walls, and other measures to reduce urban heat gain.

An additional ground plane assessment in Figure 30 shows the areas that benefit from the designed tree canopy to further reduce radiation impacts on the pedestrian realm. The analysis compares the site with and without trees. It indicates that tree canopies reduce 25% of the annual average incident solar radiation on the site. Remaining areas will be considered for highly reflective materials where possible to mitigate heat island effects.

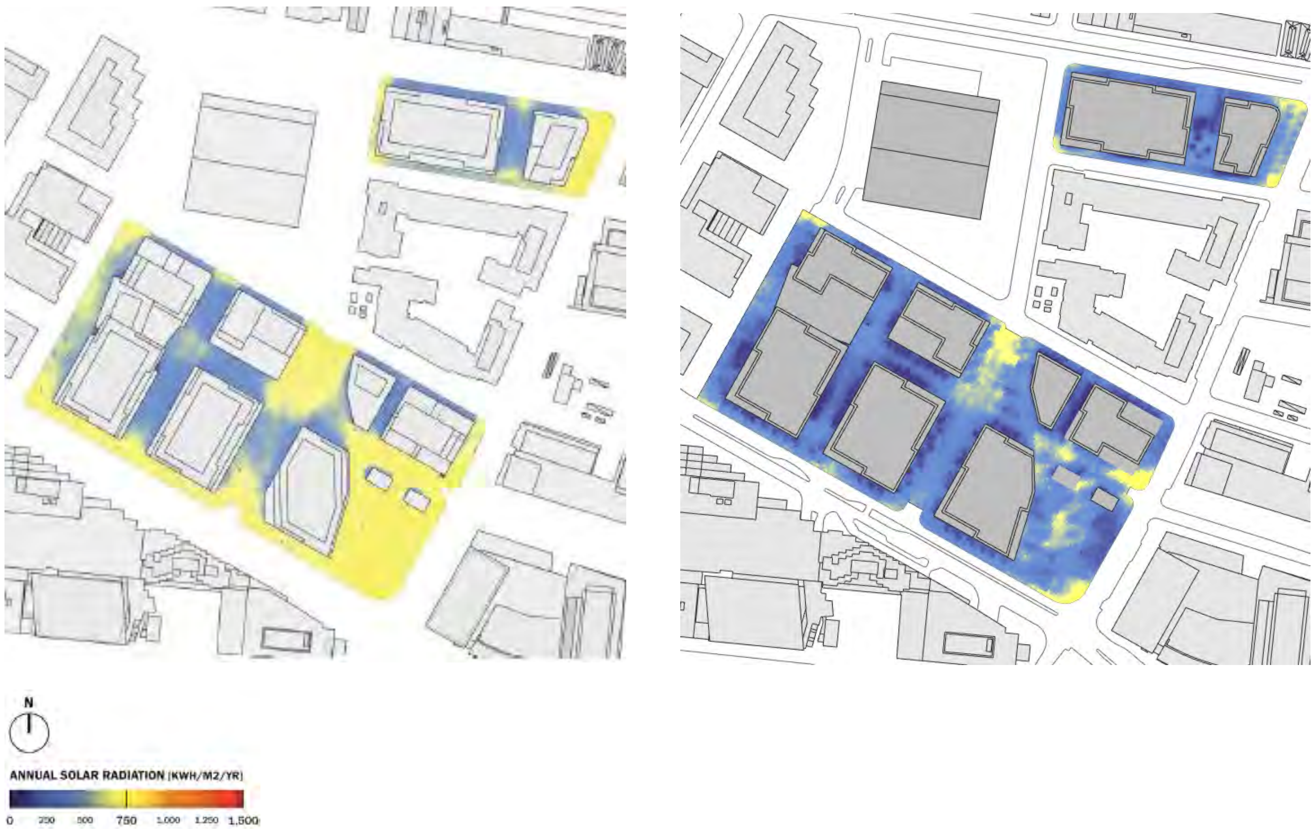


Figure 30. Study for Optimization of Heat Island Mitigation on Site – Without and With Tree Canopy Shade

TRANSIT

Located within a dense urban area, the Volpe Project reduces traffic impact on the community while accommodating alternative transportation strategies to reduce effective emissions associated with this new destination. MIT encourages alternative transportation by enhancing bicycle networks, supporting carpool/carshare, and improving pedestrian connectivity to public transit stations. The design team has conducted a Transportation Impact Study and evaluated shared parking through sharing of parking spaces by multiple uses and a Transportation Demand Management and Mitigation program.

Building parking areas will include electric charging stations and preferred parking for low-emitting vehicles and carpools to reduce the emissions from vehicles on the road.

INNOVATIVE TRANSIT

Easy access to buses and nearby connection to the MBTA will amplify the use of public transportation. Attractive pathways and amenities will further enhance the public transportation experience. The project will include real-time screens that provide transit information to users, such as when the next bus will arrive and where the nearest bike station is located, to enhance passenger experience.

The team continues to explore the future of mobility and servicing of the site. Considerations have been made for shuttles or last-mile scale of mobility that will be at the forefront of reducing reliance on personal vehicles. The team continues to explore ways the district can be designed to adapt and accommodate future technologies such as driverless cars, drone delivery, smart curb designs and more.

BICYCLE CONNECTIVITY

To reduce reliance on personal vehicles, MIT will support and extend the successful bicycle infrastructure and connectivity of the Cambridge and Boston metro areas through improved bicycle infrastructure. Bicycle parking is provided in designated areas in the garage dedicated to each building including the residences while street level bicycle facilities will provide highly visible and accessible parking for visitors. MIT will support bike share programs for the occupants to improve access to bicycles.

PARKING INFRASTRUCTURE

Meanwhile, preferred parking locations will be provided in the below grade garage(s) for low emitting/fuel-efficient vehicles and carpools. Building parking areas will include electric charging stations to reduce the emissions from vehicles on the road. MIT is committed to championing the transition to electric vehicles and will install approximately 50[3] electric vehicle charging stations, in continuation of significant allocation of EVSE charging stations at Kendall[4].

COMMUNITY + INNOVATION

> Mixed-use aspects of the Volpe Project further integrate social sustainability concepts to create a thriving community of researchers, workers, residents, and visitors.

The development includes community spaces, such as a community center, publicly beneficial open space, and programming for public recreation, social functions, and educational programs. The Volpe development supports recurring community scale innovation components, connected to the pioneering retail strategies acting as an anchor for the community.

SUSTAINABLE COMMUNITY CENTER

MIT is committed to building a Community Center at the core of the Volpe site with programming generated through an engaging community process. The sustainability of Volpe as a center of the Cambridge and Kendall community rests on the success of the Community Center and the activation of the street level throughout the district. The Community Center has a unique opportunity to employ environmental design principles in reflecting the diverse, innovative, and resilient community that is Kendall Square.

During the design and community process, opportunities for demonstration of sustainability principles will be explored, such as rooftop PV, active design features, visible passive design strategies, and more.

The Community Center commits to at least a LEED Gold Rating under the LEED v4.0 system. However, the Community Center hopes to achieve much more. As MIT moves forward with the community input on program for this space, the design teams will continue to test the definition of sustainability at the center of this development. Benchmarking of the Community Center will be inspired by elements of SITES, WELL, Fitwel, the Living Building Challenge's exclusion of materials from the Redlist, or similar adaptations. Feasibility of such programs will be evaluated through the building design process for the Community Center.

GREEN EDUCATION + TECHNOLOGIES

Educational and innovative technologies will be implemented in order to be at the forefront of environmental performance as advancements in strategies and technologies are developed, included as public educational programs for green initiatives to foster innovation. This may include renewable energy demonstrations, high-

---

[3] Current estimated EVSE count for LEED v4.0 for the district.
[4] 90 total EVSE chargers to be installed at MIT's Kendall SoMa site.

efficient heating and cooling system configurations, water management systems, and other sustainability initiatives.

Some technologies currently under consideration are smart street controls, blackwater treatment facilities, and all-electric building systems. Looking to the future, the development is preparing to adapt to advancements and innovations in transportation, renewable energy, and community engagement.

The site design will include signage identifying sustainability features in the landscape to promote environmental design and education. The Community Center program also offers a unique opportunity to employ living-lab strategies to build sustainability awareness and accessible education to the public.

HEALTHY BUILDINGS + WELLNESS

> Building and site design will integrate healthy building approaches to active design, healthy material selection, and promotion of wellness.

Providing healthy living and working environments is a further defining factor of high-performance buildings. The site area with well-balanced hardscape paving and softscape vegetation encourages activities such as outdoor classes. This increase in physical activities will be encouraged by well-designed pedestrian pathways and amenities. The project will prohibit smoking near building entrances, air intakes, and central site gathering areas.

Active movement through buildings and the open spaces through good design of stairways and circulation will increase appeal of physical activity for some occupants while still providing accessibility for all, to enhance live, work, learn and play opportunities.

Building teams will examine materials for their content to ensure products are specified that create healthy indoor environments. Materials will be low emitting, avoiding hazardous chemicals all too often found in building materials, and selected based on their reduced embodied emissions as they make their way to be installed on-site.

The team will consider opportunities to include components of alternative wellness benchmarking systems, such as WELL or Fitwel as they apply to core and shell projects. Likewise, the team will look for demonstration opportunities to exclude materials from ILFI's Living Building Challenge Red List and pursue healthy building product disclosure pathways in the LEED rating system.

Green Building Project Checklist

Green Building Project Location: Volpe PUD-7

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: PUD-7 Zoning: 3,250,000 sf (including 400,000sf for new GSA building)

☐ 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: C+S and New Construction

☐ Residential BD+C – Subcategory:

☐ Interior Design + Construction (ID+C) – Subcategory:

☐ Other:

☐ Passive House – Version:

☐ PHIUS+

☐ Passivhaus Institut (PHI)

☐ Other:

☐ Enterprise Green Communities – Version:

Project Phase

☒ **SPECIAL PERMIT**

Before applying for a building permit, submit this documentation to CDD for review and approval.

Required Submissions

All rating programs:

- ☒ Rating system checklist
- ☒ Rating system narrative
- ☒ Net zero narrative (see example template for guidance)
- ☑ Affidavit signed by Green Building Professional with attached credentials – use City form provided (Special Permit)

GREEN BUILDING PROJECT CHECKLIST • ARTICLE 22.000 • GREEN BUILDING REQUIREMENTS

Affidavit Form for Green Building Professional Special Permit

Green Building Project Location: Volpe Development, 55 Broadway, Cambridge, MA 02142

Green Building Professional

Name: David Manfredi FAIA, LEED AP

☒ Architect

☐ Engineer

Mass. License Number: 5553

Company: Elkus Manfredi Architects Ltd.

Address: 25 Drydock Ave. 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) November 4, 2020 *(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

November 4, 2020

City of Cambridge
795 Massachusetts Ave
Cambridge, MA 02139

Re: MIT Volpe Redevelopment PB368

Dear City of Cambridge,

As CEO and Founding Principal of Elkus Manfredi Architects, I am leading the planning and design of the Volpe development masterplan. 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 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 requirements under Article 22 of the Cambridge Zoning Ordinance.

Sincerely,

David Manfredi FAIA, LEEP 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

GBCI

November 4, 2020

Dear David Manfredi,

The Green Business Certification Institute's records indicate that you passed the LEED® Professional Exam™. Please see the details for your exam achievement, below:

Exam Track	Exam Date	Status
LEED AP Legacy	September 29, 2008	Active – No Expiration

In passing the LEED AP exam, you became recognized as a LEED AP by GBCI. For your reference, your GBCI # is 0010235886.

Thank you for your participation in the LEED® Professional Credentialing program. We wish you all the best in your work to create and sustain a thriving built environment.

Sincerely,

Green Business Certification Inc. (GBCI)

GREEN BUSINESS CERTIFICATION INC. 2101 L Street, NW Suite 500 Washington, DC 20037 T: 800.795.1746 F: 202.828.5110 gbci.org

GREEN BUILDING RATING SYSTEM NARRATIVE + SCORECARD

In working with the City of Cambridge to shape the PUD-7 Zoning Requirements, MIT established a minimum commitment to Leadership in Energy and Environmental Design (LEED) Gold buildings. The project is being designed to incorporate sustainability principles of energy efficiency, environmental consciousness, and health for the occupants, visitors, and community.

The Volpe Masterplan will consider registering an overall LEED Master Site for Volpe Transportation Center Site, that will take advantage of combined site, landscape, and transportation strategies. It will be confirmed pending the final development timeline. Then, each individual building will achieve the remaining credits required for a Gold rating under either the LEED v4 for Core and Shell system or LEED v4 for New Construction.

The site will be registered with the USGBC and target several credits which span the nine LEED version 4 categories (Integrative Process, Location & Transportation, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation in Design Process and the additional Regional Priority Credits) to enable the project to meet the zoning requirements. The project is committed to earn the buildings at least 60 credit points under the LEED v4 system, for LEED Gold ratings.

All LEED Minimum Program Requirements and Prerequisites will be met.

In addition to achieving the LEED project goals, measures will be taken to meet the guidelines outlined in the PUD-7 Zoning Requirements for Sustainability for the Development.

In addition, the site area will explore opportunities to align with credits in the Sustainable Sites Initiative program while the commercial buildings will explore components of WELL or Fitwel for Core + Shell projects. The Community Center design will consider its unique opportunity to test alternative benchmarking systems (Living Building Challenge, Passive House, LEED Platinum, WELL), as an exemplary demonstration of sustainability with opportunities for education on a community scale.

LEED CREDIT SUMMARY - MASTER SITE CREDITS

Master Site credits are likely applicable to all buildings that share central site amenities within the Volpe Masterplan Project boundary. Buildings will meet the credit requirements for these credits with shared amenities as well as local amenities to ensure minimum requirements are met for each building's designated occupants and visitors.

Location & Transportation

The Volpe Development site is 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 preferred parking for electric, hybrid and/or low- emitting vehicles.

Credit 3: High Priority Site

- Cleanup work will be required on site before construction to remediate the site area. A site environmental survey will be required to confirm soil classification.

Credit 6: Bicycle Facilities

- Short-term and long-term bicycle parking will be provided for occupants and visitors. In addition, showers will be located in each building to serve their 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

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

Credit 8: Green Vehicles

- MIT is targeting 5% of parking spaces for fuel-efficient vehicles and charging stations for 2% of all net new parking spaces. MIT will confirm the capacity and number of required spaces through the later design phases.

Sustainable Site
MIT is taking a comprehensive approach to site, landscape, habitat creation, stormwater management, and human use.

Credit 1: Site Assessment

- The civil and landscape teams will conduct 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

- MIT is investigating opportunities for restoring landscape. The design team is evaluating design options that specify native or adapted vegetation for trees and green roofs to meet credit requirements and limit turf grass. This credit is not currently anticipated.

Credit 3: Open Space

- Maintaining pedestrian oriented open space that is inviting and engaging is a top priority for the Volpe Project for the amount of open space that will be provided. Credit to be calculated based on LEED Master Site boundary for campus-based credits.

Credit 4: Rainwater Management

- The current design for stormwater management collects roof and site water to be directed into infiltration areas for phosphorous removal and ground water recharge. The intent will be to design the stormwater management systems such that the mechanical and/or green technologies meet the LEED v4 requirement as well as local watershed requirements.

Credit 5: Heat Island Reduction

- Roofs will be designed with high-albedo materials to reflect heat and mitigate urban heat island effects. The site design will include high SRI and permeable pavers, which would comply with the requirements for this credit. Trees and shading elements are being optimized to further reduce heat island effects on hard scape areas.

Credit 6: Light Pollution Reduction

- All exterior luminaires will be carefully selected and designed to improve nighttime visibility, and to avoid light pollution.

Water Efficiency
Water Efficiency credits are mostly pursued on a building-by-building approach. However, the Master Site area may have a single approach to outdoor water use for the shared open space.

Prerequisite 1 and Credit 1: Outdoor Water Use Reduction

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

Materials and Resources

Prerequisite 2: Construction and Demolition Waste Management Planning

- 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.

Indoor Environmental Quality

Prerequisite 2: Environmental Tobacco Smoke (ETS) Control

- The credit is achievable under Master Site when smoking is prohibited site-wide within 25 ft of major entrances or air intakes.

LEED CREDIT SUMMARY - BUILDING DESIGN AND CONSTRUCTION CREDITS

The following LEED projections are made beyond the Master Site credits to achieve a LEED Gold rating for each building on the Volpe site. Depending on the program of the building, the project team will pursue either Core and Shell or New Construction certification.

The credits listed below are feasible based on understanding of the sustainability ambitions at the masterplan level:

Integrative Process

Credit 1: Integrative Process

- The design team will complete a preliminary energy model and water budget, and both will be documented in the buildings' OPR & BOD.

Location & Transportation

Credit 2: Sensitive Land Protection

- The development parcels are located on a previously developed urban site in Cambridge.

Credit 4: Surrounding Density and Diverse Uses

- The Volpe site is in an urban area in the city of Cambridge. The surrounding community is replete with housing, restaurants, shops, grocery stores, educational and religious institutions, performance venues and other community amenities. In addition, the project itself will add residential, office, lab, retail and services to the community.

Credit 5: Access to Quality Transit

- The Volpe site is easily accessible from the Kendall Square MBTA Station located right across Broadway. Also, local bus routes connect the location to other areas of the community and Boston.

Sustainable Sites

Prerequisite 1: Construction Activity Pollution Prevention

- The contractors shall follow best practice construction methods and submit and implement an Erosion and Sedimentation Control (ESC) Plan for construction activities related to the construction of the new building specific to this project. The ESC Plan shall conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit and specific municipal requirements for the City of Cambridge.

Credit 7: Tenant Design and Construction Guidelines (For Core and Shell)

- Design requirements for tenant fit-outs will be utilized for Core and Shell areas to commit future tenants to the principles pursued by the project as a whole for sustainability.

Water Efficiency

Prerequisite 2 and Credit 2: Indoor Water Use Reduction

- The project will install efficient flow and flush fixtures as well as compliant equipment to reduce building potable water consumption. The district blackwater reuse system will contribute to reduction in potable water use for flow and flush fixtures.

Prerequisite 3 and Credit 4: Water Metering

- The project will install water meters to measure and evaluate water consumption for each building. Beyond the whole building and site water metering, the project will study installing permanent water meters for two or more water subsystems and determine WE Credit 4 achievability.

Credit 3: Cooling Tower Water Use

- The design team will conduct 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. The district blackwater reuse system will contribute to reduction in potable water use for cooling towers.

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

- Buildings will engage a commissioning agent and develop and perform fundamental commissioning.
- Enhanced monitor-based commissioning to be pursued and consider opportunities for envelope commissioning.

Prerequisite 2 and Credit 2: Energy Performance

- Each building will establish energy performance target and be designed based on the upcoming stretch code which is already more stringent than the LEED baseline. Additional credit points will be achievable through tenant guidelines that outline lighting and equipment efficiencies.

Prerequisite 3 and Credit 3: Energy Metering

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

Credit 5: Renewable Energy Production

- Rooftop solar panels will generate electricity to be used by each building. The credit point will be eligible by percentages of the equivalent cost of usable energy produced by renewable energy to the total building energy cost. Credit is not anticipated but feasibility being studied.

Credit 6: Enhanced Refrigerant Management

- 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.

Materials and Resources
Healthy building objectives encourage each 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

- Each building will have designated areas for the collection and storage of recyclable materials, including mixed paper, corrugated cardboard, glass, plastics, and metals.

Credit 1: Building Life-Cycle Impact Reduction

- The building design teams will consider conducting life-cycle assessments of the project building's structure and enclosure to optimize the environmental performance of products and materials.

Credit 2: Building Product Disclosure & Optimization: Environmental Product Declarations

- The credit requires use of at least 20 different products (10 for core and shell) with environmental product declarations.

Credit 3: Building Product Disclosure & Optimization: Sourcing of Raw Materials

- This credit encourages to select products verified to have been extracted or sourced in a responsible manner.

Credit 4: Building Product Disclosure & Optimization: Material Ingredients

- The credit requires using at least 20 different products (10 for core and shell) that demonstrate the chemical inventory of the product, such as Health Product Declaration (HPD), Cradle to Cradle, and Declare.

Credit 5: Construction & Demolition Waste Management

- The construction team will reduce waste disposed of in landfills by recovering, reusing, and recycling materials, targeting 75% diversion from landfill with 4 material streams.

Indoor Environmental Quality
Prerequisite 1 and Credit 1: Indoor Air Quality Strategies

- Each building will be designed following ASHRAE 62 requirement to supply enough ventilation air. In addition, indoor air should be maintained in high quality with proper filtration and monitoring strategies.

Credit 2: Low-Emitting Materials

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

Credit 3: Construction IAQ Management Plan

- 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.

NEXT STEPS

The above LEED credits will be reviewed during the individual building design process along with other LEED credits not currently listed as being pursued. Each building will achieve 60 points at a minimum, but a range of 65-75 points is likely depending on the building type.

Through the individual building design process, each team will explore feasibility of incorporating updated LEED v4.1 requirements where they may streamline credit documentation and/or allow for an optimized approach to site strategies, rainwater management, building materials, and/or indoor environmental quality.

LEED SCORECARD – CORE AND SHELL (COMMERCIAL)

LEED v4 for BD+C: Core & Shell — **Volpe COMMERCIAL BUILDING**

last updated: 10/13/2020

Achievability			
high	med	low	NP
68	16	17	9
73	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.

(highlighted) *Credits can be pursued through Master Site*

high	med	low	NP			
1	0	0	0		**Integrative Process**	Standard
1				IP Credit 1	**Integrative Process**	Perform preliminary energy model and water budget before the completion of SD and document in OPR & BOD.
19	0	1	0		**Location & Transportation**	Standard
			20	LT Credit 1	**LEED for Neighborhood Development Location**	Locate the project in within a development certified under LEED for Neighborhood Development.
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).
2		1		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).
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.
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.
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.
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).
1				LT Credit 8	**Electric Vehicles (v4.1)**	Provide preferred parking for 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.
8	1	1	1		**Sustainable Sites**	Standard
Y				SS Prereq 1	**Construction Activity Pollution Prevention**	Create and implement erosion control plan that meets the 2003 EPA Construction General Permit.
1				SS Credit 1	**Site Assessment**	Complete comprehensive site survey; topography, hydrology, climate, vegetation, soils, human use and human health effects.
1			1	SS Credit 2	**Site Development:** Protect or Restore Habitat	Protect 40% of greenfield area, restore soils, and restore 30% of previously developed site with native/adapted plants (2pts) - OR - provide $0.40/sf to accredited land trust (1pt).
	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.
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).
2				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).
1				SS Credit 6	**Light Pollution Reduction**	Meet uplight and light trespass requirements, and do not exceed exterior signage luminance requirements.
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.
8	1	2	0		**Water Efficiency**	Standard
Y				WE Prereq 1	**Outdoor Water Use Reduction:** 30%	Reduce outdoor water use by 30% over the baseline specified in LEED.
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.
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.
2				WE Credit 1	**Outdoor Water Use Reduction:** 50% Reduction / No Potable Water Use	Reduce potable water used for irrigation by 50% (1pt) - AND - use no potable water for irrigation (1pt).
3	1	2		WE Credit 2	**Indoor Water Use Reduction:** 25% / 30% / 35% AND / OR 40% / 45% / 50%	Reduce building water use over LEED baseline.
2				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).
1				WE Credit 4	**Water Metering**	Install permanent water meters for two or more water subsystems.
15	6	7	5		**Energy & Atmosphere**	Standard
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.
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.
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.
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.
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)
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.
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.
1	2			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.
	2	1		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.
		3		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.
			3	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.
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.
		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).
		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.
1				EA Credit 6	**Enhanced Refrigerant Management**	Select refrigerants with low global warming potential and ozone depletion potential.
	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.

4	3	4	3		**Materials & Resources**	**Standard**
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.
Y				MR Prereq 2	**Construction and Demolition Waste Management Planning**	Develop and implement a construction and demolition waste management plan.
	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.)
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.
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).
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
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)
6	4	2	0		**Indoor Environmental Quality**	**Standard**
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.
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.
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).
1	2			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.
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.
	1	2		EQ Credit 4	**Daylight (v4.1):** 55% / 75% / 90%	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).
	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.
5	1	0	0		**Innovation**	**Standard**
1				IN Credit 1.1	**Innovation in Design**, Green Building Education	Provide comprehensive Green Education program and signage.
1				IN Credit 1.2	**Innovation in Design**, O+M Starter Kit	Green Cleaning Policy + Integrated Pest Management
	1			IN Credit 1.3	**Innovation in Design** Alternate ID Point (O+M Starter Kit 2?)	Site Management -OR- Ongoing Purchasing and Waste -OR- Facility Maintenance and Renovations Policy
1				IN Credit 1.4	**Innovation in Design**, Purchasing - lamps	Implement the lighting purchasing plan to limit mercury content.
1				IN Credit 1.5	**Innovation in Design**, Pilot Credit, Assessment and Planning for Resilience	Complete a Hazard Assessment prerequisite plus at least one of two options: 1) Climate Related Risk Management Planning or 2) Emergency Preparedness Planning.
1				IN Credit 2	**LEED™ Accredited Professional**	LEED Accredited Professional on design team.
4	0	0	0		**Regional Priority**	**Standard**
1				RP Credit 1.1	**Regional Priority**, High priority site	Point threshold: 2 – Locate the project on site with priority designation
1				RP Credit 1.2	**Regional Priority**, Indoor water use reduction	Point threshold: 4 – Achieve more than 40% of indoor water use reduction
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
1				RP Credit 1.4	**Regional Priority**, Optimize energy performance	Point threshold: 8 – Achieve more than 17% of annual energy cost saving

LEED SCORECARD – NEW CONSTRUCTION (RESIDENTIAL)

LEED v4 for BD+C: New Construction — **Volpe RESIDENTIAL BUILDING**

last updated: 10/26/2020

Achievability			
high	med	low	NP
59	20	19	12
67 Projected Pts			

Credits can be pursued through Master Site

high	med	low	NP	Credit	Name	Description
[illegible]	[illegible]	[illegible]	[illegible]		**Integrative Process**	Standard
[illegible]				IP Credit 1	Integrative Process	Perform preliminary energy model and water budget before the completion of SD and document in OPR & BOD.
[illegible]	[illegible]	[illegible]	[illegible]		**Location & Transportation**	Standard
			16	LT Credit 1	2	Locate the project in within a development certified under LEED for Neighborhood Development.
1				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).
1		1		LT Credit 3	High Priority Site	Locate the project on an infill site in historic district (1pt) - OR - site with priority designation (1pt) - OR - brownfield site where contaminated soil/groundwater remediation is required (2pts).
5				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.
5				LT Credit 5	Access to Quality Transit (v4.1)	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.
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. Residential: long term storage for at least 15% of all regular building occupants but no less than 1 space per 3 residential units.
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).
1				LT Credit 8	Electric Vehicles (v4.1)	Provide preferred parking for 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.
[illegible]	[illegible]	[illegible]	[illegible]		**Sustainable Sites**	Standard
Y				SS Prereq 1	Construction Activity Pollution Prevention	Create and implement erosion control plan that meets the 2012 EPA Construction General Permit.
1				SS Credit 1	Site Assessment	Complete comprehensive site survey: topography, hydrology, climate, vegetation, soils, human use and human health effects.
[illegible]			1	SS Credit 2	Site Development: Protect or Restore Habitat	Protect 40% of greenfield area, restore soils, and restore 30% of previously developed site with native/adapted plants (2pts) - OR - provide $0.40/sf to accredited land trust (1pt).
	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.
[illegible]		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).
[illegible]				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).
1				SS Credit 6	Light Pollution Reduction	Meet uplight and light trespass requirements, and do not exceed exterior signage luminance requirements.
[illegible]	[illegible]	[illegible]	[illegible]		**Water Efficiency**	Standard
Y				WE Prereq 1	Outdoor Water Use Reduction: 30%	Reduce outdoor water use by 30% over the baseline specified in LEED.
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.
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.
1	1			WE Credit 1	Outdoor Water Use Reduction: 50% Reduction / No Potable Water Use	Reduce potable water used for irrigation by 50% (1pt) - AND - use no potable water for irrigation (1pt).
3	2	1		WE Credit 2	Indoor Water Use Reduction: 25% / 30% / 35% / 40% / 45% / 50%	Reduce building water use over LEED baseline.
			2	WE Credit 3	Cooling Tower and Process Water Use (v4.1)	Conduct a water analysis to optimize cooling tower cycles. Option 1: Cooling Tower Water Use: Maximizing cycles (1pt) OR maximize cycles and increase the number of cycles by a min. of 25% (2pts) OR meet maximum calculated cycles and use a min. of 20% recycled non-potable water use (2pts) OR Option 2: No cooling tower (2pts) OR Option 3: Process Water Use - Use min. 20% recycled water to meet process water demand (1 pt.) or 30% recycled water. (2pts).
1				WE Credit 4	Water Metering	Install permanent water meters for two or more water subsystems.
[illegible]	[illegible]	[illegible]	[illegible]		**Energy & Atmosphere**	Standard
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.
Y				EA Prereq 2	Minimum Energy Performance	Reduce energy cost by 5%, 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.
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.
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.
4	2			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)
6				EA Credit 2	Optimize Energy Performance	Reduce building energy cost by 6% / 8% / 10% compared to ASHRAE 90.1-2010, Appendix G.
3	2	1		EA Credit 2	Optimize Energy Performance	Reduce building energy cost by 18%/ 20%/ 22% compared to ASHRAE 90.1-2010, Appendix G.
		3	3	EA Credit 2	Optimize Energy Performance	Reduce building energy cost by 32%/ 35%/ 38% compared to ASHRAE 90.1-2010, Appendix G.
	1			EA Credit 3	Advanced Energy Metering	Install energy metering for whole building energy and individual energy end uses representing 10% of more of total consumption.
		2		EA Credit 4	Grid Harmonization (v4.1)	Design building and equipment for participation in demand response programs through load shedding or shifting for any project, even if program is available (2pts) - OR - if DR program not available, provide infrastructure for future (1pt) OR implement one or more of the Load Flexibility and Management Strategies (1-2 pts)
		1	2	EA Credit 5	Renewable Energy Production: 1% / 5% / 10%	Produce renewable energy on-site for 1% / 5% / 10% of building energy consumption, calculated by cost.
1				EA Credit 6	Enhanced Refrigerant Management	Select refrigerants with low global warming potential and ozone depletion potential.
		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.

[illegible]	[illegible]	[illegible]	[illegible]		**Materials & Resources**	**Standard**
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.
Y				[illegible]	**Construction and Demolition Waste Management Planning**	Develop and implement a construction and demolition waste management plan.
	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 enclosur demonstrating a 10% reduction, Path 4 (4pts) (demonstrate a 20% reduction for GWP and 10% reduction in two other impact categories.)
1		1		MR Credit 2	**Building Product Disclosure & Optimization (v4.1):** Environmental Product Declarations	Use 20 products sourced from five 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 Embodied Carbon or any of the 6 impact categories.
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).
1		1		MR Credit4	**Building Product Disclosure & Optimization (v4.1):** Material Ingredients	Use 20 products sourced from five 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
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)
[illegible]	[illegible]	[illegible]	[illegible]		**Indoor Environmental Quality**	**Standard**
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.
Y				[illegible]	**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.
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).
1	2			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.
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.
	1	1		EQ Credit 4	**Indoor Air Quality Assessment**	Perform pre-occupancy building flush out (1pt) or air quality testing (2pts).
1				EQ Credit 5	**Thermal Comfort**	Meet ASHRAE 55-2010, Thermal Comfort Conditions for Human Occupancy, provide individual thermal comfort controls for at least 50% of individual occupant spaces, and provide group controls for all shared multi-occupant spaces.
1			1	EQ Credit 6	**Interior Lighting**	Provide lighting controls for 90% of individuals and 100% of shared multi-occupant spaces (1pt) - AND/OR - meet four of LEED's lighting quality requirements (1pt).
	1	1		EQ Credit 7	**Daylight (v4.1):** 55% / 75% / 90%	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).
	1			EQ Credit 8	**Quality Views**	Provide direct views to the outside that meet 2 out of 4 LEED view criteria in 75% of regularly occupied spaces.
		1		EQ Credit 9	**Acoustic Performance (v4.1)**	Meet two of the following requirements for HVAC background noise, sound transmission and/or reverberation time for all occupied spaces. Meet all three for exemplary performance.
[illegible]	[illegible]	[illegible]	[illegible]		**Innovation**	**Standard**
1				[illegible]	**Innovation in Design,** Green Building Education	Provide comprehensive Green Education program and signage.
1				[illegible]	**Innovation in Design,** O+M Starter Kit	Green Cleaning Policy + Integrated Pest Management
	1			[illegible]	**Innovation in Design,** TBD	Site Management -OR- Ongoing Purchasing and Waste -OR- Facility Maintenance and Renovations Policy
1				IN Credit 1.4	**Innovation in Design,** Purchasing - lamps	Implement the lighting purchasing plan to limit mercury content.
	1			IN Credit 1.5	**Innovation in Design, Pilot Credit,** Assessment and Planning for Resilience	Complete a Hazard Assessment prerequisite plus at least one of two options: 1) Climate Related Risk Management Planning or 2) Emergency Preparedness Planning.
1				IN Credit 2	**LEED™ Accredited Professional**	LEED Accredited Professional on design team.
[illegible]	[illegible]	[illegible]	[illegible]		**Regional Priority**	**Standard**
1				[illegible]	**Regional Priority,** High priority site	Point threshold: 2 – Locate the project on site with priority designation
1				RP Credit 1.2	**Regional Priority,** Indoor water use reduction	Point threshold: 4 – Achieve more than 40% of indoor water use reduction
	1			[illegible]	**Regional Priority,** Rainwater Management	Point threshold: 2
1				RP Credit 1.4	**Regional Priority,** Optimize energy performance	Point threshold: 8 – Achieve more than 17% of annual energy cost saving

NET ZERO NARRATIVE

PROJECT PROFILE

The information included in this Special Permit Net Zero narrative submission is based on masterplan level analysis of the Volpe development project. Likewise, information included in the Project Summary Table below in this draft submitted to the City sustainability group will be aligned with Volpe's Special Permit submission. Performance values and systems included in this documentation are subject to change through the individual design process; however, energy reduction targets against Stretch Code will be maintained. Updated Net Zero narrative tables will be included in each building's Design Review submission, more closely representing the projected building performance.

Project Summary Table

Lot Area (sq.ft.) of Development Parcel:	451,671 sq.ft. (approx. 10.369 acres)
Existing Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Government facility, other (n/a.)
Proposed Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Mixed-use ▪ Office/R+D: approx. 1,756,000 sq.ft. ▪ Residential: approx. 1,128,000 sq.ft. ▪ Retail/Active Uses: approx. 100,000 sf ▪ Community Center: approx. 20,000 sf
Proposed Building Height(s) (ft. and stories): Approximate heights	North of Potter : R4 : Maximum 250 feet C4 : Maximum 170 feet South of Potter : Residential (R1,R2,R3) : Maximum 500 feet Commercial (C1,C2,C3) : Maximum 250 feet
Proposed Dwelling Units:	Approx. 1,400
Proposed Open Space (acres):	Over 2.5 acres
Proposed Parking Spaces:	Approx. 1,876 spaces
Proposed Bicycle Parking Spaces (Long-Term and Short-Term):	Long term: approx. 1,765 spaces Short term: approx. 302 spaces

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 BD+C NC v4, LEED Core and Shell v4	Seeking Certification?*	Yes
Rating Level:	Gold	# of Points:	Likely 65-70

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

PROPOSED PROJECT DESIGN CHARACTERISTICS

Building Envelope

The following assumptions have been used in the Master Planning phase to determine energy drivers, opportunities for district energy, and efficiency opportunities on the building scale.

Assembly Descriptions:

Commercial:

Roof:	Code Baseline: Insulation entirely above roof deck with minimum R-30 c.i. Details TBD w/ Bldg Design
Foundation:	Code Baseline: Slab-on-grade floor with minimum insulation of R-10 for 24" below. Details TBD w/ Bldg Design
Exterior Walls:	Triple-pane spandrel panel, Aluminum framing with thermal break, Minimum insulation of R-15 between framing members. Exterior walls could include masonry. Details TBD w/ Bldg Design
Windows:	Triple-pane glazing unit, Aluminum framing with thermal break SHGC 0.38 or lower for South, East and West facade Details TBD w/ Bldg Design
Window-to-Wall Ratio:	Targeting 40-70%
Other Components:	-

Residential:

Roof:	Code Baseline: Insulation entirely above roof deck with minimum R-30 c.i. Details TBD w/ Bldg Design
Foundation:	Code Baseline: Slab-on-grade floor with minimum insulation of R-10 for 24" below. Details TBD w/ Bldg Design
Exterior Walls:	Code Baseline: Metal framed wall with minimum insulation of R-13 + R-7.5 c.i. Exterior walls could include masonry. Details TBD w/ Bldg Design
Windows:	High-performance double-pane glazing unit, Aluminum framing with thermal break SHGC 0.38 or lower for South, East and West facade Details TBD w/ Bldg Design
Window-to-Wall Ratio:	Targeting 40%-60%
Other Components:	-

Envelope Performance:

All values below are estimates. Building envelope performance to be confirmed in design review.

Commercial:

	Proposed		Baseline	
	Area (sf)	U-value	Area (sf)	U-value
Window	TBD w/ Bldg Design	0.20~0.25	TBD w/ Bldg Design	0.38
Wall (Spandrel)	TBD w/ Bldg Design	0.10~0.15	TBD w/ Bldg Design	0.064
Roof	TBD w/ Bldg Design	0.032	TBD w/ Bldg Design	0.032

Residential:

	Proposed		Baseline	
	Area (sf)	U-value	Area (sf)	U-value
Window	TBD w/ Bldg Design	0.25~0.35	TBD w/ Bldg Design	0.38
Wall (Metal-framed)	TBD w/ Bldg Design	0.04~0.06	TBD w/ Bldg Design	0.064
Roof	TBD w/ Bldg Design	0.032	TBD w/ Bldg Design	0.032

Envelope Commissioning Process:

MIT will pursue envelope commissioning in line with LEED v4 Enhanced Commissioning Requirements, including Envelope Commissioning.

Building Mechanical Systems

The following assumptions have been used in the Master Planning phase to determine energy drivers, opportunities for district energy, and efficiency opportunities on the building scale.

Commercial Systems Descriptions:

Space Heating:	Space heating will be initially supplied by natural gas condensing boilers. The system will be designed to maximize heat exchange and recovery to reduce the heating load. For transition to all-electric, the gas-fired boilers could be replaced with electric boilers or air-source heat pumps (ASHPs).
Space Cooling:	High efficient electric centrifugal chillers will supply chilled water to AHUs that serve space cooling. The chiller plant could be replaced with heat pump chillers for electrification.
Heat Rejection:	Rooftop cooling towers will supply condenser water to the chiller plant.
Pumps & Auxiliary:	All pumps will be variable speed pumps.
Ventilation:	The system will include dedicated outdoor air systems (DOAS) with energy recovery. For labs, high-performance runaround heat recovery coils will be studied to recover heat from the exhaust air stream and preheat incoming outside air.
Domestic Hot Water:	Gas-fired boilers will serve domestic hot water. Conversion to electric will be explored for each building in the design phase.
Interior Lighting:	In general, all lighting fixtures will be LED with advanced lighting control systems.
Exterior Lighting:	In general, all lighting fixtures will be LED. Exterior lighting will be scheduled and controlled to minimize light pollution, while not compromising safety.
Other Equipment:	-

Residential Systems Descriptions:

Space Heating:	The residential buildings will have all-electric heating and cooling systems that consist of water-cooled heat pumps. Electric boilers or ASHPs will provide supplemental heating to maintain the condenser water loop temperature.
Space Cooling:	Water-cooled heat pumps will connect to a building condenser water loop and serve indoor units serving space cooling.
Heat Rejection:	Rooftop cooling towers will maintain the building condenser water loop.
Pumps & Auxiliary:	All pumps will be variable speed pumps.

Ventilation:	The system will include dedicated outdoor air systems (DOAS) with energy recovery.
Domestic Hot Water:	Water-to-water heat pumps connected to the building condenser water loop will serve the domestic hot water loads.
Interior Lighting:	In general, all lighting fixtures will be LED with advanced lighting control systems in base building areas.
Exterior Lighting:	In general, all lighting fixtures will be LED. Exterior lighting will be scheduled and controlled to minimize light pollution, while not compromising safety.
Other Equipment:	-

Systems Commissioning Process:

MIT will conduct commissioning in line with LEED v4 Enhanced Commissioning Requirements.

ANTICIPATED ENERGY LOADS AND GREENHOUSE GAS EMISSIONS

Assumptions

Energy modeling through the masterplanning process has included modeling loads of commercial and residential buildings to compare heating and cooling loads and identify opportunities for load sharing. Studies were also conducted to understand building performance drivers and sensitivities of energy conservation measures. Models reflected baseline code compliance versus a high or exemplary performance design. These models were used mainly to size potential district energy strategies for comparison study. Likewise, the energy profile of the development was helpful to contextualize operational energy and emissions versus possible embodied energy or renewable energy potential. Overall GHG emissions were calculated and provided; however, since buildings have not entered the design phases yet, specific energy end-use breakdowns are not included in this submission. Ventilation and potential for energy recovery along with equipment loads will drive the performance of commercial buildings for office or lab spaces while internal loads and domestic hot water loads drive residential energy performance.

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.

This Special Permit submission is for the Master Plan of the Volpe development. As each building design progresses and returns for Design Review, the following energy end-use breakdown will be provided accordingly.

Emissions and total energy use are estimated based on a preliminary split of lab and office program. Individual building designs will model performance and emissions based on current anticipated program ratios at the time of design. The below values are subject to change through the design process.

The below table for reference estimates performance of a single commercial building for energy use reduction from the Stretch Code baseline and GHG emissions.

Commercial:

	Baseline Building		Proposed Design		Future Scenario	
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Total Energy Cost						
Total Energy Use		-		16%		40%
Site EUI						
Source EUI						
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline	Tons CO2 [/SF]	% Reduction from Baseline
GHG Emissions	6,680	-	5,670	15%	4,450	35%
GHG Emissions per SF	0.009	-	0.008	15%	0.006	35%

The below table estimates performance of a single representative residential building for energy use reduction from the Stretch Code baseline and GHG emissions.

Residential:

	Baseline Building		Proposed Design		Future Scenario	
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Total Energy Cost						
Total Energy Use		-		20%		36%
Site EUI						
Source EUI						
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline	Tons CO2 [/SF]	% Reduction from Baseline
GHG Emissions	1,630	-	1,370	16%	1,090	33%
GHG Emissions per SF	0.0023	-	0.0019	16%	0.0015	33%

Charts provided for projected energy performance in the narrative/Green Building Report.

BUILDING ENERGY PERFORMANCE MEASURES

Overview

Land Uses:	Commercial and residential district. Mixed-use development promoting walking and bicycling, efficient arrangement of uses within a site.
Building Orientation and Massing:	See narrative. 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:	Envelopes have not yet been designed, but systems will be designed to incorporate external shading, insulated areas, and natural ventilation where feasible while optimizing for energy performance, daylight, views, visual comfort, and thermal comfort for occupants near perimeter areas.
Mechanical Systems:	See energy efficiency narrative. Focus in masterplanning stage has been understanding loads of commercial and residential building programs to identify opportunities for load-sharing, and ultimately, concept design of systems that shift both residential and commercial buildings towards electrification.
Renewable Energy Systems:	The team has conducted masterplan-level renewable energy studies, identifying the greatest potential for on-site energy generation and/or heating/cooling strategies with geothermal systems. The most viable on-site energy generation strategy is rooftop mounted PV. GSHPs will continue to be evaluated. See narrative.
District-Wide Energy Systems:	See narrative. District strategies will continue to be explored through design phases.
Other Systems:	Electric vehicle charging stations will be provided for at least 2% of parking spaces to meet the LEED v4 requirement.

Integrative Design Process

Sustainability has been an integral part of the masterplanning process. MIT specifically selected team members accustomed to working across disciplines to brainstorm strategies and collaborate on analysis to ensure the environmental performance goals of the project would be met. Atelier Ten, Elkus Manfredi, VHB, Reed Hilderbrand and Buro Happold engaged in robust conversations on sustainability, challenging concepts of what makes a development sustainable now and in the future. Design elements and concepts were continually evaluated through the lens of sustainability. Beyond the biweekly team discussions incorporating sustainability concepts, the design process included numerous workshops centered on sustainability.

- Sustainability Visioning Session – June 26, 2019
- Sustainability Work Session – June 26, 2019
- Sustainability Brainstorm Scatterplot Workshop – August 7, 2019
- Initial MEP Collaboration Meeting – October 1, 2019
- Sustainability Packages Presentation – October 10, 2019
- Water Reuse Strategy Meeting – February 4, 2020
- Site + Civil Workshops – March 4, 2020, March 18, 2020, March 25, 2020
- Sustainability Update Presentation – April 15, 2020
- Site + Transportation Innovation working group – biweekly April through June 2020
- Sustainability Big Ideas Evaluation Process/Meetings – April through July 2020
- Emissions + Energy Supply Meetings – July 2020
- Regroup on Sustainability Concepts and Confirm Goals + Ambitions – August through September 2020

MIT will continue to employ an integrative team process through each building design to maintain focus on sustainability and building performance.

Solar-Ready Roof Assessment

Total Roof Area (sq. ft.):	Approx. 246,000 sq. ft.
Unshaded Roof Area (sq. ft.):	The highest elevation of building roofs will have the greatest solar exposure for potential PV systems, estimated at ~167,000 sq. ft.
Structural Support:	Structural systems will be designed at the building level. Current discussions include identifying future rooftop needs (additional mechanical equipment for electrified futures, etc) so that structural systems can be designed to accommodate these loads in the coming building design process.
Electrical Infrastructure:	Capacity of electrical panel to accommodate potential solar array capacity, pathway from solar-ready roof area to electrical panel, and location reserved for future inverters and other electrical equipment to be considered by individual building design process.
Other Roof Appurtenances:	Preliminary estimates include approx. 50-75% of rooftop area reserved for mechanical equipment or headhouses. In designing for all-electric buildings or transition to all-electric buildings in the future, rooftop space would be reserved for future installation of air source heat pumps or other necessary technologies that may limit installation of PV or solar hot water panels. Likewise, there is benefit to installing green roof systems to help manage stormwater runoff and occupied terrace spaces for occupant and community benefit.
Solar-Ready Roof Area (sq. ft.):	Based on preliminary assumptions, the team estimates approx. 40,000 sq. ft. of conceptual design area could be considered for PVs across the development (excluding mechanical areas from the roof area total).
Capacity of Solar Array:	If the entire non-mechanical rooftop was utilized for PV, the district installed capacity would be approx. 680 kW (1% of development consumption).
Financial Incentives:	Given the timeline of development, MIT will investigate financial opportunities available at the time of each building coming online to support PV installations.
Cost Feasibility:	MIT has conducted preliminary pricing exercises to determine feasibility of solar renewables. Team will continue to evaluate solar renewables market as building designs progress.

Further study will be conducted to assess optimization of roof area for competing sustainability strategies with demands for roof space – either PV for energy generation OR green roofs for stormwater management and reduction in urban heat island effects.

Green Building Incentive Program Assistance

The project team will continue to consider financial support opportunities available through Mass Save. Applicable programs for the masterplan include Residential High-Rise New Construction and Commercial New Construction and Major Renovations. 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).

Residential Buildings are eligible for incentives and rebates for energy efficiency measures installed in-unit as well as common areas. Incentives are awarded based on annual site energy savings in comparison to a program-provided energy model baseline. Many of the energy efficiency measures that were evaluated aggregately at a masterplan level for the residential buildings would be eligible for funding including lighting, HVAC, domestic hot water, building enclosure, and infiltration testing. Strategies and incentive funding will continue to be explored in the building design phases.

The Office and Lab Buildings are eligible for incentives under the Commercial New Construction and Major Renovations program which 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 in the building design phase which would provide financial support to assist projects in ensuring the EUI target set during design is achieved post occupancy.

Please note by participating in a Mass Save downstream program pathway, the project is not eligible to accept any upstream incentives for the project including: HVAC, domestic hot water, food service, or lighting. The project team will coordinate with a Mass Save Account Manager during Concept Phase to further explore these incentive opportunities and to ensure the project is eligible for the maximum cost savings 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 for each project as the building design progresses and project construction timelines and phasing are determined.

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.

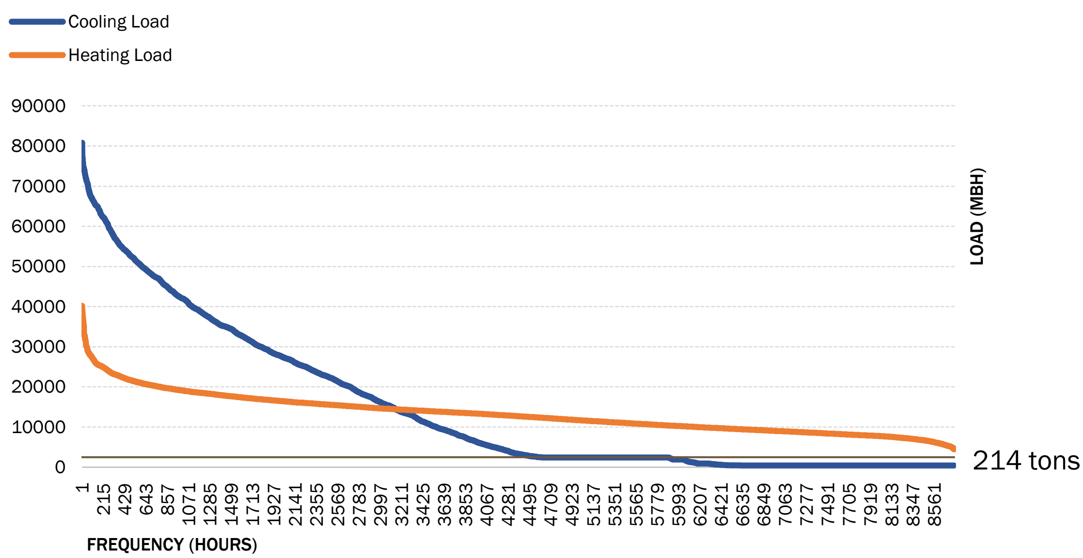
	Net Zero Condition:	Transition Process:
Building Envelope:	Likely minimal upgrades to envelope in future to achieve Net Zero. Potential for air sealing/retro-commissioning of envelope in the future.	
HVAC Systems:	Residential: Current Design/No Change – All Electric Commercial: All-Electric	Residential: None Needed, Day-1 Design Commercial: Chiller plant to be augmented with heat pump chillers. Gas-fired boilers to be transitioned to ASHPs or electric boilers. (see narrative)
Domestic Hot Water:	Hot water will be generated by electricity.	Gas boilers to be transitioned to WSHPs or ASHPs, or electric resistance heat.
Lighting:	Current Design/No Change	Lighting will be All-LED, thus minimal additional energy savings anticipated from future upgrades.
Renewable Energy Systems:	PV Installed on feasible rooftops: Current Design/No Change	
Other Strategies:	n/a	

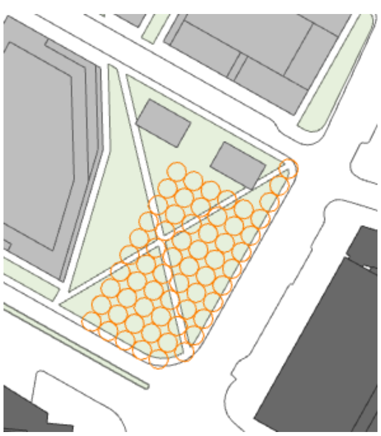
For additional assessment of the pathway to a net-zero emissions future, see Energy + Emissions section of our Green Building Report.

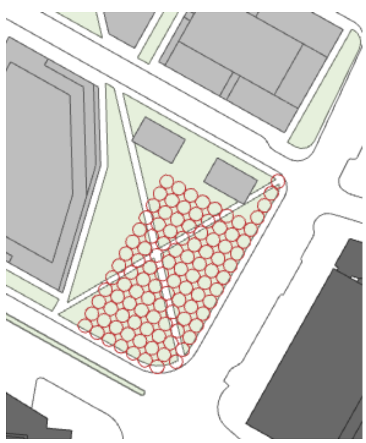
APPENDIX A: GROUND SOURCE HEAT PUMP STUDY

- Preliminary feasibility study for ground source heat pumps comparing 15-ft versus 20-ft spacing potential.
- Load comparison study included 107 wells @15ft spacing.
- Meets 3% of development total cooling capacity. (or 13% of a single commercial building)
- Meets 6% of development total heating capacity.

HEATING & COOLING LOAD FREQUENCY







GSHP Wells	
# of wells @ Green area (southeast of the site)	
20ft spacing	62
15ft spacing	107

Intentionally Blank Page