OUT OF THE SHADOWS

The Longwood Place Proposal And Its Impact On The Emerald Necklace

COMMUNITY MEETING • FEB. 27, 2023 • FENWAY COMMUNITY CENTER

AGENDA

- **Welcome/Introduction**
  Tim Horn, President, Fenway Civic Association
- **Longwood Place Shadows**
  Elena Saporta, ASLA, RLA, LEED AP
- **Shadows and the Environment**
  Jack Schleifer, Field Operations Manager, Emerald Necklace Conservancy; Master of Environmental Management, Yale University
- **Longwood Place Filing**
  Steve Wolf, Board of Park Advisors, Emerald Necklace Conservancy
- **Discussion and Next Steps**

OUT OF THE SHADOWS NEIGHBORHOOD FACT SHEET

1 OPEN SPACE: One of the city's densest neighborhoods, the Fenway has less than half the citywide average of open space per resident.

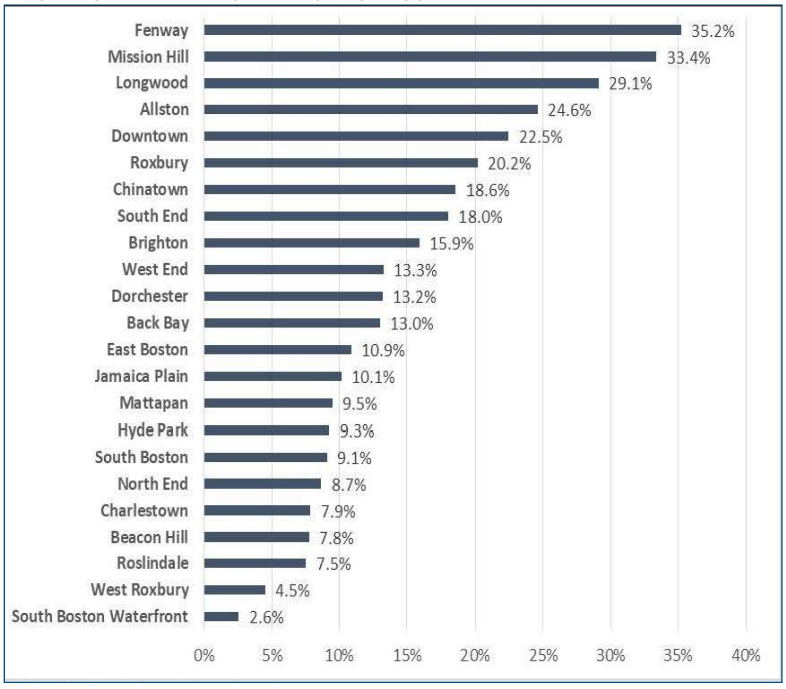
CITYWIDE AVERAGE:
7.59 ACRES OF PROTECTED OPEN SPACE PER 1,000 RESIDENTS

THE FENWAY:
- **2ND-DENSEST** NEIGHBORHOOD IN BOSTON;
- **3.52 ACRES** OF PROTECTED OPEN SPACE PER 1,000 RESIDENTS

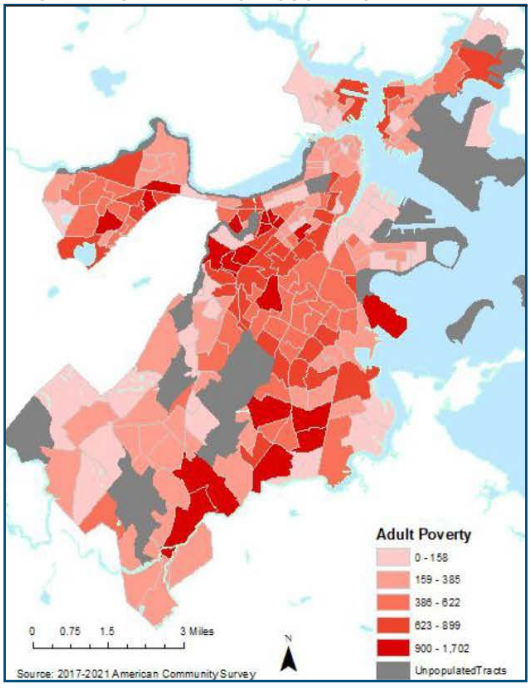
SOURCES
- FENWAY POPULATION 39,126 (AMERICAN COMMUNITY SURVEY, 2016-2020)
- BOSTON PARKS & RECREATION DEPT., OPEN SPACE PLAN, 2023-2029 PROJECTIONS

2 INCOME: The Fenway has the highest rate of adult poverty of any neighborhood in Boston.

ADULT POVERTY RATES BY NEIGHBORHOOD



ADULT IN POVERTY BY CENSUS TRACT



SOURCE: BPDA Research Division, *A Profile Of Poverty In Boston.* 3 February 2023. https://www.bostonplans.org/getattachment/732b0b04-c218-439d-aa4d-40a3111d2956. Retrieved 25 February 2023. BPDA analysis based on 2017-2021 American Community Survey

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NEIGHBORHOOD FACT SHEET

3 ***EQUITY:* Longwood Place *creates for more shadow than allowed by the* LMA Guidelines*. And even though it creates more shadow on parks than the* Winthrop Square *tower, the developer has proposed 10% of the open-space mitigation funding from Winthrop Square.***

How Does Longwood Place Compare?

	LMA GUIDELINES	LONGWOOD PLACE	WINTHROP SQUARE
SHADOWS	March 21: **No more than 1 hour** of new shadow allowed on the Emerald Necklace	• March 21: **5.25 hours** of new shadow • Dec 21: **6.75 hours** of new shadow • **11 acres** affected	**1.5 hours** of new shadow on the Boston Common and the Public Garden
PROJECT SIZE IN SQUARE FEET	–	1,750,000 SF	1,000,000 SF
PARKS MITIGATION FUNDING	–	$6 million*	$56 million

* *The developer has pledged an additional $1 million for a study of the impact of shadows on parkland, but it stipulated that its own project must remain exempt from any policies that result from that study.*

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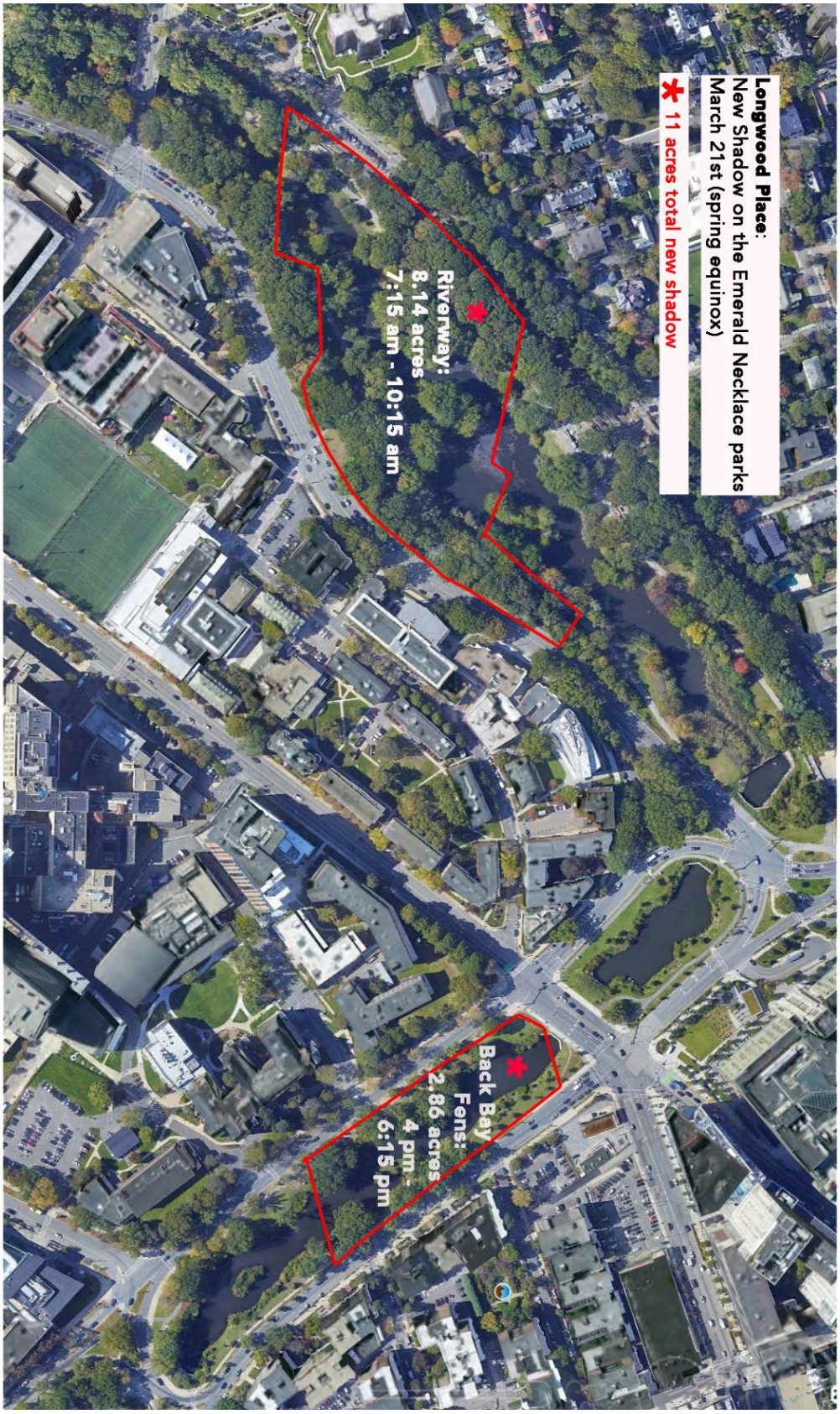
LONGWOOD PLACE SHADOWS ON MARCH 21



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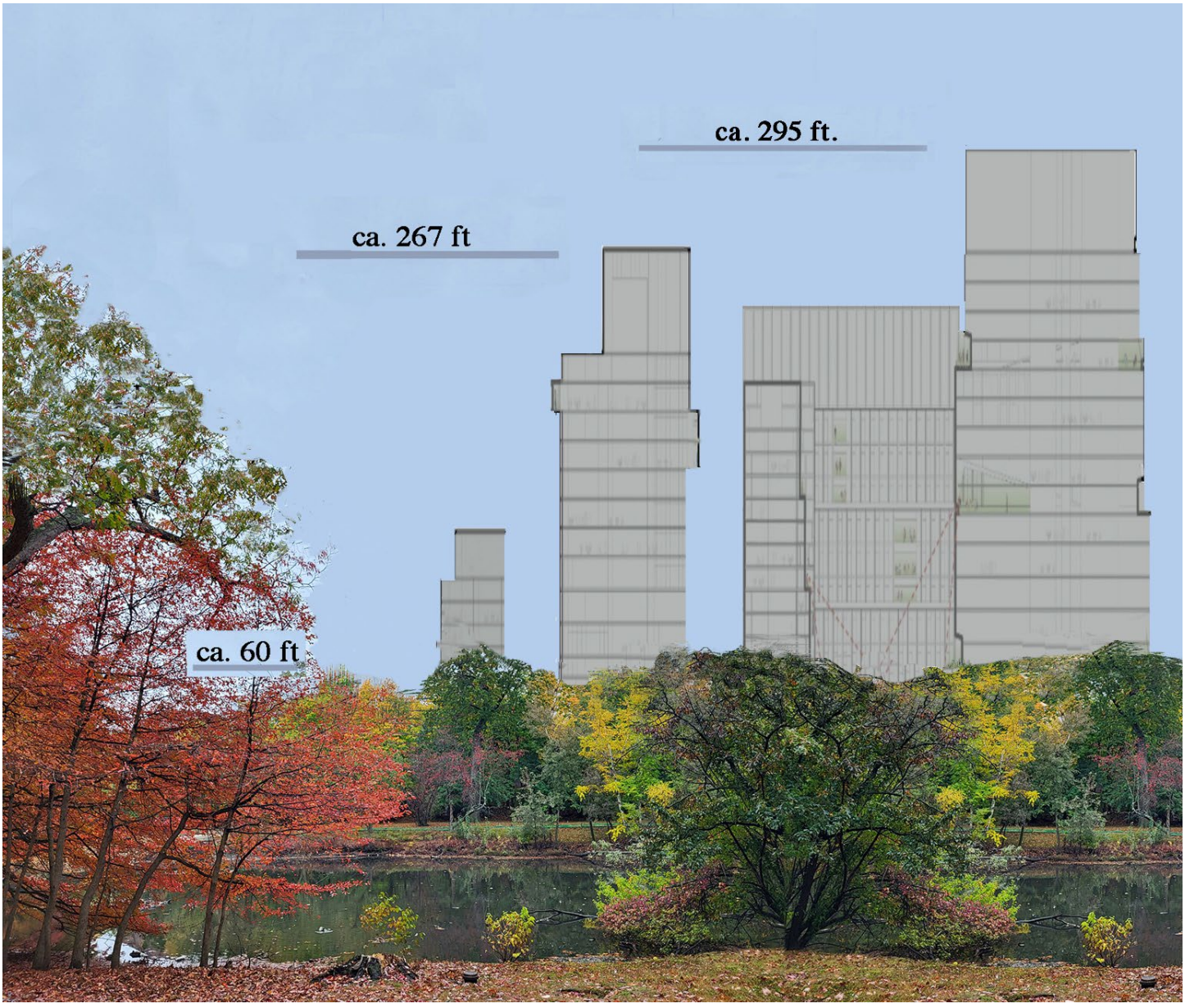
LONGWOOD PLACE BUILDING HEIGHTS



Photomontage: Elena Saporta, ASLA

OUT OF THE SHADOWS LONGWOOD MEDICAL AREA INTERIM DEVELOPMENT GUIDELINES

The following language appears verbatim in "LMA Interim Development Guidelines," released by the Boston Redevelopment Authority in 2003 and available at https://www.bostonplans.org/planning/planning-initiatives/longwood-medical-area-interim-guidelines

During this interim period, while the LMA Master Plan is being developed, the BRA will employ this set of interim guidelines (the "Interim Guidelines") to govern proposed development, prevent ad hoc growth in the LMA, and control growth in a fair and equitable manner. These guidelines will inform the BRA's considerations while reviewing projects and Institutional Master Plans in this area. The Interim Guidelines will be implemented through the BRA's development review process as outlined in Article 80 of the Boston Zoning Code.

The Interim Guidelines set principles, as described below, **to enhance and protect the physical assets of the LMA — its neighborhoods, parks, streets and sidewalks, views, landmarks, and human scale:**

- Create no-build zones along the Riverway and Fenway, Avenue Louis Pasteur and Brookline Avenue to protect existing parks and parkways;
- **Restrict new shadow impacts on City of Boston parks. In the interim period, no project will be approved if it casts any new shadow for more than one hour on March 21st on the Emerald Necklace,** Joslin Park or Evans Way Park. This standard is consistent with the most recent shadow restrictions adopted in the City's Municipal Harbor Plan.

SPECIAL STUDY AREAS

The Interim Guidelines provide general dimensional guidelines for the LMA district. There are, however, a number of special areas that will receive additional scrutiny and attention during the interim period and also for the master plan study. These areas are designated as Special Study Areas and include:

- The Emerald Necklace and public park system which in the interim will be governed by the Parks and Boulevard Protection Zone;
- The Longwood Avenue Corridor;
- The Huntington Avenue Corridor;
- The Fenwood Neighborhood Transition Area;
- Brigham Circle; and
- The central intersection of Longwood and Brookline Avenues."

DIMENSIONAL GUIDELINES

Height and setback guidelines will ensure that building massing and bulk are sited to have the least visual and environmental impact on the area's physical assets. The dimensional guidelines establish the following:

Height Zones

- Three height zones are in effect during the interim period. The first zone is designed to maintain the prevailing character of the existing streetwalls and will be applied along the major streets and any area adjacent to parks and the Fens. The controlling height in this first zone will vary according to the specific location to reinforce the prevailing existing streetwall height, but will have a potential maximum of 75′;
- The second height zone, typically adjacent to the streetwall zone, will have a base height of 75′ and a potential maximum height of 150′; and
- The third height zone will typically apply to the center of the blocks and will have a base height of 150′ and a potential maximum height of 205′

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LONGWOOD MEDICAL AREA INTERIM DEVELOPMENT GUIDELINES

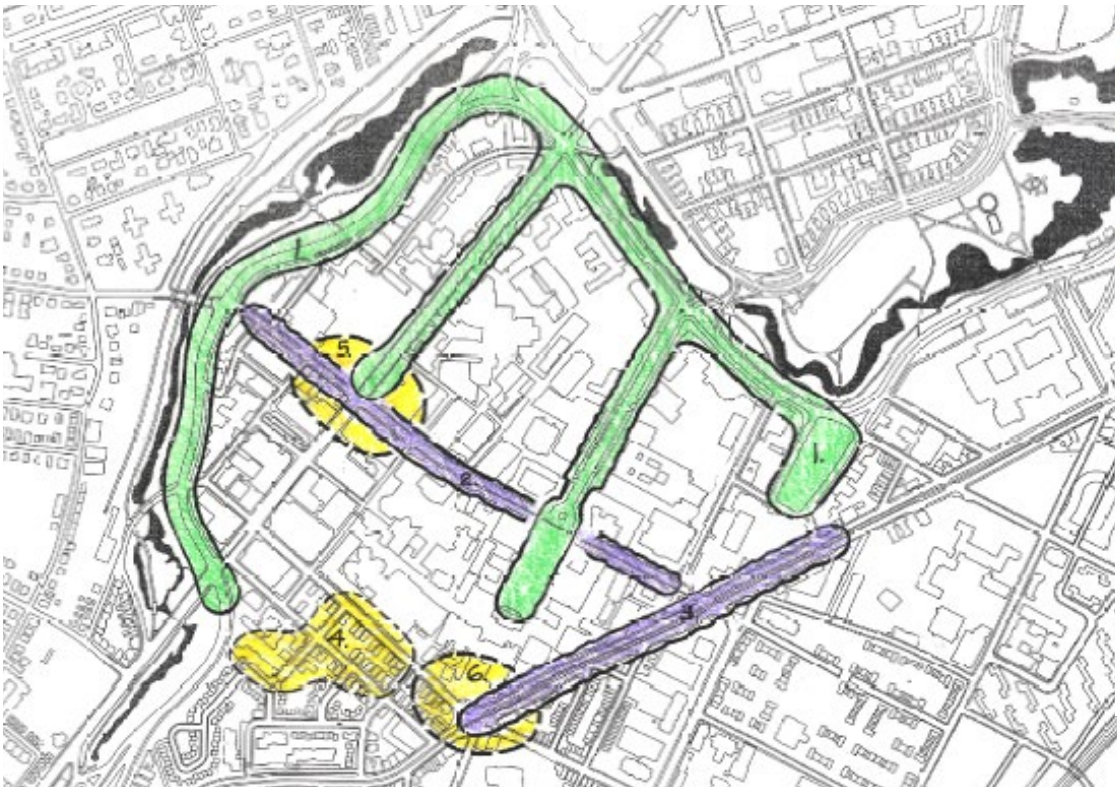
LMA Interim Guidelines

Parks and Boulevards Protection Zone

no buildings; no shadows of greater duration than one hour

prevailing building height; potential maximum of 75'

Boston Redevelopment Authority



Master Plan Special Study Areas

1. Parks and Boulevards Protection Zones
2. Longwood Avenue Corridor
3. Huntington Avenue Corridor
4. Fenway Neighborhood Transit Zone
5. Longwood/Brookline Intersection
6. Brigham Circle

Boston Redevelopment Authority

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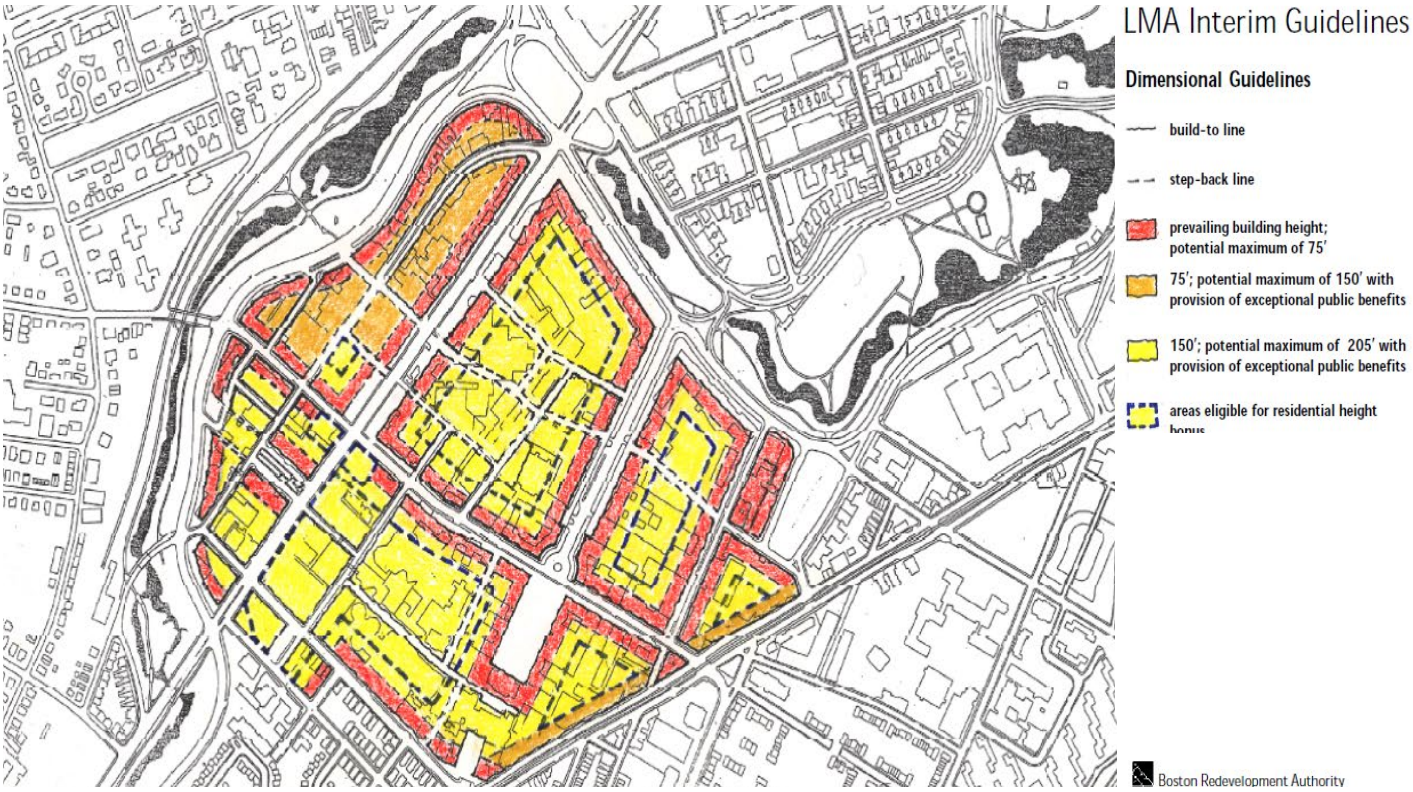
LONGWOOD MEDICAL AREA INTERIM DEVELOPMENT GUIDELINES



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COMMENTS FROM SIGNERS OF CHANGE.ORG PETITION

"The Emerald Necklace parks have been protected for generations by landmark status, by codified development setback requirements and by shadow restrictions. All such protections should remain in force for this project. Private open space should never be created at the expense of the public legacy—and certainly not by the degradation of our world-renowned, Olmsted-designed Emerald Necklace."

"The Emerald necklace is not just idle open space, it is a national landmark and concept important to the Victorians as the Industrial Revolution and immigrant population boomed. It tried to create the healthy balance. Unfortunately, today any open space, green, any HISTORY is being reduced by overdevelopment without acknowledging consequences. This is also an equity issue. People of Boston and inner cities deserve and are proud of our historic parks. Where is the compromise? And where are those architects who are problem solvers?"

"I hope that Simmons, Skanska, and the BPDA board will reconsider the height and shadow impacts of these buildings. This project is built on terra firma rather than on air rights or in some other difficult location. Surely this development can be reduced in height and still remain viable."

"I agree strongly about the damage shadows do to the health of our public park spaces. Parks must be protected so they can continue to provide the important amenities that support urban life."

"Sunlight around the parks was a the safe haven during the pandemic for young families like mine. We live in a neighborhood, most of us in apartments and condos without a lot of spacious outdoor space. Taking away sunlight in the few green spaces we have, we have would be a tragedy. This is a neighborhood."

"We must pay attention more closely than ever to the impacts of human activity on our parks, forests and public spaces. We can no longer accept compromise when negotiating for a viable sustainable future. We need our natural urban spaces defended and protected, we are in a climate emergency."

"The BPDA needs to adhere to its own regulations. Once there is an exception, there will be hundreds. The proposed development is way out of scale with the surrounding buildings and completely inappropriate for the site. Their amount of lost green space and light is irreplaceable. Please require a re-imagining of this project."

"The BRA guidelines are important. As a Boston resident for over 45 years, I have had many opportunities to enjoy the Emerald Necklace. Please make a decision that complies with the guidelines. Stop the shadows. And don't set a horrible precedent."

"As a Simmons alum, I am embarrassed and appalled that the university is pursuing something so damaging to the environment as we see the chaos caused by climate change all around us. This project absolutely contradicts Simmons' vision to be known for "expertise in fields which improve the human condition" and the core value of 'collective investment in community'."

"I am a Simmons alumnus and a Fenway resident. I am very familiar with the parcel(s) in question. The Emerald Necklace in this particular section it truly a gem of peace and repose. I urge developers to think more in depth about the massing of the buildings proposed to mitigate to the maximum extent, the shadows that will be cast."

"We need the green space and the trees to be preserved to protect the environment for all the people there. Simmons can scale back their plans to something that respects the BRA's original guidelines, and Skanska should go someplace far away, out of town. They have no business bullying their way into a district focussed on education, healthcare care and medical research. Protect this

OUT OF THE SHADOWS

ASSESSING THE IMPACT OF SHADOWS IN URBAN PARKS

1. Sunlight-sensitive park resources depend on sunlight to maintain overall usability and/or health, whether for human activity or horticultural needs.

2. Urban development typically prolongs the coverage and duration of shadows cast by taller buildings. As shadows increase, direct sunlight exposure gains increasing importance as a resource for people and nature, particularly in historic green spaces, where millions of people go each year to relax individually, gather as a community, walk to work, and enjoy recreation.

3. Weighing the impact on parks of a lack of sunlight requires assessing both how shadows affect the growth cycle and sustainability of natural features and how they affect the comfort and enjoyment of users.

4. Human use and comfort assumes particular significance during the cold winter months when there is less available sunlight, especially during morning and afternoon commuting hours, when thousands of people pass through these parks daily. Human-related sunlight-sensitive resources during the warm months include use of the walking paths along Riverway Park and the footbridge leading to Longwood MBTA train station.

Adapted from New York City Mayor's Office of Environmental Coordination: *New York City Environmental Quality Review Technical Manual* (Chapter 8: Shadows). December 2021. https://www.nyc.gov/site/oec/environmental-quality-review/technical-manual.page.

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SUNLIGHT AND URBAN GREEN SPACES— A DEEP DIVE INTO THE EVIDENCE

ADAPTED FROM A REPORT PUBLISHED IN 2019 BY THE FRIENDS OF THE PUBLIC GARDEN

EXECUTIVE SUMMARY

Essential and irreplaceable treasures in our urban environment, parks offer places for respite, socializing, exercise and recreation, and protest, celebration and solitude. As people become increasingly disconnected from the natural world, urban parks help them reconnect to nature in the middle of the city. Trees, shrubs, lawns, and flowers are essential elements that make parks, parks.

A. Parks, oases of plants, flowers, birds, and insects require sunlight.

- Solid shade cast by buildings (as distsinct from tree-canopy shade) lowers soil temperatures, inhibiting plant growth, root development, soil ecosystems, and biologic composition. The shade affects diversity and density and nutrient processing/availability.
- Low soil temperatures can inhibit water uptake, retard photosynthetic processes, potentially decrease root metabolism, restrict plant growth, and restrict CO2-capturing potential.
- Diverse, productive, and healthy urban green spaces have demonstrated greater successes in maintaining bee populations.

B. Like park plants, humans, too, need sunlight.

- Sunlight improves bone health by stimulating the body's production of Vitamin D.
- Sunlight and plant-generated compounds mitigate conditions from psoriasis to SAD to ADHD to high blood pressure.

C. Healthy people + healthy parks = healthy city.

- Neighborhoods with access to green spaces had fewer instances of domestic abuse, less crime, and stronger community relationships.
- Research has linked views of natural settings to reduced sick time taken in the workplaces studied.

D. The Emerald Necklace parks—and all parks—play a significant role in Boston's ability to mitigate the impacts of climate change.

- The Necklace contains some of the region's oldest trees. Research has shown that old trees aren't just carbon reservoirs, as their mass suggests; they also perform well in removing carbon from the air.
- Parks and their vegetation help regulate the urban heat-island effect (by cooling air in the parks themselves and in nearby blocks); reduce air pollution; and decrease contaminated stormwater runoff. They perform all these services while increasing habitat and food sources for urban wildlife.

E. Keeping parks sunny produces significant economic benefits.

- Tourist spending around Boston parks generates revenue for the City and income for local businesses.
- Healthy parks help lower healthcare costs
- Parks and their vegetation help reduce stormwater-related costs
- Sunlight has a significant impact on the experience of people living and working in, visiting, and enjoying Boston, and on the success of the city itself.

OUT OF THE SHADOWS SUNLIGHT AND URBAN GREEN SPACES— A DEEP DIVE INTO THE EVIDENCE

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A. Sunlight Strengthens Park Vegetation

- Urban environments host multiple microclimates, formed by several different variables. Differing light availability plays a central role in delineating these microclimate zones.
  - A study of microclimate influence on the overall health of trees in San Francisco clearly demonstrates that areas with greater sun exposure and warmer temperatures performed demonstrably better. The study included *Prunus serrulata* (Japanese cherry), a tree found along the Emerald Necklace. **(1)**
- Shade cast by structures and buildings lowers soil temperatures, which inhibit plant growth, root development, soil ecosystems, and biologic composition. This affects species diversity, density, and nutrient processing/availability. **(2)**
  - Plant-created shade helps plants, people, and soils.
  - "A poorly understood limitation in the urban environment is the effects of shade created by buildings on the adequacy of photosynthetically active radiation (PAR) for plant growth… reduced PAR by almost 50% when compared to fully exposed conditions." **(3)**
- Plants react differently, both physiologically and biochemically, to shade originating from another plant versus an artificial source; i.e., a building. **(4)**
- A reduction in sun exposure lowers soil temperatures.
  - Low soil temperatures can inhibit water uptake, retard photosynthetic processes, potentially decrease root metabolism, restrict plant growth, and restrict CO2 capturing potential. **(5)**
- Healthy plants contribute to effective mitigation of noise pollution. **(6)**

B. Healthy Plants Produce Healthy Minds, Bodies and Souls.

- Healthy plants produced by healthy soils create a more desirable and effective park oasis for urbna residents. Soils benefit from natural soil-temperature regulation that provides the conditions necessary for plant growth and success. (2)
- People spend a remarkable 75% of their daily life under artificial light sources. This raises the importance of exposure to the sun in northern latitudes in particular. "Even if we manage a lunchtime walk, in many of our major cities, tall buildings shade out the light." **(7)**
- Exposure to sunlight and green spaces promotes overall wellbeing; plants generate organic compounds that improve the health of humans in their proximity **(8)** in a variety of way. Sunlight and exposure to plants:
  - Increases serotonin production for improved moods and reduction of mild depression such as seasonal affective disorder **(9)** Living farther from the equator with much shorter days increases SAD cases. 1% of residents in Florida suffer from SAD; in New England or Alaska, the proportion reaches 9%, **(10)** underscoring the importance of sunlight access in parks during the darkest months of the year.
  - Lowers blood pressure. **(12)**
  - Improved bone health .**(13)**
  - Mitigates overactive immune system, as with autoimmune conditions such as psoriasis **(14)**
  - Exposure to nature ameliorates ADHD symptoms. **(15)**
- Trees provide relief from intense sun during the summer while providing cooling through evapotranspiration in leaves In winter months, sunlight passes freely through leafless branches. **(11)**

C. Value and Role of Green Spaces for Urban Residents

- 83.7% of the US population lives in an urban environment, underscoring the importance of positive improvements to urban green spaces. **(15)**
- Massachusetts could see 40% of its "non-urban forests subsumed by projected urban growth from 2000–2050," a demonstration of the urgency of protecting urban tree stands. **(16)**
- Neighborhoods with access to green spaces showed fewer instances of domestic abuse, less crime, stronger community relationships. **(15, 17)**
- Studies have found that workplace environments with views of the outdoors (specifically, trees and sunlight) on average report a 23% reduction of sick time used in comparison to workplaces with no access to views of nature. **(15)**

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D. Resilience and Sustainability

Mature and aging trees play an essential role in mitigating climate change.

- Mature trees don't simply act as carbon reservoirs, as their mass suggests; they also remove high levels of carbon from the atmosphere. This makes these trees extremely valuable, especially when compared to the smaller mass of juvenile trees. As an analogy, a bigger sponge soaks up and retains more water than a smaller one.
  - "For most species mass growth rate increases continuously with tree size; a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree." **(18)**
  - "For 97% of the species surveyed, the mass growth rate—literally, the amount of tree in the tree—kept increasing even as the individual tree got older and taller." **(19)**
- Urban forests and vegetation intercept and absorb air pollution and surface water pollution; increase water infiltration; and mitigate heat-island effects. **(15, 20)**
- Rooftops and pavements, particularly asphalt and dark shingles, absorb and retain high levels of heat during the summer, turning cities into "urban heat islands." Vegetation and green spaces play a vital role in counteracting this effect through natural shading and evapotranspiration (the evaporation of water as part of normal leaf photosynthesis). Promoting the health of these green spaces, in part by increasing the sunlight they receive, helps counterbalance increased heat in the urban environment. **(15, 20)** Multiple researchers predict that Boston's summertime temperatures will rise dramatically over this century. Under a scenario with limited reduction of atmospheric carbon, Suffolk County could see 37.4 days with temperatures above 90°F in the period 2060 to 2080 That compares to 9.5 days above 90°F in the period 1990–2010. **(26)**
- Habitat loss due to urbanization and paved areas contributes to a declining population of many species of wildlife.
- Healthy trees and horticulture in urban parks and naturalized green corridors provide benefits for urban wildlife:
  - They increase habitat and forage for beneficial insect populations, which help pollinate plants, reduce pest-insect population,s and provide food for bird populations. **(21)**
  - Bird populations in the US and Canada have fallen by nearly 30% in the past 50 years, with a loss of 3 billion total. **(21)**
  - Insect populations globally have steadily declined in recent decades:
    - Over the past 30 years in Germany, total populations of flying insects have fallen 78%, and the summer population spike has dropped by 82%. **(22, 23)**
    - Over the past 20 years in the US, populations of monarch butterflies have fallen by 90% (equivalent to 900 million individuals); populations of the rusty patched bumblebee, once widespread in 28 states, have fallen by 87%. **(23)**
  - Diverse, productive and healthy urban green spaces have demonstrated greater successes with bee populations, where city bees are performing better than those in rural areas. **(23)**

E. Economic Value of Urban Green Spaces

- The economic importance of protecting urban green spaces: US urban areas contain approximately 3.8 billion trees valued at $2.4 trillion. **(15)**
  - Trees in New York City return benefits valued at $5.60 for every $1 spent on planting and maintaing them. **(15)**
- Urban trees throughout the lower 48 states **(16)**:
  - Remove about 784,000 tons of air pollution annually, valued at $3.8 billion.
  - Store more than 770 million tons of carbon, valued at $14.3 billion
  - New York City trees reduce surface water runoff by 69 million cubic feet per year, providing $4.6 billion worth of flood-control service per year. **(24)**

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- Healthy parks contribute to a thriving tourism industry, which boosts the urban economy and local businesses. **(6)** In New York City, "Spending by these individuals [visitors] directly and indirectly supported 1,871 jobs, generated $87.5 million in earnings, and yielded $203.8 million in economic output." **(24)**
- Lower healthcare costs can be attributed to healthy and active urban green spaces. **(6)**
- Research has found increased property values as a function of proximity to green spaces. **(6, 25)**
- "Oregon has quantified the returns from investing in the city's tree canopy, attributing $15.3 million in additional tax revenue in 2010 to increased tree coverage." **(24)**
- Statistics from a Trust for Public Land study in 2007 **(26)** identifies the following value assessments of parks in Boston:
  - $1.9 million ($2.4 million in 2019 dollars) in taxes generated by tourists who came to Boston primarily because of its parks.
  - $6.7 million ($8.3 million in 2019 dollars) in increased wealth due to tourist-originated sales.
  - $78 million ($97.1 million in 2019 dollars) saved on medical expenditures by residents directly associated with access to green space.
  - $3.9 M ($4.9 million in 2019 dollars) saved on public safety-related costs due to a decrease in criminal activity because of public green space access.
  - $8.7 M ($10.8 million in 2019 dollars) saved on stormwater-treatment costs due to water infiltration into the soil and uptake by trees and shrubs in Boston parks.
  - $550,000 ($685,000 in 2019 dollars)—the value attached to improved air quality because of pollutant removal by urban vegetation.

REFERENCES

1. Martin, Meredith, P. "Survival is not Enough: The effects of microclimate on the growth and health of three common urban tree species in San Francisco, California." *Urban Forestry and Urban Greening*, vol. 19, Sept. 2016, pp. 1-6.
2. Brady, Nyle C, and Ray R Weil. *Elements of the Nature and Properties of Soils.* 2nd ed., Pearson Education, Inc., 2004.
3. Tan, P. Y., & Ismail, M. R. B. (2014). "Building shade affects light environment and urban greenery in high-density residential estates in Singapore." *Urban Forestry & Urban Greening,* 13(4), 771–784.
4. Bell, Gregory. "The importance of Light and Managing Shade." *Turfgrass Physiology and Ecology: Advanced Management Principles,* CAB International, 2011, pp. 75-87
5. Anderson, Jay E., and S. J. McNaughton. "Effects of Low Soil Temperature on Transpiration, Photosynthesis, Leaf Relative Water Content, and Growth Among Elevationally Diverse Plant Populations." *Ecology*, vol. 54, no. 6, 1973, pp. 1220–1233.
6. Kastelic, J. (2014). *The Economic Benefits of Green Space* (pp. 1–80). Trust for Public Land.
7. Marshall, F. (2003). *Positive options for seasonal affective disorder (SAD): self-help and treatment.* Alameda, CA: Hunter House Publishers.
8. Kuo, M. (2015). "How might contact with nature promote human health? Promising mechanisms and a possible central pathway." *Frontiers in Psychology*, 6, 1–8.
9. Lambert, G., Reid, C., Kaye, D., Jennings, G., & Esler, M. (2002). "Effect of sunlight and season on serotonin turnover in the brain." *The Lancet,* 360(9348), 1840–1842.
10. Horowitz S. "Shedding light on seasonal affective disorder." *Alternative and Complementary Therapies.* 2008;14(6):282–287.
11. Georgi, J. N., & Dimitriou, D. (2010). "The contribution of urban green spaces to the improvement of environment in cities: Case study of Chania, Greece." *Building and Environment,* 45(6), 1401–1414.
12. University of Southampton. (2014, January 17). "Here comes the sun to lower your blood pressure." *ScienceDaily.*
13. Michael F Holick, "Sunlight and vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease," *The American Journal of Clinical Nutrition,* Volume 80, Issue 6, December 2004, Pages 1678S–1688S.
14. Kazandjieva, J., & Grozdev, I., et. al. (2008). "Climatotherapy of psoriasis." *Clinics in Dermatology,* 26(5), 477–485.
15. New York Restoration Project. (2011). *Vibrant Cities & Urban Forests: A National Call to Action.* (1st ed., pp. 1–23). New York, NY.

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16. Nowak, David J.; et al. (2010). U.S. Department of Agriculture, Forest Service, Northern Research Station. "Sustaining America's urban trees and forests: A Forests on the Edge report." (*Gen. Tech. Rep. NRS-62.* Pp. 1-28) Newtown Square, PA.
17. Urban Releaf. *Benefits of Trees*. (2013, January 24).
18. N. Stephenson, et. al. "Rate of tree carbon accumulation increases continuously with tree size" *Nature*, vol. 507, 2016, pp. 90-93.
19. B. Walsh (2014, January 15). "When It Comes to the Climate, Older Trees Do It Better." *Time* magazine.
20. Coutts, E., et. al. (2015). *Urban Heat Island Mitigation in Boston* (pp. 1–81). Boston, MA: Tufts University Urban and Environmental Policy and Planning.
21. Zimmer, C. (2019, September 19). "Birds Are Vanishing From North America." *New York Times.*
22. Vogel, G. (2017, May 10). "Where have all the insects gone?" *Science Magazine*.
23. "The Insect Apocalypse" (2018, November 27). *New York Times Magazine.*
24. New Yorkers for Parks. (2019). *Bright Ideas: New York City's Fight for Light.* (pp. 1–29). New York,
25. Aiello, D., et. al. (2010). *Measuring the Economic Impact of Green Space in Pittsburgh.* The Urban Redevelopment Authority of Pittsburgh.
26. Trust for Public Land's Center for City Park Excellence. (2008). *How much value does the City of Boston Receive from its Park and Recreation System?* (pp. 1–84).
27. Douglas, Ellen and Kirshen, Paul. (2022). *Climate Change Impacts and Projections for the Greater Boston Area.* University of Massachusetts Boston, School for the Environment (p. 48).