Restringing the Emerald Necklace:
An Ecological Assessment of Boston's Largest Public Park System with Selected Areas for Improvement

Nathan Oalican
GSDSCI6318: Urban and Town Ecology
Professor Richard T.T. Foreman

In 1878, Fredrick Law Olmsted, father of American Landscape Architecture, relocated his household and architectural firm to Boston, Massachusetts. By this time in his career, Olmsted had refined his style of landscape design from a lifetime of fieldwork which took him across the United States. He came from New York City, where he had served as the Chief Architect of Central Park.[1] It was with this mature architectural perspective that Olmsted immediately set to work in Boston, and by the time of his death in 1903 he had fundamentally transformed Boston's urban greenspace through the creation and connection of over 1000 acres of parkland in the city. Olmsted's unique execution of spatial connectivity, by which he strung together Boston's parklands though landscape corridors, would after his death become known as Boston's "Emerald Necklace". The Emerald Necklace, comprised of verdant "emeralds" of parkland connected by corridors of green space, remains the crowning achievement of Boston's park system, and provides significant ecological benefits to the city. The following report, informed by two photographic field days, (accompanying field day logs and observations can be found at nathanoalican.com/emerald-necklace) provides a review of and suggests proposals to improve two of the largest ecological services that the Emerald Necklace provides: its ability to sustain biodiversity and its role as an ecological corridor linking Boston parks to each other and beyond.

Unlike New York City, where Olmsted worked within a highly rectilinear and mature urban fabric, the Boston that Olmsted encountered was a city rapidly expanding its boundaries, often in novel ways, such as by filling in the mudflats which surrounded what was once the narrow neck of the Shawmut Peninsula on which the city sat.[2] [Fig. 1] In this way, Olmsted

[1] "Olmsted–Designed Parks: NYC Parks," New York City Parks Department, accessed May 10, 2020, https://www.nycgovparks.org/about/history/olmsted-parks.
[2] Walter Muir Whitehill, *Boston: A Topographical History*, 3rd ed., enl. (Cambridge, Mass.: Belknap Press of Harvard University Press, 2000).

began his work in Boston at a critical moment in which the city was establishing its spatial identity and relationship to nature. One Bostonian, writing to Olmsted, spoke prophetically: "Boston is a crooked and confused territory; if we ever get it straightened out, it must be in the next or succeeding generations, if we are to have parks, now is the time to secure lands for the purpose."[3]

Olmsted succeeded in securing these lands. Beginning in 1879 with a plan for parkland in the Back Bay Fens and continuing for the next several decades, Olmsted by the end of his lifetime had established a chain of greenspaces shown contemporarily in Figure 2**.** Generally speaking, the primary constituents of this parkland system (1) the Southern *large parklands*, consisting of Franklin Park and the Arnold Arboretum of Harvard University, (2) *riparian parklands*, which include small ponds and parks along the muddy river as it flows towards the Charles River, and (3) the *urban parklands* which comprise Boston's Public Garden and Commons and are connected to the rest of the system via the Commonwealth Avenue Mall and Charles River Esplanade. Taken together, the Emerald Necklace forms an ecologically significant partial greenbelt around Boston, with links to surrounding natural areas.

By providing a variety of ecosystem subtypes, the Emerald Necklace sustains levels of biodiversity that are uncommon in U.S. urban areas. These ecosystem subtypes range from semi-open fields (Boston Common and Franklin Park) to ornamental parkland forests (Arnold Arboretum), a large freshwater body (Jamaica Pond), disturbed riparian areas (Muddy River), and neglected urban wildlands (Bussey Brook Meadow of the Arnold Arboretum). For images of parenthetical areas, please reger to the Field Day Site Overviews at nathanoalican.com/emerald-necklace). In many cases, these areas contain small pockets of surprising biodiversity. A small

[3] James Haughton, "Letter to Fredrick Law Olmsted," February 14, 1870.

pond near Olmstead park, for example, holds Massachusetts only population of three-spined stickleback fish, and 180 of Boston's 200 bird species have been recorded in the Back Bay Fens.[4] Larger patches of biodiversity include the Arnold Arboretum, one of the most florally diverse areas outside of the tropics which contains over 4000 non-spontaneous species over 80 ha, and the Northern Reaches of Franklin Park, which holds a locally distinctive mixed-hardwood deciduous forest.[5] Though there is a lack research which quantifies the relative biodiversity of Emerald Necklace parks, one exemplary study of bird diversity by Strohbach, Lerman and Warren found that the largest determinant of bird species richness in Boston's parkland was habitat patch size and proximity to other green spaces. The authors concluded that "patch area matters and new green space will have the highest benefit when it is large and close or connected to larger patches of existing green space," and highlighted the Emerald Necklace as a "green network" in which distinct habitat patches in close proximity form an effectively continuous habitat area.[6]

However, there is much room for improvement in the biodiversity of the Emerald Necklace. It is plausible to assume that Strohbach's conclusions with regard to bird species, which are able to easily travel between habitat patches, are less applicable to flightless animals and certainly do not follow for aquatic flora and fauna. In order to facilitate biodiversity, then, the Emerald Necklace must include habitat patches with the highest potential for biodiversity within the confines of limited habitat area and relative isolation from other patches. Though these specifications are admittedly restrictive, there is precedent for supporting significant

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[4] Priyanka Vankina, "Beyond Drawing the Line: A Study of the Edge Structure of Boston's Emerald Necklace," *All Theses*, May 1, 2013, https://tigerprints.clemson.edu/all_theses/1656.
[5] Richard T. T. Forman, *Urban Ecology: Science of Cities* (New York: Cambridge University Press, 2014).
[6] Michael W. Strohbach, Susannah B. Lerman, and Paige S. Warren, "Are Small Greening Areas Enhancing Bird Diversity? Insights from Community-Driven Greening Projects in Boston," *Landscape and Urban Planning* 114 (June 1, 2013): 69–79, https://doi.org/10.1016/j.landurbplan.2013.02.007.

biodiversity in isolated and relatively small patches by conserving neglected areas as urban wildlands. In urban areas, often the biodiversity correlates highly with degree of human maintenance and design.[7] At present, the Emerald Necklace is a highly managed system and there are multiple agencies such as the Emerald Necklace Conservancy, the Massachusetts DCR and Harvard University which employ year-round staff to maintain its parks.[8] Perhaps counterintuitively, it will be necessary to scale back human management of some area in the Emerald Necklace to promote biodiversity. Though this is not possible throughout much of the system because scaling back land management would conflict with other goals like providing accessible space for recreation, the Bussey Brook Meadow of the Arnold Arboretum can serve as a model as one such existing small wildland which supports biodiversity without sacrificing other land management goals.

The 24-acre Bussey Brook Meadow, [Fig. 3] which abuts Washington street and lies adjacent to the Forest Hills MBTA station on Washington Street in the Jamaica Plain neighborhood of Boston, was acquired by the arboretum in 1996 after serving for decades as a dumping ground for the MBTA. It is an area of shocking diversity: a 2005 census conducted by the Arnold Arboretum discovered 322 plant species distributed across six natural communities from Oak-hickory forested slope to mudflats. Rather than recommend intensive management of the site, the Arboretum recommended a modest once-annual mowing of the meadowland portion to suppress invasive species populations.[9] In the present, the Bussey Brook Meadow represents the most species-rich parcel in the Emerald Necklace, and future initiatives to facilitate

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[7] Forman, *Urban Ecology, 233*.
[8] "Public Private Partners," The Emerald Necklace Conservancy, accessed May 11, 2020, https://www.emeraldnecklace.org/about-us/public-private-partners/.
[9] Joy VanDervort-Sneed and Ailene Kane, "Botanical Survey of Bussey Brook Meadow" (Arnold Arboretum of Harvard University: New England Wildflower Society, n.d.), 8.

biodiversity in the park system should emulate the Arnold Arboretum's landscape management strategy. Thankfully, this management strategy is non-intensive, cheap, and easily reproducible.

Though suitable parcels for urban wildlands are limited throughout the Emerald Necklace, one candidate for establishing a similar center of biodiversity is the northern section of Franklin Park. Praising it as unequaled in its "simple, and pleasingly simple, rural aspect," Olmsted designed Franklin Park to place "within the easy reach of the people of the city the enjoyment of such a measure as it practicable of rural scenery".[10] However, in the century since Franklin Park's establishment, much of the park has been diverted to other uses, such as the Franklin Park Zoo and William J. Devine Golf Course. Contrary to Olmsted's vision, the enormous 10,000 seat White Stadium occupies a large segment of the northern parkland and bifurcates the wooded area of the park. [Fig. 4]. This stadium, which remains closed to recreation throughout the year with the exception of weekend football games, is heavily underutilized and lies in one of the least-frequented areas of the park.[11] Surrounding the stadium is a woodland which contains neglected paved trails and ruins of abandoned zoo facilities. The city of Boston, which has pledged $28 million towards the redevelopment of Franklin Park, should consider demolishing White Stadium and converting some of the created land as urban wildland to enhance connectivity between the northeast and northwest wooded sections of the park.[12] The city should also perhaps consider replacing aging paved pathways with dirt hiking trails and promote the use of the area as an urban woodland. Such a measure would not deprive the public

[10] Frederick Law Olmsted, "Notes on the Plan of Franklin Park and Related Matters" (Boston, Mass.: City of Boston, 1886), 44.
[11] "Walsh Announces Master Plan Effort to Improve Franklin Park - The Boston Globe," accessed May 11, 2020, https://www.bostonglobe.com/metro/2019/04/05/mayor-walsh-announces-new-master-plan-effort-improve-franklin-park/ShpGu6C08rJtYGURme16BP/story.html.
[12] "First Public Meeting Announced for Franklin Park Master Plan," Boston.gov, January 24, 2020, https://www.boston.gov/news/first-public-meeting-announced-franklin-park-master-plan.

of recreational space, acres of which are still available as continuously accessible outdoor fields and baseball pitches directly South of White Stadium. Evidently, the city is failing to properly maintain its parkland and recreational facilities in northern Franklin Park; reimagining this area, then, as a natural space could align it more closely with both Olmsted's original intention to provide rural scenery, increase public access to nature, facilitate a biodiverse urban wildland in the center of one of Boston's most densely populated residential areas, and increase habitat connectivity.[13]

Facilitating habitat connectivity in Franklin Park would further augment one of the Emerald Necklace's exceptional ecological characteristics: it integrates what would otherwise be spatially isolated urban green spaces into one consistent parkland system. The connectivity facilitated by the Emerald Necklace is two-fold: not only does it relate the urban greenspaces of Boston to each other, but it also connects Boston's unified parkland to the more consistent suburban and exurban greenspace in the urban fringe and beyond. This interurban connectivity creates green corridors which provide a variety of ecological services. Green corridors can function as conduits for flora and fauna, reduce surface water runoff, increase water infiltration, support biodiversity, and provide functionally significant habitat heterogeneity.[14] A particularly striking example of such connectivity that the Emerald Necklace provides can be found at its Southwestern Boundary. Moving westward from the Emerald Necklace's Arnold Arboretum, one encounters the Allendale Woods, the Country Club golf course, the Hancock Woods system, Brook Farm and Burial Grounds, West Roxbury's Millenium Park, and finally the city of Needham's public parkland and meadowland alongside the Charles River. [Fig. 5] Though these

[13] Dustin T. Duncan, *Spatial Distribution of Population Density across Boston...* (Demographic Research), accessed May 11, 2020, https://www.researchgate.net/figure/Spatial-distribution-of-population-density-across-Boston-census-tracts_fig5_254404787.
[14] Forman, *Urban Ecology, 362-365*.

parks are not directly connected, at most, only several treelined residential streets separate them. In total, they form an *ecological network*, which provides steppingstones for species dispersal and function as "habitat structures between core nature areas," which are in this case the exurban forests to the West, "and facilitate the biological conductivity in the landscape".[15]

Though the Emerald Necklace provides exceptional connectivity to disparate natural areas though its Southwestern edge, other areas of the park system are noticeably lacking in connectivity. Franklin Park, though massive and connected to adjacent cemeteries and a small nature reserve managed by the Massachusetts Audubon Society to the South, is relatively isolated in relation to other natural areas. [Fig. 6] One proposed solution to increase connectivity and provide an ecological corridor linking Franklin Park to other natural areas in Boston has been the redevelopment of Columbia Road in Dorchester and South Boston as a treelined parkway, similar in style to the Jamaicaway or Arborway which follow the course of the Muddy River.[16] [Fig.7] This proposal, developed by David Manfredi for Boston's 2024 Olympic bid, would connect Franklin Park with Moakley Park in South Boston.[17] Taken together with the extant Emerald Necklace parks, it would encircle Boston's urban core with an unbroken system of public parklands. Though this proposal has stalled since the failure of Boston's Olympic ambitions, the city should reconsider completing the project as an independent endeavor in order to build a more robust ecological network.

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[15] Rob H. G. Jongman, Mart Külvik, and Ib Kristiansen, "European Ecological Networks and Greenways," *Landscape and Urban Planning*, International Greenway Planning, 68, no. 2 (May 30, 2004): 305–19, https://doi.org/10.1016/S0169-2046(03)00163-4.

[16] James C O'Connell, "The Legacy of Frederick Law Olmsted's Emerald Necklace in Contemporary Boston," *National Park Service* 5, no. 1 (2016): 9.

[17] Michael Levenson Globe Staff et al., "Boston 2024 Sees Columbia Road as Olmsted Jewel - The Boston Globe," *Boston Globe*, accessed May 11, 2020, https://www.bostonglobe.com/metro/2015/07/19/boston-pledges-complete-olmsted-vision-columbia-road/VdXZpgM6VKdT3JJeDsbjIP/story.html.

Another area of the Emerald Necklace with deficient ecological connectivity is the Charlesgate Park, where the Muddy River flows into the Charles River. Originally designed by Olmstead as a grassy parkland intersected by residential roads, the park has been fundamentally disrupted by the expansion of the Massachusetts Turnpike and construction of the Bowker Overpass, which runs parallel and directly above the Muddy River as it enters the Charles River. Relegated and in the shadow of an overpass, the banks of the Muddy River along the Charlesgate Park are clogged with trash and lack vegetation. [See images on website] Duckweed blooms are common, which signals a locally hypereutrophic environment which lacks dissolved oxygen and is inhospitable for aquatic animals.[18] These blooms are probably a signal that significant runoff and dry deposition from the road infrastructure above is occurring, since runoff often contains high levels of nitrogen phosphorous, and heavy metals constituents, particularly in climates such as Boston with frequent application of de-icing agents and frequent precipitation.[19] Thus, Charlesgate Park, originally designed as a graceful connection between two significant park spaces, the Back Bay Fens and the Charles River Esplanade, is at present heavily polluted and inhibits ecological connectivity. Furthermore, Charlesgate is impassable to pedestrians; in order to reach the Charles River, passerby must navigate a slew of road crossings and walk eastward 0.2 miles to Massachusetts Avenue for access to the Charles. Thus, Charlesgate at present delivers only the bare minimums ecological value and recreational use.

Charlesgate has not escape widespread criticism from the urban planning community in Boston, which has floated numerous proposals to reconfigure the park in recent years. Though it may not be possible to remove the Bowker Overpass without probative costs, other plan to make

[18] Masoud Kayhanian et al., "Review of Highway Runoff Characteristics: Comparative Analysis and Universal Implications," *Water Research* 46, no. 20 (2012): 6609–6624, https://doi.org/10.1016/j.watres.2012.07.026.
[19] Kayhanian et al.

the Charlesgate more usable have surfaced in recent years. One such proposal is a joint collaboration between the Emerald Necklace Conservancy and Massachusetts DCR, who hired the firm Landing Studio to complete conceptual designs for the space. [Fig. 8] Without altering the road superstructure, these plans establish a more robust and accessible park system that prioritizes habitat and water quality.[20] When considering designs to improve the Charlesgate's accessibility and ecology, planners should look to another recent Emerald Necklace improvement: the restoration of a section of the Muddy River near Boston's Landmark Center in response to costly flooding of the river in the late 1990's.[21] This project removed a large section of the Muddy River from a culvert and prioritized riparian wildlife, including emergents, wetland species, low and high shrubs, and trees.[22] [Fig. 8] In doing so, it transformed a lot which formerly contained a Sears department store parking lot into an area of enhanced ecological connectivity and recreational possibility. This improvement's design should inform any future developments at Charlesgate.

Fredrick Law Olmstead's Emerald Necklace transformed Boston's Park System into a coherent spatial system, and it remains to this day the most ecologically valuable interconnected green space in the City of Boston. The Emerald Necklace provides unusually high levels of biodiversity through its variety of habitats and ecotones and facilitates species movement through a continuous ecological corridor that nearly spans the length of the city and provides linkages to regional parkland and conserved areas. Though nearly a century of consistent us has resulted in the degradation of areas of the Emerald Necklace such as Northern Franklin Park and

[20] "Charlesgate," LANDING STUDIO, accessed May 11, 2020, http://www.landing-studio.com/charlesgate.
[21] "Flood Control Improvement – MMOC-Muddy River Restoration Project," accessed May 11, 2020, http://www.muddyrivermmoc.org/flood-control/.
[22] "Enhancement of Aquatic/Riparian Habitat – MMOC-Muddy River Restoration Project," accessed May 11, 2020, http://www.muddyrivermmoc.org/habitat-enhancement/.

the Charlesgate, future planners need look no than the Emerald Necklace, in places such as the Bussey Brook Meadow and the newly restored Muddy River, for inspiration in refining Olmsted's vision and improving the biodiversity and conductivity of the parkland system.

Appendix

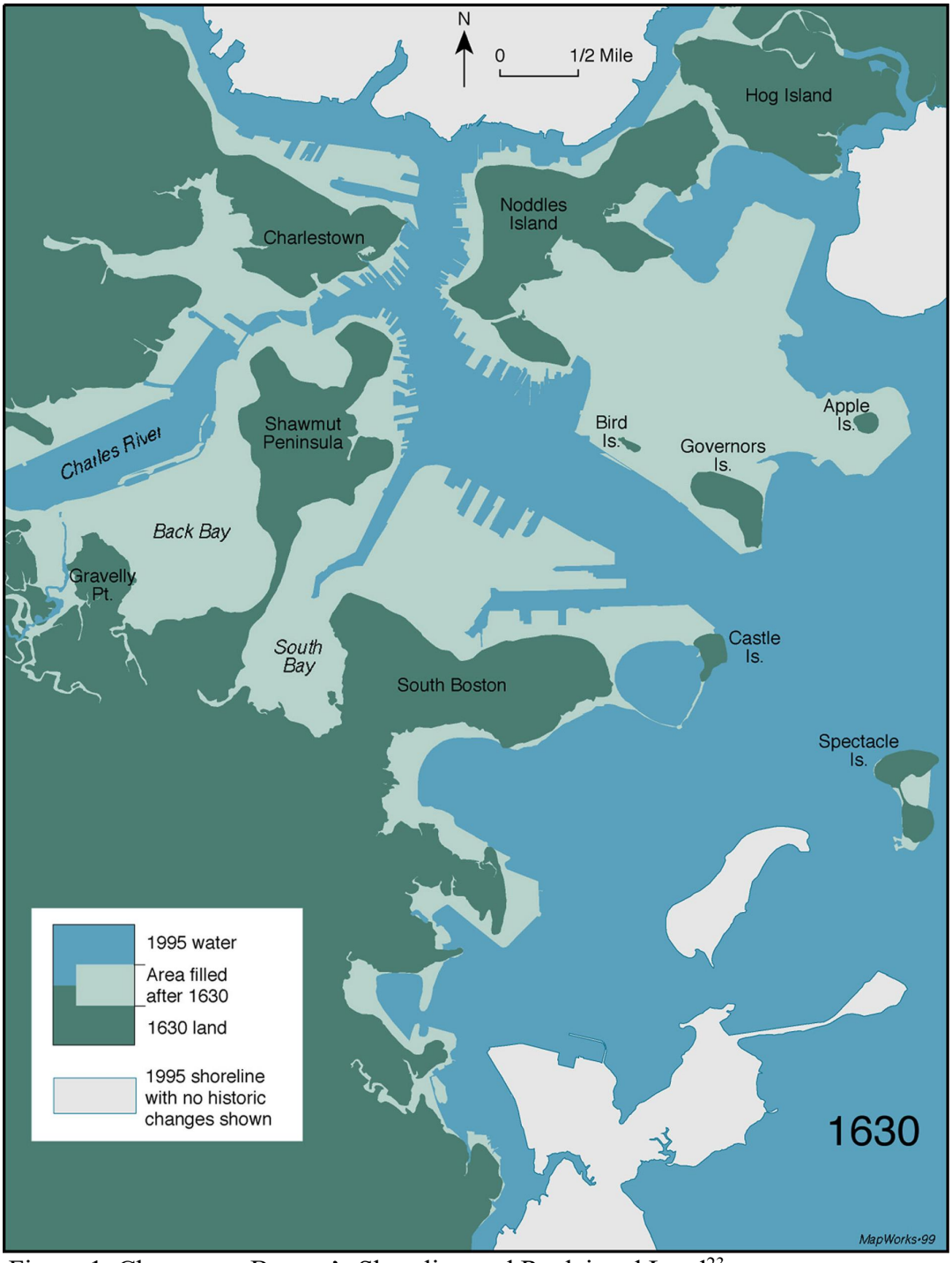

Figure 1. Changes to Boston's Shoreline and Reclaimed Land[23]

[23] Betsy Mason, "How Boston Made Itself Bigger," *National Geographic*, June 13, 2017, https://www.nationalgeographic.com/news/2017/06/Boston-landfill-maps-history/.

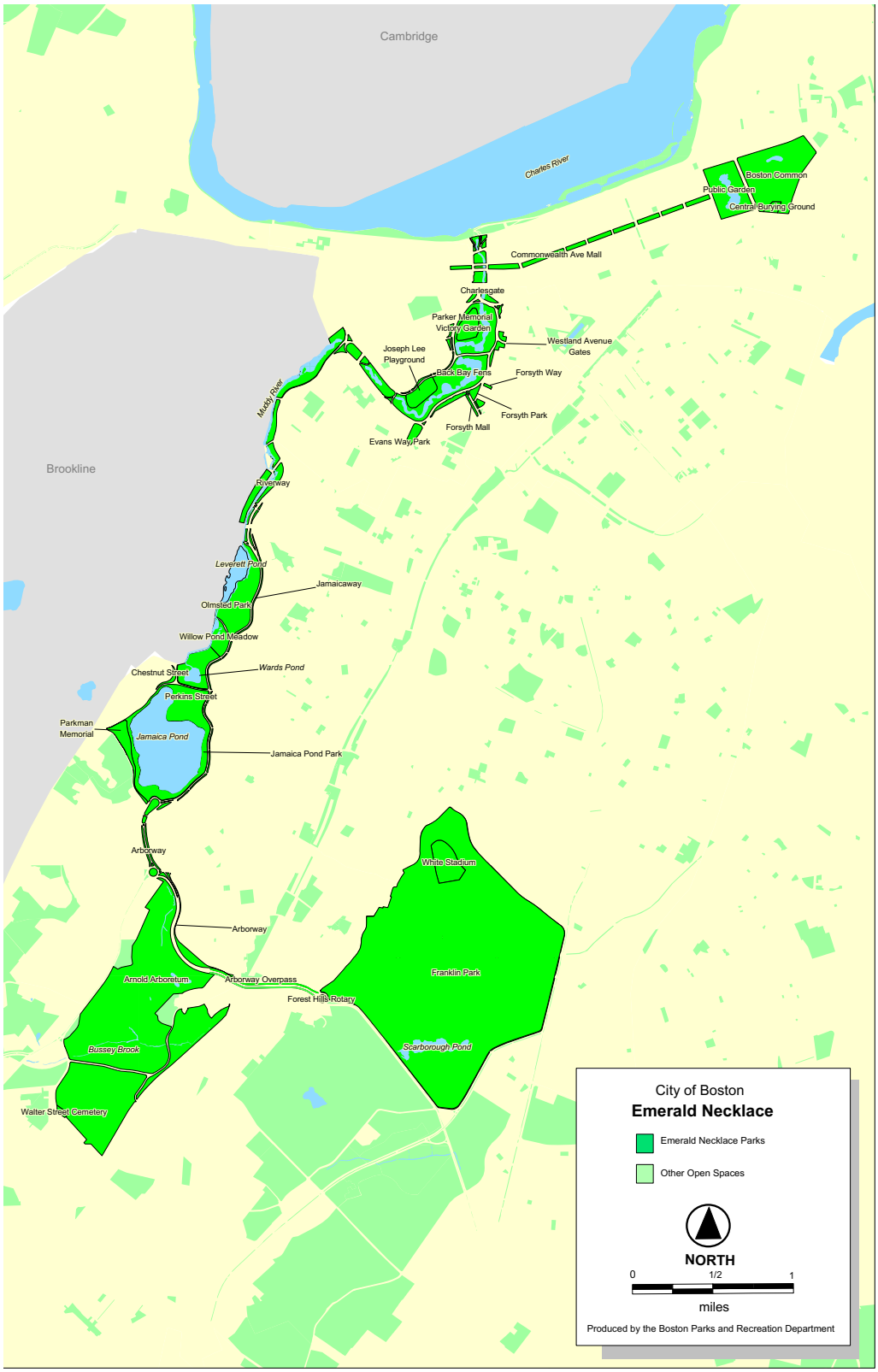

Figure 2. Boston's Emerald Necklace and Major Constituents[24]

[24] *City of Boston: Emerald Necklace* (Boston, Massachusetts: City of Boston, n.d.).

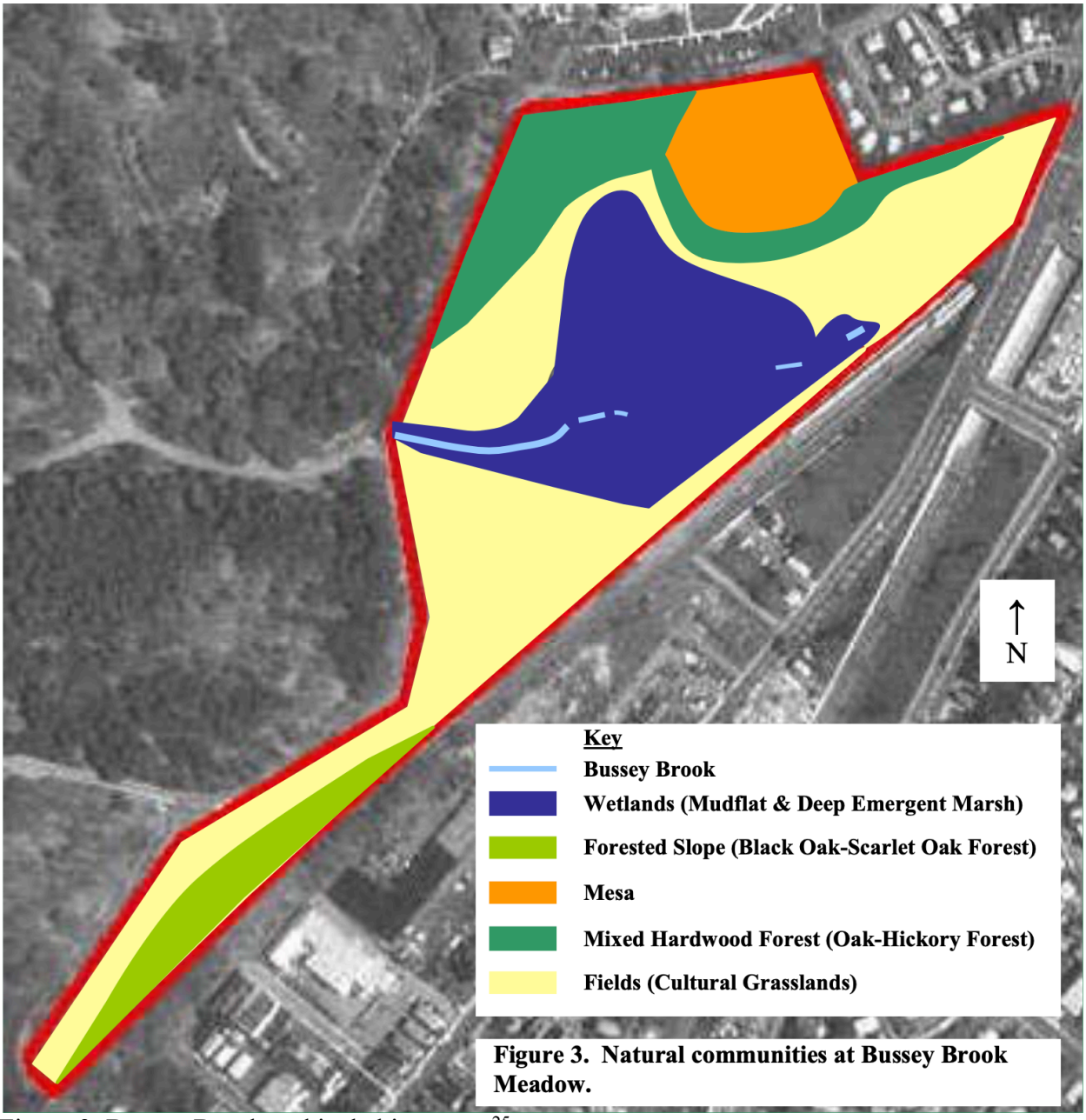

Figure 3. Bussey Brook and its habitat types[25]

[25] Joy VanDervort-Sneed and Ailene Kane, "Botanical Survey of Bussey Brook Meadow" (Arnold Arboretum of Harvard University: New England Wildflower Society, n.d.), 10.

Figure 4. Northern Franklin Park, with White Statdium visible at center[26]

[26] Nathan Oalican, *Northern Franklin Park* (Boston, Massachusetts: Google Earth, n.d.).

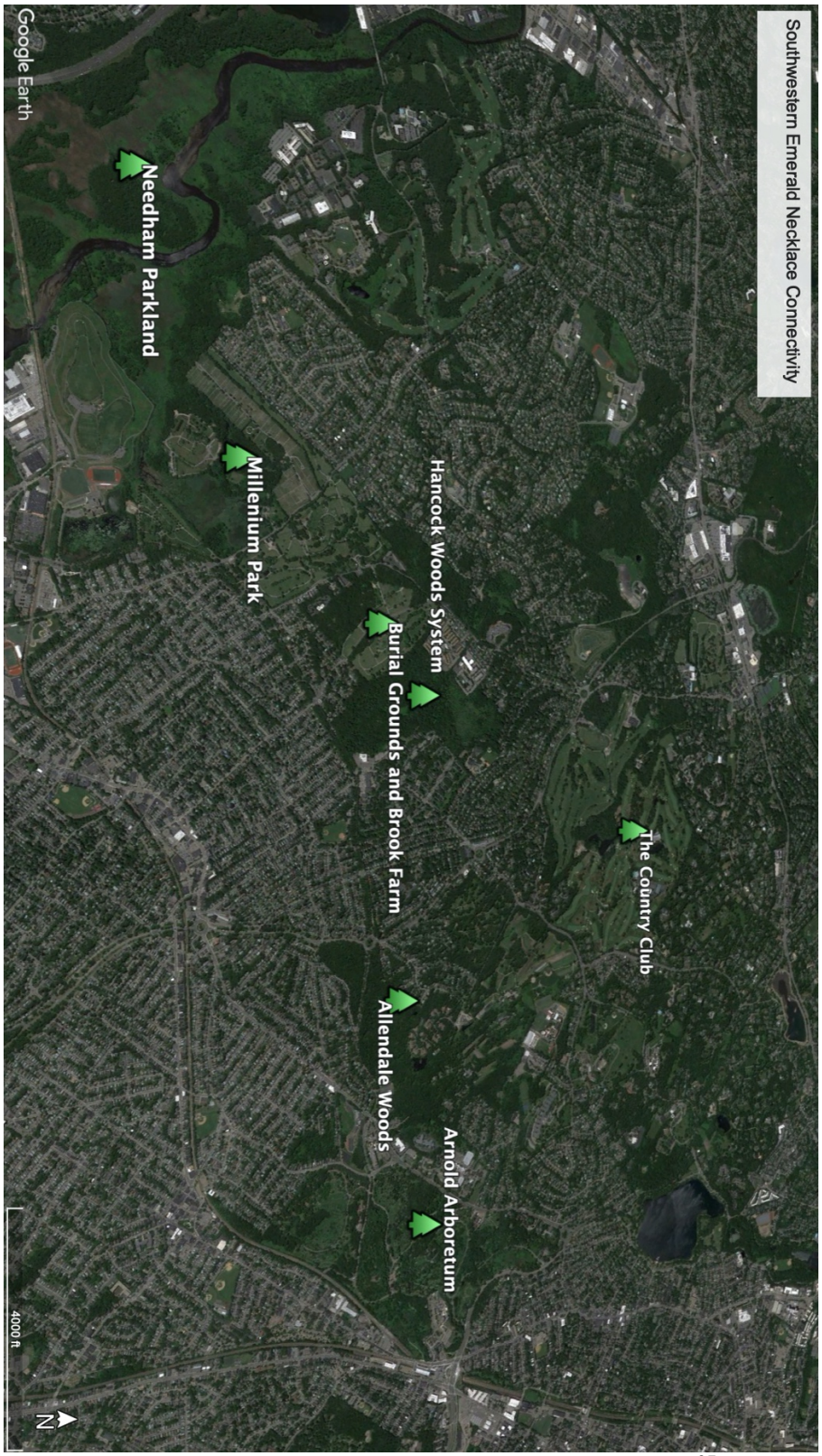

Figure 5. The Southwestern Emerald Necklace and linkages[27]

[27] Nathan Oalican, *Southern Emerald Necklace Linkages* (Boston, Massachusetts: Google Earth, n.d.).

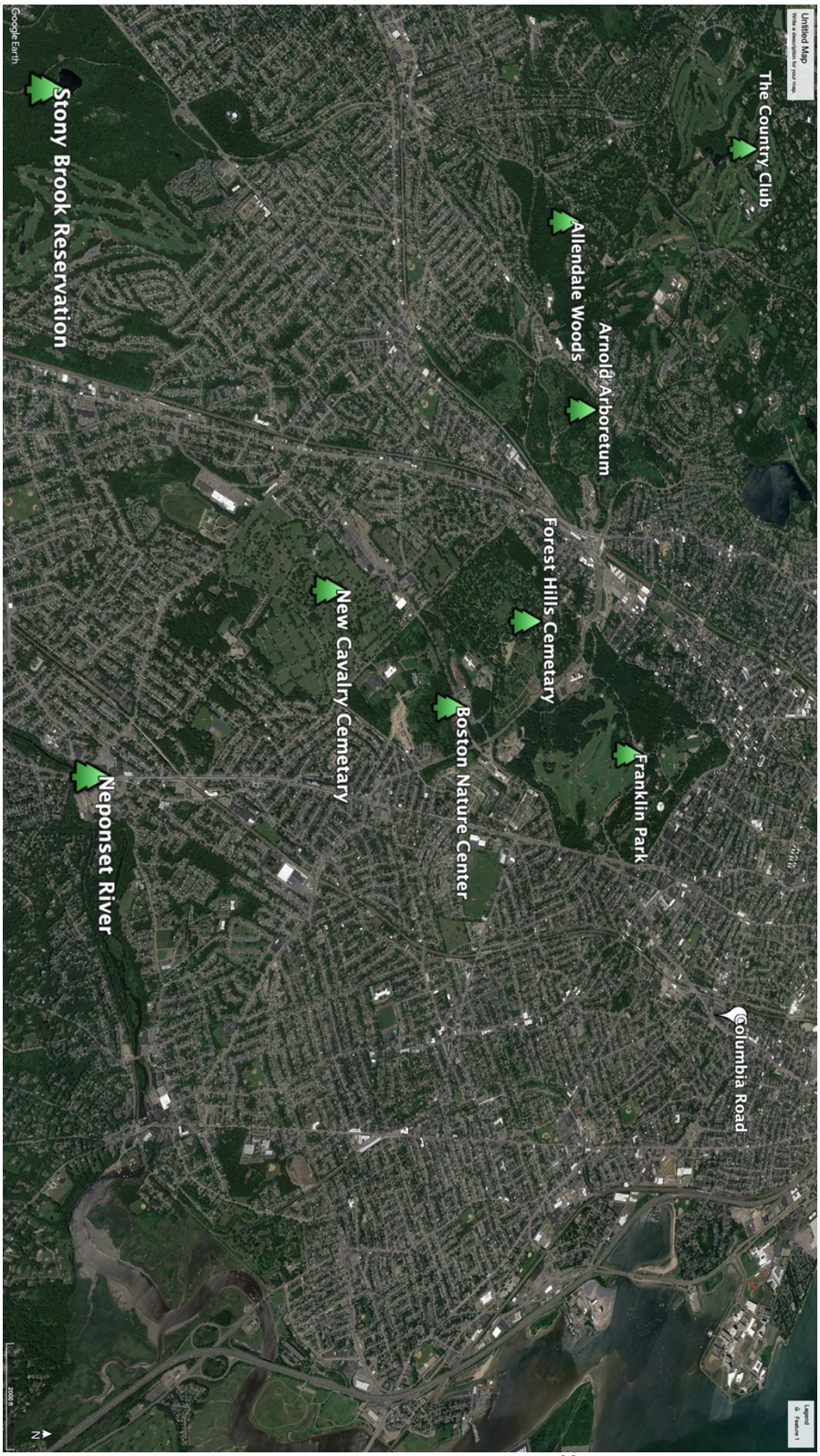

Figure 6. Franklin Park and its relative isolation[28]

[28] Nathan Oalican, *Franklin Park and Surroundings* (Boston, Mass.: Google Earth, n.d.).

Figure 7. Landing Studio's proposed Charlesgate redevelopment[29]

[29] *Charlesgate* (Boston, Mass.: Landing Studio, 2019).

Figure 8. The Emerald Necklace with proposed Columbia Road linkage[30]

[30] O'Connell, "The Legacy of Frederick Law Olmsted's Emerald Necklace in Contemporary Boston."

Figure 9. The Muddy River Before and after the restoration project[31]

[31] Nathan Oalican, *Muddy River, 2011 and 2020* (Boston, Mass.: Google Earth, n.d.).

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Staff, Michael Levenson Globe, July 19, 2015, and 11:51 p m Email to a Friend Share on Facebook Share on TwitterPrint this Article View Comments54. "Boston 2024 Sees Columbia Road as Olmsted Jewel - The Boston Globe." *Boston Globe*. Accessed May 11, 2020. https://www.bostonglobe.com/metro/2015/07/19/boston-pledges-complete-olmsted-vision-columbia-road/VdXZpgM6VKdT3JJeDsbjIP/story.html.

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