CHAPTER THREE

ENVIRONMENTAL CONTEXT

The environmental context of a given area, including its geology, topography, hydrology, and natural resources, plays a significant role in determining the nature of human activity that took place within it over time. This chapter presents an overview of the environmental history of southern New England with specific reference to the Green Line Extension project in the Cambridge/Medford/Somerville area, proceeding from macro-level considerations, such as the effects of glacial activity in the Northeast, to site-specific conditions.

Physiographic Setting

The project lies within the Seaboard Lowland physiographic province of southern New England (Figure 3-1). It is part of the Eastern Plateau, a geological region characterized by broad, gentle slopes, low-rounded hills, and open valleys. At a more local scale, Cambridge, Somerville and Medford and several other adjacent towns are situated along the boundary of the Boston Basin and Middlesex fells uplands. The Boston Basin is a structural and topographic feature bounded on the north by a distinct fault zone (Billings 1976; Kaye 1976). The fault zone along the south/southeast margin of the Middlesex fells extends through Arlington and Belmont and includes Menotomy Rocks just southwest of Fresh Pond. Along the basin boundary escarpment west of Fresh and Spy Ponds the largest hills reach maximum elevations of 150–350 feet above sea level (ft asl). Below the basin boundary escarpment to the north and northeast of Fresh Pond is a large glacial outwash plain feature that extends from the lower Charles River to Alewife Brook and the Mystic River estuary. Elevations in the outwash plain range from 10–30 ft asl.

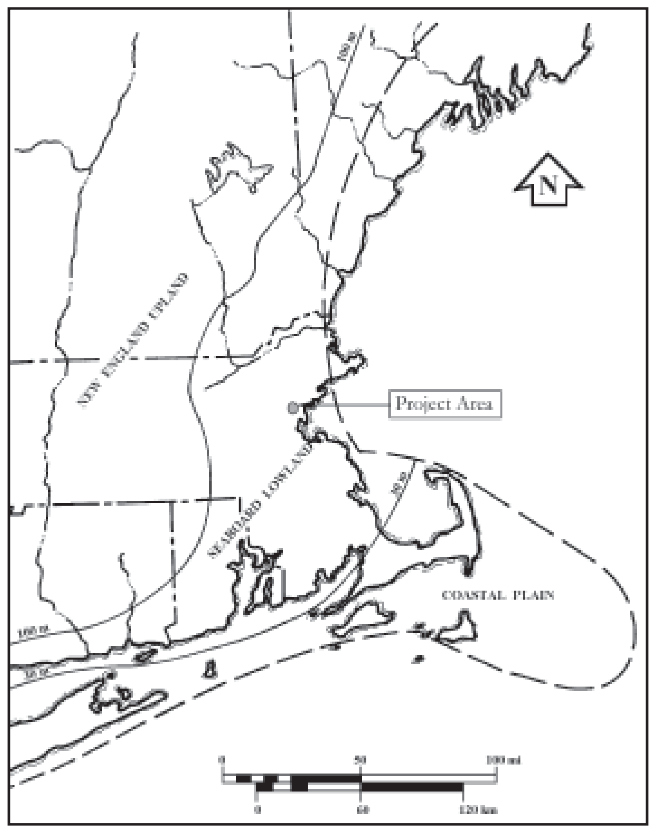

Figure 3-1. Physiographic zones of New England with the approximate location of the Green Line Extension project area (source: Fenneman 1938).

Geology and Glacial Activity

The bedrock underlying the project area is part of the Milford-Dedham Tectonic Zone, a lithotectonic subdivision consisting of upper Proterozoic quartzite, volcanic, and plutonic rocks extending across the Boston region, southeastern Massachusetts, Cape Cod, and into northern Rhode Island (Zen et al. 1983). The bedrock is typically oriented from the southwest to the northeast, following the tectonic plate. A secondary system of north-south faults enabled watercourses such as the Malden, Mystic, and Aberjona rivers to flow out of the Middlesex Fells. The granites, gneisses, dolomites, and felsites are visible in exposed ledges in the Blue Hills and the Middlesex Fells. In different areas, these rocks may be intruded by granites, metamorphosed to gneiss, or overlain and cut by rocks from other zones.

The primary bedrock type underlying the project is Cambridge Argillite, which is deeply buried under glacial outwash deposits. This formation includes gray argillite, some quartzite, and small amounts of sandstone and conglomerate (Clapp 1902). Cambridge Argillite was an important lithic raw material for the manufacture of chipped-stone tools by pre-contact period Native American populations in the northern Boston Basin and several river drainages to the west. During the post-contact period the argillite along with slate was used for building material (foundation stone, roofing slate) and gravestones. Eighteenth-century quarries operated in Medford and Somerville (MHC 1981a).

The original topography of the Boston Basin is largely the result of glacial activity (Kaye 1976). Successive advances and retreats of ice sheets have eroded the soft, fine-grain argillite bedrock of the basin and dropped a series of outwash deposits creating large areas of swamp and bog. Much of this erosion occurred during the Wisconsin Glacial Period. The retreat also exposed a system of drumlins, smooth elliptical hills composed of gravels. Many of these drumlins were leveled for materials to fill low-lying areas but some evidence still remains (Beacon Hill, Bunker Hill). Drumlins are generally elongated in shape, with the long axis considered indicative of the direction of ice flow. Within the Boston Basin, however, drumlin shape varies greatly. This along with other evidence indicates that glacial ice flowed into the area from various directions, ranging from the southwest to the east (Kaye 1976).

The surficial geology of southern New England is attributed to Pleistocene glacial effects. The final Pleistocene glacial advance and retreat during the Wisconsin period eroded and displaced bedrock, realigned drainages, and deposited till, erratics, and glacial moraine. Evidence of these effects is widespread. The landscape was covered both by glacial till, a “heterogenous mixture of rock particles ranging in size from clay to fine silt to boulders [erratics]” (Power 1957) deposited directly by the retreating ice, and by sand and gravel outwash, deposited by meltwater streams. The resulting landscape consists of kame terraces, outwash plains, and ground moraine. Other glacially formed landscape features occur in localized areas and include swamp deposits of partially decomposed organic material mixed with sand, gravel, and alluvium, and pockets of sorted sand, gravel, and silt (Power 1957).

Glaciation also influenced the coastline and drainages in the Boston Area. Rising sea levels, local topography, and crustal rebound produced a flooded landscape. The larger drumlins became islands and peninsulas, and major rivers became estuaries.

Hydrology

The project is located within the Charles and Mystic river drainage basins (Figure 3-2). The confluence of Boston Inner Harbor, the Charles River, and the Mystic River intersect within one-half mile of the eastern limit of the Green Line Extension project area. Beginning in Hopkinton, the Charles River meanders for 80 miles and drains 308 square miles in 35 municipalities before emptying into Boston Harbor (CRWA 2007). The river is generally divided into three subregions: the rural upper basin, the suburban lakes or middle region, and the urban lower basin. The project area is within the lower basin, where the Charles River converges with another major watershed, the Mystic River at the western portion of Boston Harbor. The urban lower basin is formed by the tidal estuary of the Charles, and extends 8 miles upstream from Boston Harbor to Watertown Square. This section of river was subject to the ebb and flow of the tides until the completion of the Charles River Dam near the harbor in the early 1900s. Almost the entire length of the estuary was characterized by salt marshes until the early post-contact period.

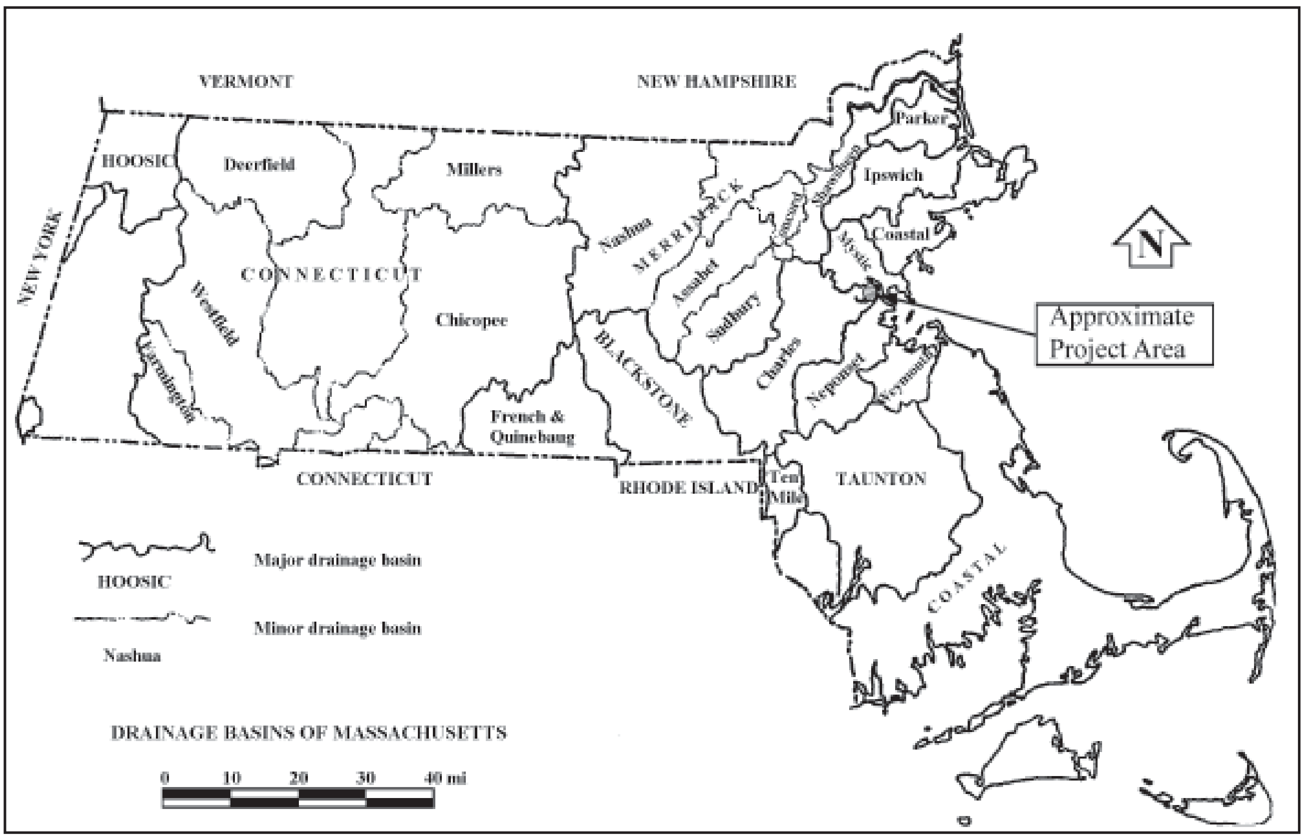

Figure 3-2. Drainage basins of Massachusetts, with the approximate location of the Green Line Extension project area.

The Mystic River has a total length of 17 miles and meanders northwest to southeast. The headwaters of the system begin in Reading and form the Aberjona River, which flows into the Upper Mystic Lake in Winchester. The Mystic River flows from the Lower Mystic Lake through Arlington, Medford, Somerville, Everett, Charlestown, Chelsea, and East Boston before emptying into Boston Harbor (MRWA

2007). The Mystic River is classified as an urbanized system, dammed by flood control and salt water control dams (Bickford and Dymon 1990).

Prior to the nineteenth and twentieth century the Millers River, also known as Gibbons Creek or Willis Creek, provided a marshy landscape and tidal estuary environment along the northern boundary of the former Lechmere Point. The filling and landmaking in East Cambridge, which began in the 1830s and continued through the 1920s, completely eliminated the Millers River at this location, which historically separated Cambridge and Charlestown (Maycock 1988).

Soils

Primarily a marshland/estuarine environment before European contact, the area has been extensively filled and modified over the past several centuries so that the constituent soils are now Urban Land (USDA 1986). Urban land is characterized by areas where the soil has been altered or obscured by buildings, industrial buildings, paved parking lots, sidewalks, roads, and/or railroad yards. More specific soils information, largely obtained from the Geotechnical Data Report prepared for the project (Parsons Brinckerhoff 2008), is discussed in Chapter 7: Results for Archaeological Resource Potential.