Massachusetts Department of Conservation and Recreation
Bureau of Planning, Design & Resource Protection
Resource Management Planning Program

RESOURCE MANAGEMENT PLAN

Charles River Esplanade - New Basin Complex

Including the Charles River Lower and New Basins, and City Square Park

February 2015

Cover Photo
Hatch Memorial Shell Area on the Boston Esplanade

dcr
Massachusetts

Charles River Esplanade - New Basin Complex

Including the Charles River Lower and New Basins, and City Square Park

RESOURCE MANAGEMENT PLAN

2015

Charles D. Baker, Governor
Karyn E. Polito, Lt. Governor
Matthew A. Beaton, Secretary
John P. Murray, Commissioner

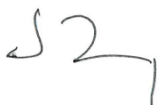
Resource Management Plans provide guidelines for management of properties under the stewardship of the Department of Conservation and Recreation (DCR). They are intended to be working documents for setting priorities, enabling the Department to adapt to changing fiscal, social and environmental conditions. The planning process provides a forum for communication and cooperation with park visitors, partners and the surrounding communities to ensure transparency in the DCR's stewardship efforts.

The parks within the Charles River Esplanade - New Basin Complex are among the most popular in the Commonwealth. They provide a variety of recreational opportunities, from scenic walks along the river, to bike rides along the 18-mile Dr. Paul Dudley White Bicycle Path, to taking in a summer concert at the Hatch Shell or in City Square Park. These parks are a common ground where people of widely different backgrounds meet.

Intense boating activity makes the Lower Basin one of the nation's great water parks. Each year the Charles River welcomes crew teams and rowers from around the world. The Lower Basin has a long tradition of public rowing and sailing programs. It is an important resource for private boaters and tour boats.

A half million people attend the Boston Pops concert and fireworks display held at the Hatch Shell every Independence Day. The Boston Esplanade also hosts more than seventy free public concerts, movies and special events each year.

This Resource Management Plan represents both a connection to the historic past and a guide to the future for the DCR properties within the Charles River Esplanade - New Basin Complex. Recommendations are provided to protect these resources while providing for compatible recreation, so that they may be enjoyed for generations to come.



John P. Murray
Commissioner

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, dams, and parkways. Led by Commissioner John P. Murray, the agency's mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources for the well-being of all. To learn more about the DCR, our facilities, and our programs please visit us at http://www.mass.gov/eea/agencies/dcr. Contact us at mass.parks@state.ma.us.

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EXECUTIVE SUMMARY

INTRODUCTION

Resource Management Plans (RMPs) are working documents that provide a guide to the short- and long-term management of properties under the stewardship of the Department of Conservation and Recreation (DCR). They include an inventory and assessment of natural, cultural, and recreational resources; identify unique characteristics and values of a property; and analyze complex resource protection and recreation issues. They guide the management of DCR's properties by setting priorities, targeting capital and operational resources, protecting sensitive resources, and improving communication and cooperation with park visitors, stakeholder organizations and the surrounding communities.

The Department of Conservation and Recreation is directed by a legislative mandate (M.G.L. Chapter 21: Section 2F) to prepare management plans for "all reservations, parks, and forests under the management of the department." Although the mandate does not specify the format or content of these management plans, it does require that:

"Said management plans shall include guidelines for the operation and land stewardship of the aforementioned reservations, parks and forests, shall provide for the protection and stewardship of natural and cultural resources and shall ensure consistency between recreation, resource protection, and sustainable forest management."

The legislative mandate also establishes two other requirements. First, that the DCR "shall seek and consider public input in the development of management plans, and shall make draft plans available for a public review and comment period through notice in the Environmental Monitor." Second, management plans must be reviewed and adopted by the DCR Stewardship Council, a volunteer citizen oversight entity. Within 30 days of adoption, the Commissioner "…shall file a copy of such management plans as adopted by the council" with the Secretary of State and the Joint Committee on the Environment, Natural Resources and Agriculture.

CHARLES RIVER ESPLANADE - NEW BASIN COMPLEX

This plan covers the Charles River Esplanade - New Basin Complex located at the mouth of the Charles River in the municipalities of Boston and Cambridge. The Charles River Esplanade - New Basin Complex is one of 32 management units maintained and operated by DCR. This designed landscape includes parkways, parks and natural areas along a 3-mile long portion of the Charles River Basin extending from the BU Bridge to Boston Harbor. The Charles River Esplanade is well known for its Independence Day celebrations at the Hatch Shell.

DCR staff assigned to the Charles River Esplanade - New Basin Complex manages the Cambridge and Boston Esplanades, New Basin Parks, City Square Park, Memorial and Storrow Drives, two indoor skating rinks, two dams and six pedestrian bridges connecting adjacent neighborhoods to the parks. Seven boathouses, two yacht clubs, a food concession, and the Museum of Science are operated by private organizations on DCR property within the Complex. Boston University, the Massachusetts Institute of Technology and Massachusetts General Hospital are located adjacent to the Complex.

MANAGEMENT PRINCIPLE AND GOALS

The resource management planning process has identified the following management principle and associated goals to guide future management of the Charles River Esplanade - New Basin parks, and provide a foundational structure for this plan.

Management Principle

Create a more sustainable, universally accessible pastoral landscape that restores the park's historic character and provides high-quality recreational facilities through the creative use of limited state resources and private partnerships.

Management Goals

Improve river water quality.

- Achieve swimmable and fishable water quality.

- Maximize public access to the water while ensuring a safe and quality experience for all.
- Raise awareness of water-access opportunities.

Enhance the natural landscape.
- Diversify plant communities for a healthier and more attractive native landscape.
- Enhance wildlife habitats while managing invasive plant species.
- Establish a more sustainable and easily maintained landscape.
- Establish best management practices for achieving the highest quality of design, sustainability, maintenance and landscape restoration for the park.
- Interpret the natural resource systems of the parks and the region.

Restore the Cambridge Esplanade.
- Enhance the character-defining features of the landscape while adapting the park for contemporary users.
- Install historical lighting and benches.
- Separate footpaths and bike paths.

Provide contemporary recreation facilities on the Boston Esplanade.
- Assure that all park uses shall be public in nature or provide direct and substantial public benefits.
- Support a variety of uses that relate to and directly benefit from the river setting.
- Balance and distribute active and passive uses along the banks in a manner that minimizes conflicts, restores historic buildings and protects the landscape.
- Separate footpaths and bike paths.
- Ensure that park structures complement the pastoral river setting.
- Improve public access to the banks and water for people of all ages, abilities and backgrounds.
- Support use of the park during the winter months and evening hours wherever possible.
- Provide a wide range of regional events and programs while mitigating impacts on both the park and surrounding neighborhoods.
- Reduce the impact of cars on pedestrian paths and parklands.

Complete the New Basin parks and pathways.
- Provide safe and continuous bicycle, skating, running, jogging and pedestrian access along the entire length of the New Basin.
- Complete riverfront parks at the old lock area and Lovejoy Wharf.
- Establish easier and safer pedestrian and bike access across the river, railroads and dams.
- Reclaim as much previously public open space from parking uses as required by Ch. 91.

MANAGEMENT RECOMMENDATIONS

Recommendations are characterized on the basis of priority (i.e., High, Medium, or Low) and resource availability. High priority recommendations are those that address regulatory compliance or public health and safety; prevent immediate damage to, or loss of, resources; or repair or replace damaged equipment or systems critical to park operations. They are typically time sensitive. Medium priority recommendations maintain existing resources and visitor experiences. Low priority recommendations enhance resources or visitor experiences; they are not time sensitive.

Resource availability considers both funding and labor. A resource availability of "1" indicates that funding and/or labor are available to implement the recommendation. A resource availability of "2" indicates that funding and/or labor are not currently available but may become so in the near future (i.e., the next five years). A resource availability of "3" indicates that funding and/or labor are not anticipated in the next five years. Resources to implement these recommendations may, or may not, become available after five years.

This RMP identifies 52 recommendations; 25 are classified as high priorities (see Table 1). Resources are currently available to implement 13 of these high priority recommendations. It is anticipated that resources will be available within the next five years to implement the remaining 12 high priority recommendations. Short-term actions to advance the management recommendations and the lead DCR unit responsible for coordinating their implementation are identified in the Action Plan that accompanies this Executive Summary (see Table 2).

Table 1. Number of Management Recommendations by Priority and Resource Availability

	Resource Availability[a]			
Priority	**1**	**2**	**3**	**Total**
High	13	12	0	25
Medium	7	17	0	24
Low	0	2	1	3
Total	20	31	1	52

a. Availability of resources for implementing recommendations: 1 = funding and/or labor is currently available; 2 = funding and/or labor is currently unavailable, but may become so in the next five years; and 3 = funding and/or labor is currently unavailable, but may become so in more than five years.

Table 2. Action Plan 2015-2018

Short Term Action	DCR Lead Unit
Improve river water quality.	
Require that all capital projects employ stormwater best management practices, treatment systems that remove phosphorus from stormwater, and state-of-the-art Low Impact Development techniques to encourage stormwater infiltration and reduce surface runoff into the River (e.g., vegetated swales, infiltration catch basins and stormceptors).	Engineering
Establish and maintain low vegetative riparian buffers using native species along the shoreline to provide wildlife forage and cover; increase stormwater infiltration directly into the groundwater table; restrict the ability of geese to move between water and lawn without flying; and absorb sediments and nutrients before they enter the River.	Planning
Enhance the natural landscape.	
Collaborate with the Division of Marine Fisheries to support an evaluation of diadromous fish migration at the New Charles River Dam in order to optimize fish passage, with consideration for the dam's operation, existing hydrologic and hydraulic conditions. Decommission the existing fish passage to minimize migratory fish kills in the fish ladder.	Planning
Implement invasive plant best management practices to support native plant populations along the River. Work with stakeholder organizations to develop an Invasive Plant Management Plan for species determined to be "invasive" or "likely-invasive" by the Massachusetts Invasive Plant Advisory Group. Implement the Plan after appropriate review and approval by local and state regulatory authorities.	Planning
Discourage Canada geese from congregating along the riverbanks by mowing the lawn as infrequently as possible and planting less-palatable grass species (e.g., tall fescue K-31 instead of Kentucky bluegrass). Use low vegetative buffers adjacent to the riverbank, solar powered geese beacons and trained dogs to discourage geese from feeding in active recreation areas.	MassParks

Continued on next page.

Table 2. Action Plan 2015-2018 (Continued)

Short Term Action	DCR Lead Unit
Restore the Cambridge Esplanade.	
Construct the previously designed and permitted Memorial Drive Phase II project that will introduce a parallel multi-use path along Memorial Drive to separate pedestrian and bike traffic, install historic lighting and make landscape improvements. Add stormwater improvements to promote stormwater infiltration and implement best management practices to remove nutrients, pollutants and suspended sediments from stormwater.	Engineering
In conjunction with the Longfellow Bridge project, create new traffic signals and crosswalks to link the Broad Canal path to Cambridge Parkway.	Planning
Provide contemporary recreation facilities on the Boston Esplanade.	
Work with The Esplanade Association to develop and implement a comprehensive ecologically sustainable landscape management plan for the Lower Basin.	Planning
Work with stakeholder organizations to develop an interpretive master plan for the Complex including recommended themes, interpretive signage, program descriptions and staff requirements.	Ranger Services
Work with Community Boating to repair the boathouse roof and exterior masonry, and install a lift to provide ADA access to the second floor.	Engineering
Where feasible, separate bicycle paths from lower speed walking paths throughout the basin and use softer surfaces on paths for runners and joggers. Work with stakeholder organizations to improve visitor safety through pavement markings, signage, public awareness campaign, changes to pathway surfaces and enforcement.	Planning
Design, permit and construct a new multi-use path connecting the Emerald Necklace at Beacon Street to the Boston Esplanade using the Harvard Bridge multi-use ramp.	Planning
Work with stakeholder organizations to develop a uniform directional, regulatory, informational and donor recognition signage system for the Lower and New Basin Parks to enhance pedestrian and bicycle connectivity.	Planning
Work with MassDOT and the Mass Eye and Ear Infirmary to integrate new parkland into the Boston Esplanade created by relocating the Storrow Drive west bound lanes under the inland Longfellow Bridge arch adding 75 feet of useable riverfront parkland at a critical choke point; and constructing a garage under the Charles Circle ramps with a new surface park that connects the Boston Esplanade to the hospital area and Charles/MGH station.	Planning
Work with The Esplanade Association (TEA) to prepare a coordinated public/private action plan to implement the Esplanade 2020 Vision for the Hatch Shell area.	Planning
Restore Commissioners Landing and the Grand Promenade on the Boston Esplanade. Build a new events/services court with seating and picnic areas.	Planning
DCR undertake a reuse study of the Lee Pool area that incorporates current DCR program needs and considers the feasibility of the TEA Esplanade 2020 Vision for an all-seasons recreation program.	Planning

Continued on next page.

Table 2. Action Plan 2015-2018 (Continued)

Short Term Action	DCR Lead Unit
Complete the New Basin parks and pathways.	
Stabilize the historic Upper Lock Gate House and Boat House by renovating the building exterior, repairing structural defects and removing hazardous materials.	Planning
Seek legislative authorization to include the historic Upper Lock Gate House, Boat House and Stable Buildings in the DCR Historic Curatorship Program.	Planning
Remediate the North Point CA/T contaminated soil stockpile.	Engineering
The on-going DCAM, State Police, DCR facility study of the Old Lock Area consider the recommendations of the TEA Esplanade 2020 Vision to create a new entry plaza to greet and orient visitors to the Esplanade.	Planning
Fund MBTA design and construction of a multi-use pathway on the upstream side of the Bascule Railroad Drawbridge connecting the North Point and Nashua Street parks.	Planning
Design, permit and construct a new 12’ wide multi-use South Bank Bridge over the MBTA railroad tracks behind North Station connecting Nashua Street Park to the proposed South Bank Park.	Engineering
Design and construct inundation protections for the Charles River Dam Pump Station to protect the flood control pumps from rising sea levels.	Engineering

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Charles River Lower Basin

SECTION 1. INTRODUCTION

1.1. MISSION OF THE DEPARTMENT OF CONSERVATION AND RECREATION

The Department of Conservation and Recreation (DCR) is responsible for the stewardship of approximately 450,000 acres of Massachusetts' forests, parks, reservations, greenways, historic sites and landscapes, seashores, lakes, ponds, reservoirs and watersheds. The DCR was created pursuant to state legislation that in 2003 merged the former Metropolitan District Commission (MDC) and the former Department of Environmental Management (DEM). It is one of the largest state park systems in the country. The mission of the DCR is:

"To protect, promote and enhance our common wealth of natural, cultural and recreational resources for the well being of all."

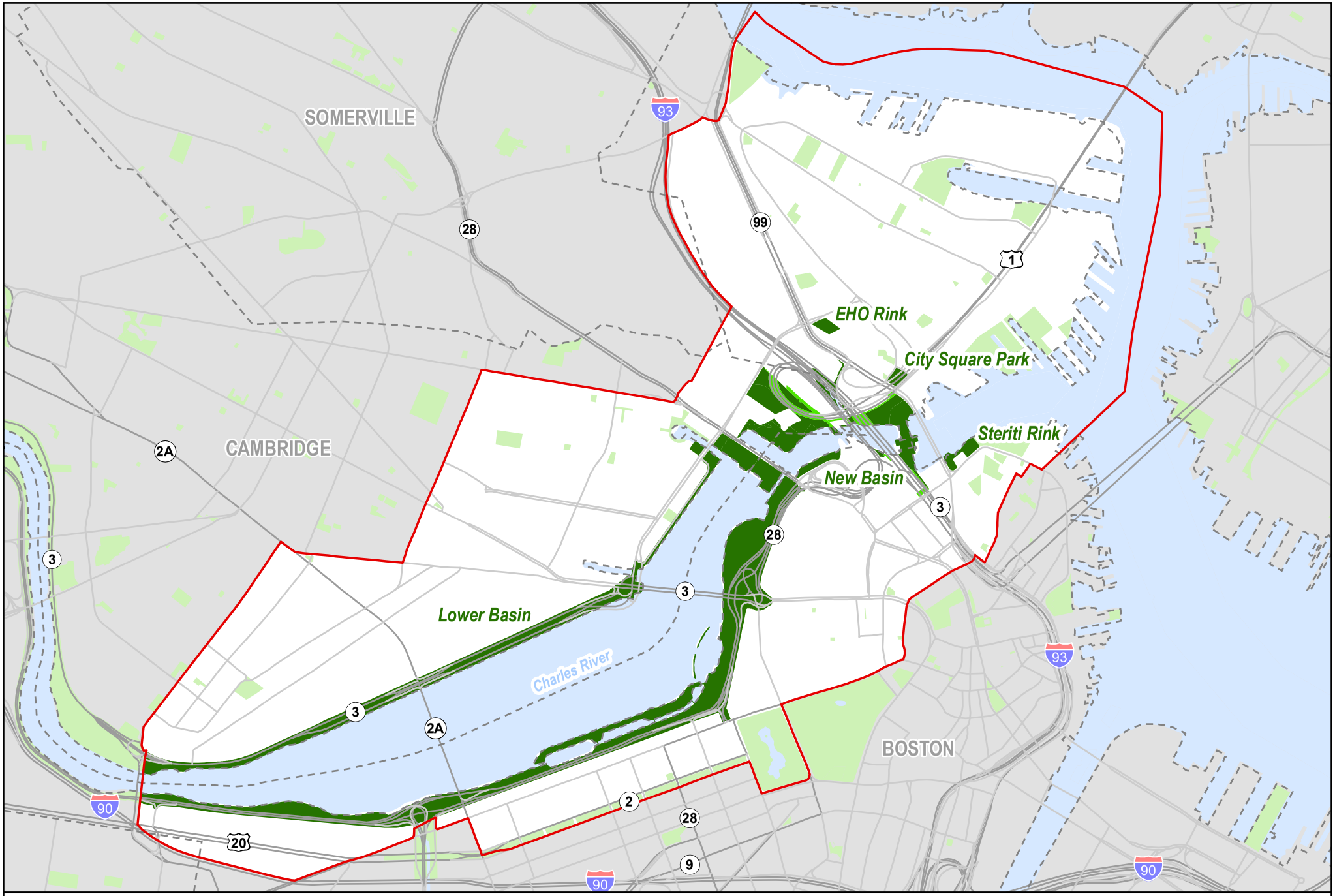
In meeting today's responsibilities and planning for tomorrow, the DCR's focus is to:

- Protect our state's natural and cultural resources.
- Enhance outdoor recreation opportunities for our residents.
- Continue investment in current and new facilities and programs.
- Promote access to all programs and facilities.
- Expand public involvement in carrying out the DCR's mission.
- Establish first-rate management systems and practices.

The health and happiness of people across Massachusetts depend on the accessibility and quality of our green spaces – our natural and cultural resources, recreation facilities, and great historic landscapes. The DCR continues to improve this vital connection between people and their environment.

1.2. CHARLES RIVER ESPLANADE - NEW BASIN COMPLEX

The Charles River Esplanade - New Basin Complex includes the Charles River Lower and New Basins, City Square Park, and two ice skating rinks. These properties are included in this plan because of their physical proximity, and because they share a common management structure; all are part of the DCR's Charles River Esplanade - New Basin Complex administrative unit. Locations of these properties are identified in Map 1.


SOMERVILLE
CAMBRIDGE
BOSTON
EHO Rink
City Square Park
Steriti Rink
New Basin
Lower Basin
Charles River
93
99
28
1
2A
3
90
20
2
9
Esplanade - New Basin Complex
DCR Fee Interest
DCR Other Legal Interest
Other Protected Open Space
Open Water
Major Road
Minor Road
Town Boundary
Properties Included in the Charles River
Esplanade - New Basin Complex RMP
0
0.25
0.5
Mile
Geographic data provided by MassGIS and DCR GIS.
N
W
E
S
dcr
Massachusetts

The Charles River Esplanade - New Basin Complex is the final 3-mile run of the longest river within Massachusetts. From its source at Echo Lake in Hopkinton to its termination in Boston Harbor, the Charles River twists and turns eighty miles dropping 340 feet in elevation.

Historically, the Charles River Basin was a shallow and muddy tidal estuary. In 1910, completion of the first Charles River Dam turned tidal marshes and mud flats into a fresh water basin. The Lower Basin, located between the Boston University (BU) Bridge and the first Charles River Dam, was designed to provide city dwellers access to outstanding river scenery and recreational opportunities on both land and water. Less than 300 feet wide at the BU Bridge, the Lower Basin expands to 2,200' at the Esplanade.

The New Basin extends the Charles River Lower Basin a half-mile below the first Charles River Dam to the new Charles River Dam and Boston Harbor. The Central Artery/Tunnel (CA/T) Project funded the construction of the New Basin and City Square Parks to mitigate highway impacts on the river.

DCR staff assigned to the Charles River Esplanade - New Basin Complex is responsible for managing the river, shore lands and parkways located between the BU Bridge and Boston Harbor. This three-mile basin is a complex weave of natural, historic and recreational resources, including two dams, two parkways, five vehicular and six pedestrian bridges, four public boat landings, eight boathouses, a yacht club, and two indoor ice skating rinks.

Though entirely designed, the Basin contains wildlife habitat for hundreds of animal and plant species that play a role in the ecology of the region and enrich the experience of urban park users. Water quality in the once heavily polluted Basin has improved dramatically in recent years, creating better habitat for wildlife and attracting people back to the river.

The Basin is one of the most intensely used recreational resources in the Boston metropolitan area. The River is within walking distance of more than 250,000 urban residents. From spring through fall, between five and twenty thousand people enjoy the basin parks each day. During the famous Fourth of July festivities held along the river, crowds reach half a million people. Small sections of the Basin, such as the Boston and Cambridge Esplanades, North Point Park and Lederman Park, have enormous local significance, providing crucial and intensely used open space for the urban neighborhoods that border them. At the same time, these small park areas are part of a continuous greenway along the Charles River that is used by many to travel greater distances.

The river itself is a world-renowned recreational boating resource. The Lower Basin has a proud tradition of promoting access to the water, and is home to Community Boating, the oldest public sailing program in the nation. Children under the age of 16 can sail all summer for an affordable fee that is based on family income. Close to 1,500 youth participate each year and thousands have learned to sail on the Lower Basin over the last six decades. The Head of the Charles Regatta is one of the largest rowing events in the world, bringing more than 3,500 rowers and 700 boats to the river each fall, making the area one of the international centers of the sport.

The banks of the river support a wide range of activities from picnicking to sunbathing, people watching to dog walking, playing volleyball to playing baseball. The eighteen mile loop of the Paul Dudley White Path is suitable for road races and walkathons as well as distance biking, inline skating, and running. The Hatch Shell, in addition to hosting more than 70 free public concerts and special events each year, is the stage for Boston's famous Fourth of July festivities.

This vibrant mixture of uses and people makes the Charles River Esplanade - New Basin Complex one of the most diverse and intensely used open spaces in the region, and one of its best-loved places. It is also one of the region’s most scenic. The Lower Basin in particular, with the elegant simplicity of the MIT seawall on one bank and the formal grace of the Esplanade on the other, is emblematic of the Boston area, its image gracing postcards, T-shirts, and many movie and TV series filmed in the city. The role of the Lower Basin in creating the identity of the host cities is evident in the fact that many residents and visitors think first of the Charles River Lower Basin when they think of the Boston region.

After a century of use, the Lower Basin is showing signs of wear. Decades of underfunding, reduced park staffing and deferred maintenance have placed a strain on its resources and compromised the

visitors' experience. Granite steps are deteriorating, park turf is severely compacted and worn, historic buildings need significant work, paths and parts of the river are overcrowded, and invasive plants compromise river bank and wetland habitat.

This Resource Management Plan (RMP) addresses DCR's ability to provide continued public access to the basin parks while protecting their natural resources, cultural resources, and existing infrastructure. It provides guidance that will promote, protect, and enhance resources in the Charles River Esplanade - New Basin Complex.

1.3. Resource Management Plans

Resource Management Plans (RMPs) guide the management of properties under the stewardship of the DCR. They inventory and assess natural, cultural and recreation resources; identify current management practices and capabilities; and develop specific, implementable management recommendations.

The DCR is required to prepare management plans for "all reservations, parks, and forests under the management of the department" (M.G.L. Chapter 21: Section 2F). These plans "shall include guidelines for the operation and land stewardship of the aforementioned reservations, parks and forests, shall provide for the protection and stewardship of natural and cultural resources, and shall ensure consistency between recreation and resource protection." This is achieved through the preparation of RMPs.

This RMP covers the Charles River Esplanade - New Basin Complex, one of 32 field management units that maintain and operate DCR's facilities statewide. DCR staff assigned to the Charles River Esplanade - New Basin Complex is responsible for management of all DCR's facilities located along the 3-mile section of the Charles River located between the BU Bridge and Boston Harbor.

1.4. The Planning Process

RMPs are developed by the DCR's Regional Planning Program through an iterative process of data gathering and analyses, public input, writing, review, and revision.

Public input is an important part of the resource management planning process. The legislative mandate that requires the preparation of management plans directs the Commissioner of the DCR to "seek and consider public input in the development of management plans, and ... make draft plans available for a public review and comment period through notice in the Environmental Monitor."

There were two periods of public input associated with the preparation of this RMP. The first occurred early in the planning process, prior to preparing the RMP. The second coincided with the release of the draft plan. A public meeting was associated with each of these comment periods. Additional information on public participation in the development of this plan is provided in Appendix B.

Following public comment and revision, draft RMPs are submitted to the DCR Stewardship Council for review. Once reviewed and adopted by the council, RMPs become the primary guidance document for managing a complex's resources.

Notice of a public meeting and of the DCR's intent to prepare an RMP for the Charles River Esplanade - New Basin Complex was published in the September 25, 2013 Environmental Monitor. Notices were also e-mailed or mailed to Charles River stakeholder organizations. An initial public meeting was convened at the Shriners Hospital for Children, Boston on October 10, 2013. Twenty two people attended this meeting, which ran from 6:30 to 7:40 P.M. Public input on this plan was received at the meeting; an additional two written comments were received via U.S. and e-mail after the meeting.

Notice of a public meeting on the draft RMP for the Charles River Esplanade - New Basin Complex, and of the availability of the draft plan, was published in the August 27, 2014 Environmental Monitor. Notices were also e-mailed or mailed to approximately 95 stakeholders. The meeting was held on September 18, 2014 at the Shriners Hospital for Children, Boston; approximately 28 people attended.

The public comment period on the draft RMP ran from September 18 through October 31, 2014; eleven written comments were received. Detailed information on the public process for this RMP is provided in Appendix B (Public Participation).

This Resource Management Plan was submitted to the DCR's Stewardship Council on December 5,

2014, and was adopted by the council on February 6, 2015.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) has regulatory authority for, and experts on, the plants and animals protected under the Massachusetts Endangered Species Act (MESA). They provide assistance, in both capacities, with the preparation of RMPs. Since no state-listed species have been documented within the Complex, the NHESP has not designated any portion of the Complex as Priority Habitat.

1.5. MANAGEMENT PRINCIPLE AND GOALS

The resource management planning process has identified the following management principle and associated goals to guide future management of the Charles River Esplanade - New Basin parks, and provide a foundational structure for this plan.

Management Principle

Create a more sustainable, universally accessible pastoral landscape that restores the park's historic character and provides quality recreational facilities through the creative use of limited state resources and private partnerships.

Management Goals

Improve river water quality.
- Achieve swimmable and fishable water quality.
- Maximize public access to the water while ensuring a safe and quality experience for all.
- Raise awareness of water-access opportunities.

Enhance the natural landscape.
- Diversify plant communities for a healthier and more attractive native landscape.
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- Provide safe and continuous bicycle, skating, jogging, running and pedestrian access along the entire length of the New Basin.
- Complete riverfront parks at the old lock area and Lovejoy Wharf.
- Establish easier and safer pedestrian and bike access across the river, railroads and dams.
- Reclaim as much previously public open space from parking uses as possible.

Table 3. Physical, Ecological and Political Settings

Management Unit:	Charles River Esplanade - New Basin Complex			
Location:	Boston and Cambridge			
DCR Management Structure:	Region: Boston District: Rivers			
Properties:	**Municipality**	**Land Area[ab] (acres)**	**Water Sheet[a] (acres)**	**Total Area[a] (acres)**
Charles River Lower Basin	Boston, Cambridge	164.3	433.8	598.1
Charles River New Basin	Boston, Cambridge	33.9	26.8	60.7
City Square Park	Boston	1.4	0.0	1.4
Ice Skating Rinks	Boston	3.0	0.0	3.0
EPA Ecoregion:	Boston Basin			
Watershed:	Charles River			
Legislative Districts:				
Senate:	Middlesex and Suffolk First and Second Suffolk and Middlesex			
House:	Second, Seventh, Eighth, Ninth and Eighteenth Suffolk Twenty Sixth Middlesex			
Designations:	**Property**	**Designation**		
	Lower Basin	National Register of Historic Places		
	Lower Basin	National Historic Civil Engineering Landmark		
	Charles River	BioMap2 Aquatic Core Habitat		
	Boston Esplanade	Boston Landmark District		
	Boston and Cambridge	Environmental Justice Populations - 32,078 people[ac]		

a. These values were calculated through the use of a Geographic Information System.
b. Values are for land owned in fee by DCR, and do not include Easements or Access Right of Ways.
c. This value reflects the total population of 2010 Census Block Groups that intersect with the Complex boundary. Individuals live within and just outside the Complex boundaries.

1.6. REGIONAL CONTEXT

The Charles River Esplanade - New Basin Complex is located in the cities of Cambridge and Boston. Within the Complex, the municipal boundaries are located along the historic center lines of the Charles and Miller Rivers. Created from tidal marshes and mud flats, the Complex provides both cities with access to outstanding river scenery, and recreational opportunities on both water and land.

City of Boston

Boston was founded on the Shawmut Peninsula in 1630 by Puritan colonists from England. Boston grew to be an important port and manufacturing hub, as well as a center for education and culture. The area's many colleges and universities make Boston an international center of higher education, medicine and high technology industries.

Construction of the interstate highway system after World War II accelerated the movement of families from Boston to surrounding suburban communities. As a result of this migration, Boston's total population declined by 29.8% between 1950 and 1980. Since 1980, Boston's total population has increased modestly by 13.0%. The 2010 U.S. Census reported that Boston had 617,594 residents, a 4.8% population increase over 2000.

Approximately 1.2 million people are in Boston during work hours, and as many as 2 million during special events. This fluctuation is caused by hundreds of thousands of suburban residents who travel to the city for work, education, health care and special events.

The Greater Boston metropolitan area has the sixth largest economy in the country and 12th largest in the world. Area colleges and universities are major employers and attract industries to Boston,

Cambridge and the surrounding metropolitan area. Tourism comprises a large part of the Boston's economy, with 21.2 million visitors spending $8.3 billion in 2011. Other important industries are financial services, insurance, health care, high tech industries, professional and business services, and government activities.

In 2010, Boston's population was 47.0% non-Hispanic white, 22.4% Black or African American, 17.5% Hispanic and 8.9% Asian. In 2010, the median household income was $51,729 with 16.0% of families below the poverty line. Of the total population, 28.8% of those under the age of 18 and 20.4% of those 65 and older were living below the poverty line.

City of Cambridge

Cambridge was settled in 1631 several miles up the Charles River from Boston Harbor. Harvard College was founded in 1636 to train Puritan ministers. Cambridge grew slowly as an agricultural village until the West Boston Bridge was completed in 1792 connecting Cambridge directly to Boston. Between 1790 and 1840, Cambridge grew rapidly as former country estates and marshland were converted into prime industrial and residential districts. By 1920, Cambridge was one of the main industrial cities of New England, with nearly 120,000 residents. As industry declined throughout New England during the Great Depression and after World War II, Cambridge lost much of its industrial base. As Harvard and Radcliffe Colleges grew, and the Massachusetts Institute of Technology (MIT) moved from Boston in 1916, Cambridge became a national center of higher education.

After World War II, the city's population began to decline slowly as families moving to the suburbs were replaced by single people and young couples. The city's total population declined by 21.1% between 1950 and 1980. Since 1980, Cambridge's total population has increased modestly by 10.3%. In the 2010 U.S. Census, Cambridge had 105,162 residents, a 3.8% population increase over 2000.

Manufacturing was an important part of the economy in the late 1800s and early 1900s, but educational institutions are now the city's largest employers. Harvard University and MIT are the two largest employers in the city with over 18,300 employees. Proximity to Cambridge's universities has made the city a center for technological innovation, nonprofit groups and think tanks. Today Novartis Institutes for BioMedical Research, Vertex Pharmaceuticals, Genzyme, Biogen Idec and Pfizer are among the top ten employers in the city with over 7,800 employees.

In 2010, Cambridge's population was 62.1% non-Hispanic white, 11.7% Black or African American, 17.5% Hispanic and 15.1% Asian. In 2010, the median household income was $59,423 with 8.7% of families below the poverty line. Of the total population, 15.1% of those under the age of 18 and 12.9% of those 65 and older were living below the poverty line.

Environmental Justice Populations

It is the policy of the Executive Office of Energy and Environmental Affairs (EOEEA) that environmental justice shall be an integral consideration in the implementation of all EOEEA programs, including the provision of access to both active and passive open space. All EOEEA agencies, including DCR, have been directed to identify and promote agency-sponsored projects, funding decisions and other actions to further environmental justice in the Commonwealth.

Environmental Justice Populations are those segments of the population that are least likely to gain access to state environmental resources. They are defined as neighborhoods whose annual median household income is equal to or less than 65 percent of the statewide median or whose population is 25% minority, foreign born or lacking English language proficiency.

Significant Environmental Justice Populations live in densely populated older urban neighborhoods served by the Charles River Esplanade - New Basin Complex (e.g. Boston, Cambridge, Somerville and Chelsea).

Table 4. Significant Historic Events

Year	Event
1630	Town of Boston established on the Shawmut Peninsula.
1631	Newtowne (changed to Cambridge in 1638) designated the capital of the Massachusetts Bay Colony.
1786	The Charles River Bridge opened between Boston and Charlestown.
1793	West Boston Bridge connects Cambridge Street in Boston with Main Street in Cambridge.
1809	Canal (Craigie's) Bridge opened from Boston to Lechmere Point in Cambridge.
1821	The Mill Dam is completed (along present-day Beacon Street) between Boston and Brookline.
1835	Railroads build causeways across the Back Bay and Millers River, and a bridge across the Charles River to Boston (North Station).
1851	The Union Boat Club builds a boathouse west of Brimmer Street.
1866	The City of Boston constructs two floating bathhouses on the Charles River.
1878	Frederick Law Olmsted designs the Back Bay Fens along the Muddy River, linked to the Charles River at Charlesgate; the Fens are largely completed by 1890.
1883	Seawall construction on Cambridge side begun by the Charles River Embankment Company.
1892	Charlesbank, with playgrounds and a waterfront promenade design by Olmsted, completed in Boston's West End as the first public park along the river.
1893	The Metropolitan Park Commission is established and recommends the acquisition of the edges of Boston's three rivers, including the Charles.
1894	Cambridge Park Commission acquires the first public parkland along the river in Cambridge.
1907	The Cambridge Bridge opens. It is renamed after the poet Henry Wadsworth Longfellow in 1927.
1910	The first Charles River Dam is completed on the site of Craigie's Bridge. A park on the earthen dam connects the Front (a park planned in Cambridge) with Charlesbank in Boston, and the Embankment creates a riverfront park from Charles Circle to Charlesgate.
1916	MIT moves from the Back Bay across the river to Cambridge.
1936	Storrow Memorial Embankment (now known as the Boston Esplanade) is completed.
1939	Boston University completes its first building on the new riverfront campus.
1949	The Museum of Science moves from the Back Bay to the park on the Charles River Dam.
1951	Storrow Drive, a four-lane highway through the Boston Esplanade, completed; and then expanded to six lanes in 1955.
1965	Congress directs the Army Corps of Engineers to study flood control of the Charles River.
1966	The Bowker Overpass is completed over the Back Bay Fens at Charlesgate, separating the Emerald Necklace from the Charles.
1978	The new Charles River Dam is completed, extending the Charles River Basin a half-mile downstream to Boston Harbor. Paul Revere Park is completed north of the dam.
1980	The MDC publishes a site plan for the "New Charles River Basin" to extend the Cambridge and Boston Esplanades a half-mile downstream to connect with Boston Harbor.
1996	City Square Park opens.
1998	Paul Revere Park is enlarged as the first project of the New Charles River Basin.
2002	The MDC publishes the "Master Plan for the Charles River Basin."
2004	Nashua Street Park opens.
2007	North Point Park opens.
2012	The North Bank Bridge opens connecting North Point Park to Paul Revere Park and creating the first waterfront path from Charlestown to Cambridge.

1.7. HISTORY OF THE CHARLES RIVER BASIN

The Charles River Basin was originally a productive tidal estuary and important source of fish and shellfish for the Native Americans of the region.

In 1615, the explorer Captain John Smith gave the river its modern name, in honor of Prince Charles of England. In 1617-18, the local Native American community was decimated by an epidemic, after having continuously occupied the area for the previous 4,000 years. In 1630, the first large group of English settlers established the town of Boston on the Shawmut Peninsula.

The Lower Charles River Basin in 1852.

The Charles River Basin as it exists today is almost entirely a man-made creation. Until the completion of the Charles River Dam in 1910, the history of both the Cambridge and Boston shorelines are one of continuous efforts to reclaim mud flats and marshes along the river for dry land.

Boston remained sparsely populated until after the American Revolution. Boston's population grew from 16,000 in 1775 to 61,392 in 1830. Mud flats were filled to create land for commercial, transportation and municipal development. In 1803, a new seawall was built in the West End of Boston to create a site for Boston's new almshouse.

In 1821, the Boston and Roxbury Mill Corporation completed a 1.5-mile dam along the present line of Beacon Street from Boston to Brookline. The dam enclosed 600 acres of the Back Bay creating water power for mill operations. In 1835 85% of the track for the Boston & Albany Railroad ran over mud flats and marshes.

By 1805 the Cambridge Proprietors had persuaded the federal government to designate Cambridge a port of entry and had begun to fill salt marshes for industrial development. A system of canals was also built in Cambridgeport to support new industry. Beginning in 1883 the Charles River Embankment Company built a granite seawall and laid out a grand boulevard on the river's north shore in an effort to fill the marshes and create developable land. The demand for private housing lots never developed, and in 1916 the Massachusetts Institute of Technology moved from the Back Bay to join Harvard on the north side of the River.


Cambridge Embankment at Low Tide, 1902

The Back Bay area of Boston was originally a 738-acre expanse of tidal flats, marshes and creeks that extended west from the base of Beacon Hill to the mouths of Stony Brook and Muddy River. The Back Bay separated the Boston peninsula from the Town of Brookline. The filling of Back Bay was accomplished through a series of projects, beginning at the base of Beacon Hill during the 1790s and ending near the western limit of the Bay in 1895.

As population and industrial uses grew in the 1800s, the twice daily tidal flow of the Charles River was not capable of flushing the river of raw sewage and industrial waste. At high tide the river was little more than diluted sewage filled with floating waste materials. At low tide the stench of the sewage-infested mud flats was intolerable, so much so that occupants of the Back Bay kept their windows shut on hot summer days.

In 1856 the state, the City of Boston and private owners reached an agreement to remove the failed

industrial developments in the Back Bay in favor of filling the area to end the public health problem and create a new residential district for the overcrowded Boston peninsula. By then the dam had become a popular promenade, and the value of the river as scenery was recognized. Informal teams of students and clubs began racing on the river as early as the 1850s.

In 1857, filling of the tidal flats began in earnest and continued until the late 1880's, creating over 450 acres of dry land still known as Back Bay, the premier residential district for Boston. In 1889 the firm of landscape designer Frederick Law Olmstead proposed a plan for the 26-acre Charlesbank in Boston's West End that emphasized outdoor recreation. By 1895, the Boston side of the basin had been largely filled.

In the 1890s, landscape architect Charles Eliot, Sylvester Baxter and others envisioned the Charles River as the centerpiece of a regional network of urban parks. The Charles River became one of the main connections in Boston's metropolitan park system established in 1893, a network of regional parks that includes the Blue Hills and the Middlesex Fells Reservations.

Based on Charles Eliot's proposal to "reserve" the distinctive forms of the Massachusetts landscape -- the "rock hills, the stream banks, and the bay and sea shores," the metropolitan park system was intended to provide linked open space to help shape and accommodate the rapid expansion of the Boston metropolitan area. Reservations in the hills that ring the city would be connected by landscaped parkways to reservations along the major rivers, and from there to beaches along the ocean. These reserved areas were to be maintained regardless of development pressures, providing a framework of open space to guide regional growth.

Five years later the firm of Olmsted, Olmsted & Eliot completed a park plan for Cambridge and advised damming the Charles River downstream to create a freshwater basin for boating and swimming.

The Charles River Basin Commission was formed in 1903 and recommended the construction of a dam with locks at the location of the Craigie Bridge. When the gates of the new dam were dropped into place on October 20, 1908, the dam eliminated saltwater tides from the river and transformed the Basin into an urban lake with a constant water level. The dam was designed to keep out the high tides and to hold the water in the Basin eight feet above mean low tide. The top of the dam itself formed a park framed by park buildings at either end and by the Boston Elevated Street Viaduct on the downstream side. The police headquarters, lock gate houses, boat house, stable and park, all designed by Guy Lowell, were all completed in 1910. The Boston Main Interceptor Sewer was also extended below the dam to reduce pollution in the newly created fresh water basin.

Boston Embankment, 1910

During the 1930s, a gift from Helen Osborne Storrow funded park improvements to the Boston side of the Lower Basin. The Embankment between Beacon Hill and the Cottage Farm (BU) Bridge was widened by over 100 feet. A thousand-foot long lagoon was built between Exeter and Fairfield Streets, and a breakwater was built opposite Pinckney Street to provide a protected cove for boats. Four miles of footpaths, monumental boat landings, and stone-arch bridges were erected over the ends of the Storrow Lagoon.

In 1934 the first of two temporary music shell was built to house "Riverside Concerts," which conductor Arthur Fiedler had initiated in 1929. In 1940 the Edwin Hatch Memorial Shell was built to replace the earlier amphitheater. With the establishment of Boston University on the banks of the Charles in 1939 the Basin's institutional character was expanded.

Parkways following the banks of the river were developed piecemeal beginning in Cambridge in the

1890s. In contrast to the historic maze of town and city streets nearby, these tree-lined parkways were broad and expansive. They were intended to provide access to river scenery at a leisurely pace. The 1910 Embankment on the Boston side was built adjacent to Back Street, the existing alley. The 1936 expansion of the Esplanade was funded in part by a gift from Helen Storrow, but a parkway through the 1910 Embankment was rejected.

Boston Esplanade, 1935

After World War II, the increasing demand for quick and convenient access from the western suburbs to the city by car transformed the character of these pleasure drives. Parkways were widened and new limited access exchanges built. In 1951, a four-lane highway was built over a portion of the Boston Esplanade. In exchange for the land taking necessary to build Storrow Drive, the existing island along Storrow Lagoon was extended and connected to the shoreline by pedestrian bridges. In 1955 Storrow Drive was expanded to six lanes and the Bowker Overpass was built over the Muddy River in 1965, cutting off the Fens from the Charles River Basin.

By the end of World War II water pollution was so severe that the MDC banned swimming in the river and built swimming pools along its shores. The Museum of Science moved from the Back Bay to the Charles River Dam in 1949. Within ten years its buildings covered almost all the parkland on the old dam.

Many neighborhoods along the river in Boston and Cambridge were flooded during the hurricanes of 1954 and 1955. The 1955 storm dumped 12 inches of rain in two days, and the water in the basin rose more than four feet above normal. Following a series of studies, it was concluded that a new dam should be constructed downstream of the 1910 dam with a pumping station of sufficient capacity to push flood waters from the basin into the harbor even in the face of high storm tides. The new Charles River dam and pumping station was completed in 1978 extending the freshwater basin to Boston Harbor. At the same time, Paul Revere Park was constructed north of the new dam.

In 1980, the MDC prepared a site plan for the "New Charles River Basin" to connect the Boston and Cambridge Esplanades with Boston Harbor (MDC, 1980). In 1990, the Central Artery/Tunnel (CA/T) project was approved, including funding for park construction in the New Basin to mitigate highway impacts on the river.

City Square Park (Rose Mellino)

City Square Park opened in 1996, Nashua Street Park in 2004, and the North Point Park in 2007. In 2012, the North Bank Bridge completed the greenway connection along the north bank of the Charles River between the Cambridge Esplanade and the Boston Harbor Walk in Charlestown.

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Charles River New Basin (Cambridge Planning Commission)

SECTION 2. EXISTING CONDITIONS

This chapter describes the present state of the natural, cultural and recreation resources in the Charles River Esplanade - New Basin Complex. Assessment of condition of major infrastructure managed by DCR is also included.

2.1. NATURAL RESOURCES

Geology and Soils

The bedrock of the Charles River Lower and New Basins consists of Cambridge slate that was deposited about 580 million years ago. Cambridge slate consists of relatively soft siltstones and slates which are easily eroded (Skehan, 2001).

The Charles River lies over an east-west trending bedrock trough in the underlying Cambridge slate. Stony Brook and Muddy River, the two largest tributaries to the Charles River Lower Basin, follow the eastern and western limbs, respectively, of a large north-south trending fault that cuts across the Roxbury conglomerate bedrock (Skehan, 2001).

During the last million years, a series of glacial episodes scoured and rounded the river basin. The most recent ice sheet retreated from the Boston area about 15,000 years ago. As the ice sheet retreated from the region an extensive, fine-grained deposit known as Boston blue clay was laid down over the bedrock under shallow-marine conditions (Skehan, 2001).

The Boston blue clay is overlain by recent estuarine deposits (sand, silt, clay and salt marsh peat) deposited over the past 10,000 years. These estuarine deposits produced the landscape encountered by Native Americans when they first reached the area. Most of the estuarine deposits in the basin, in turn, have been completely covered by artificial fill over the past 300 years. A large portion of the parkland located within the Complex is artificial fill underlain by a sequence of estuarine deposits and blue clay (Skehan, 2001). Section 1.7 describes the history of filling both the Boston and Cambridge shorelines to reclaim mud flats and marshes along the river for dry land.

In the Back Bay and other filled areas, many of the building foundations were built on wooden pilings driven into the underlying estuarine muds and Boston blue clay. However, the sewers, storm drains and tunnels constructed in the fill since the buildings were built have generally leaked, lowering the average elevation of the water table in the filled areas. The lowered water table has exposed some of the wood pilings to air, causing dry rot and

threatening the structural integrity of numerous buildings (Seasholes, 2003). In 1986, the Boston Groundwater Trust was established to monitor groundwater levels in Boston and make recommendations to solve problems associated with lowered ground-water levels.

Climate

Proximity to the coast moderates the range of temperatures, but makes the area prone to Northeaster storms that can produce significant precipitation and wind driven storm surges in Boston Harbor. Total annual precipitation averages 43.7 inches. Due to its location on the ocean, the RMP focus area is often subjected to sea breezes which cool the area during the spring and summer, and warm the area in fall and winter. The hottest month is July, with an average temperature of 73.4 ºF. The coldest month is January, with an average temperature of 29.0 ºF. Temperatures exceeding 90 ºF average 13 days per year. The area averages 95 nights per year with low temperatures at or below freezing.

Carbon dioxide and other gases emitted by vehicles, power plants and other man-made sources, are accumulating in the lower atmosphere, trapping the sun's heat, and raising surface temperatures on earth. Massachusetts is subject to climate change resulting from the global warning phenomenon. Average temperatures have increased by approximately 1.8 ºF since 1970, with winters warming most rapidly (+4 ºF between 1970 and 2000). These warming trends have been associated with other observed changes, including more frequent days with temperatures above 90ºF, reduced snow, and rising sea levels (Frumhoff et al., 2006, 2007; Hayhoe et al., 2006).

By the end of the century, under the high emissions scenario of the Intergovernmental Panel on Climate Change (IPCC), Massachusetts is expected to experience a 5º to 10º F increase in average temperature. Days with temperatures greater than 90ºF are predicted to increase from the 5 to 20 days per year that Massachusetts experiences today to between 30 to 60 days annually. Winter precipitation, mostly in the form of heavy wet snow and rain, is expected to increase by 12 to 30 percent. Rising summer temperatures coupled with little change in summer rainfall are projected to increase the frequency of short-term droughts and decrease summer river flows. The number of snow events is predicted to decrease from five each month to one to three each month (Hayhoe et al., 2006). Changing climate is inevitable, but the exact range of changes in precipitation and temperature are difficult to predict precisely.

Table 5. Changes in Massachusetts' Climate

Parameter	Current Conditions (1961-1990)	Predicted Range of Change by 2050	Predicted Range of Change by 2100
Annual Temperature	46 ºF	+4 to 5 ºF	+5 to 10 ºF
Sea Surface Temperature	53 ºF	+3 ºF	+8 ºF
Annual Precipitation	41 in.	+5-8%	+7-14%
Growing Season	184 days	+12 to 27 days/yr	+29 to 43 days/yr

Source: Massachusetts EOEEA, 2011.

Global warming affects sea levels by causing ocean water to expand as it warms and by melting land-based ice. NOAA operates a series of sea-level gauges, including a station in Boston Harbor. With records going back to 1921, NOAA data indicate that over the past 93 years, the mean sea level in Boston Harbor has risen about 9.6 inches. With ongoing green house gas emissions, global sea levels are projected to rise between one to two feet by 2050, and three to six feet by 2100 (Vermeer and Rahmstorf, 2009). Rising sea levels will increase the frequency and severity of damaging storm surges and coastal flooding. Hurricane intensity appears to be linked to warm ocean temperatures and may also increase in intensity during the upcoming century (IPPC, 2012).

It is necessary to consider changing climatic conditions while planning for future management of DCR properties and resources. The amount and type of precipitation have effects on both growth and condition of vegetation, amounts of surface runoff, possible flooding and erosion, and vulnerability of existing infrastructure that was constructed based on historic weather patterns. Higher average temperatures could stress park plantings, especially if coinciding with drought. Rising air temperatures also affect recreational activities in the RMP focus area. Demand for swimming increases significantly during days with temperatures greater than 90 ºF.

The Charles River

The Charles River flows 83 miles through 23 communities from its source in Hopkinton to its mouth at Boston Harbor. The longest river entirely within Massachusetts, the Charles River drains a watershed of 308 square miles populated by about 1 million people, making it one of the most densely populated watersheds in New England.

Upstream of the Watertown Dam, the Charles River drains a 268 square mile area with an estimated mean flow at the dam of about 400 cubic feet per second (Zarriello and Barlow, 2002). The Charles River watershed above the Watertown Dam is relatively flat, contains extensive riparian wetlands and has 19 impounded sections along the main river. These factors combine to give the upper watershed an unusually high flood storage capacity, which moderates the effects of large storms on the River below the Watertown Dam (Weiskel, et. al., 2005).

Stony Brook is the largest tributary to the lower Charles River, draining 13.9 square miles in the Roxbury, Jamaica Plain, Roslindale, Hyde Park and West Roxbury sections of Boston. All of the dry-weather flow and part of the storm flow in the Stony Brook Conduit are discharged into the Boston Marginal Conduit which follows the south bank of the Basin. Stream flow in Stony Brook is highly variable. Dry weather flows average about 10 cubic feet per second, and peak flows can reach 1,000 cubic feet per second. During large rainstorms, flows in the Stony Brook conduit typically exceed flows in the Charles River at the Watertown Dam (Zarriello and Barlow, 2002).

The Muddy River drains a 6.3 square mile area in Brookline and Boston. The Muddy River was originally a low-gradient tidal creek over most of its length. Emerald Necklace parklands now border the river along its entire 3.5-mile length. Dry weather flows and water levels in the Muddy River are affected by operations at the New Charles River Dam. Dry weather flows average about 4 cubic feet per second, and peak flows can reach 230 cubic feet per second. The Muddy River commonly floods during large rainstorms, in part because of constrictions where the stream enters a culvert upstream of the Back Bay Fens (Breault, et. al., 1998).

The Charles River provides wildlife habitat, a watercourse for many recreational uses, water supply to communities in the upper watershed and storm water assimilation. The lower watershed has a long history of water-quality and aquatic-habitat impairment linked to over 375 years of human settlement. Over the last 40 years, environmental restoration of the river has been a high priority for private and public organizations across the region.

From 1870 to 1950, the percentage of impervious area in the lower watershed increased greatly, and extensive storm-drain networks were constructed to convey runoff from streets, roofs and other impervious areas into the lower Charles River and its tributaries (Weiskel, et. al, 2005). At the same time, the flood storage capacity of the lower watershed was reduced as wetlands were filled and natural tributaries were placed in culverts. As a result, flooding adjacent to the lower reaches of the Charles River, Stony Brook and Muddy River became more common.

In August 1955, Hurricane Diane dropped 12.5 inches of rain and the Charles River flooded about 1,700 acres in Boston, Cambridge and Watertown (U.S. Army Corps of Engineers, 1968). An innovative, twofold approach to this flood hazard was implemented by the Corps of Engineers. First, 8,500 acres of near stream or riparian wetland areas in the middle and upper watershed were acquired to protect natural flood storage areas.

Second, a new dam was completed at the mouth of the Charles River in 1978. Six high-capacity pumps (each @ 600,000 gallons per minute) in the dam were designed to maintain a constant water level in the freshwater basin behind the dam, even under extreme flood and high tide conditions. These pumps can lower the Charles River Basin one foot per hour, assuming there is no inflow (MDC, 1978). This combination of structural and nonstructural approaches was effective in preventing flood damage by the Charles River during the blizzard of 1978 and other large storms over the past 35 years.

In October 1996, a 5.5-inch rainstorm severely flooded the Muddy River and lower Stony Brook corridor, causing over $70 million in damage and disabling a portion of the Green Line for several weeks. In response, the Corps of Engineers is implementing the Muddy River Flood Control Enhancement Project in Brookline and Boston. The

purpose of the project is to improve water quality through increased detention, reduce flooding in the Fenway by increasing storm surge storage, enhance aquatic and riparian habitat, and improve the recreational use of the Emerald Necklace Parklands. Major features of the plan include: channel improvements, removal of undersized culverts, day lighting two sections of the Muddy River, dredging approximately 200,000 cubic yards of sediment, eradication of *Phragmites* from wetland and riparian areas, and restoration of the historic park.

The project is designed to protect against recurrence of the October 1996 flood (a 20-year event), and significantly reduce flood stages for all events. It will restore over 40 acres of urban aquatic habitat including anadromous fish spawning habitat, benthic habitat and warm-water fish communities. It will also enhance biodiversity by eradicating extensive stands of invasive *Phragmites* and restoring the riparian edges with native vegetation. The removal of contaminated sediments will also reduce PCB levels in fish.

Flood Elevations

Flooding in the Charles River Basin is caused primarily by the difference between the normal water level that is maintained in the Charles River basin (2.5 feet NAVD88) and high storm tides in Boston Harbor (8.2 feet NAVD88). Damage resulting from high water levels along the Charles River basin begins at an elevation of 3.8 feet NAVD88 (FEMA, 2013).

Storm surges in Boston Harbor are caused mainly by onshore winds, wave setup and low barometric pressures that cause a rise in the water-surface elevation. The dominant surge-producing storm in Boston Harbor is the northeaster. These storms are typically less intense than hurricanes, but they occur more frequently and are larger and slower-moving. They have a significantly greater probability of combining with a high astronomical tide causing an extreme high-water level (FEMA, 2013).

Elevated storm surge elevations and waves occurring during astronomical high tides have flooded piers and low-lying areas around Boston Harbor. Northeasters often last several days providing several opportunities for coastal flooding during astronomical high tides. Astronomical tide levels are extremely important in the determination of total water levels as they have a mean tidal range of 8.7 feet and a spring tide range of more than 11.2 feet. These ranges are considerably larger than the expected storm surges, thus making the phasing of the astronomical tide critical to the determination of total water levels in the harbor (FEMA, 2013).

During the northeaster of February 1978, flood elevations in Boston Harbor ranged from 8.6 to 10.1 feet NAVD88, which caused one to three feet of flooding and wave damage in low-lying areas around the harbor. The recorded harbor elevation was 9.8 feet NAVD88 at the New Charles River Dam, which has a crest elevation of 12.2 feet NAVD88. Since the Charles River Basin is normally maintained at elevation 2.5 feet NAVD88, the harbor storm elevation was 7.3 feet higher than the normal Basin water level (FEMA, 2013). During the Northeaster of 1978, the new pumping station was able to maintain water levels in the basin below flood elevations.

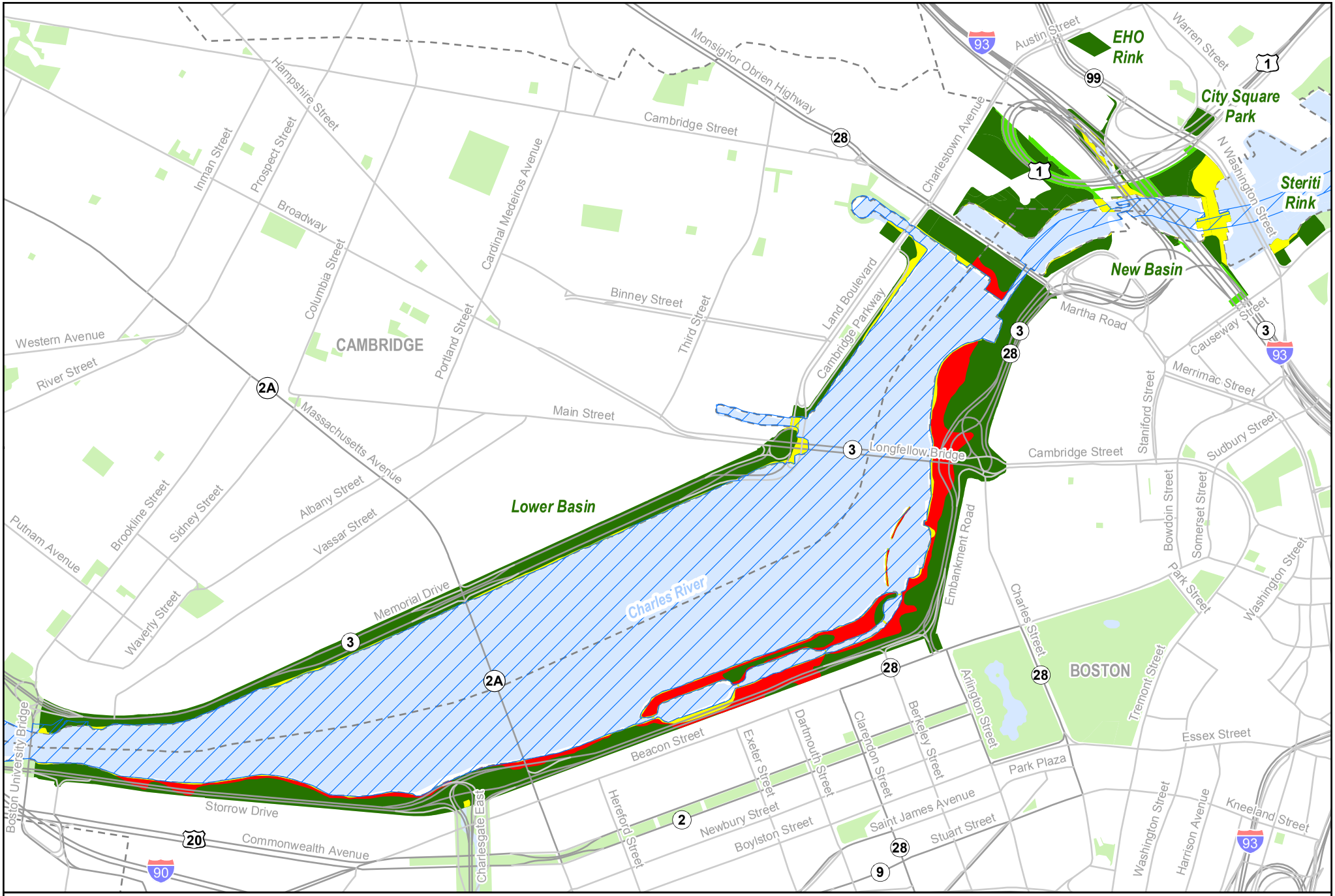
The stillwater elevation is the elevation of the water due to the effects of the astronomic tides and storm surge on the water surface. Two to three foot waves in Boston Harbor can flood areas up to elevation 11.9 NAVD88 in the Charlestown Navy Yard (FEMA, 2013).

Table 6. Stillwater Elevations

Flood Frequency	Elevation (NAVD88)[a]	
	Boston Harbor[b]	Charles River Basin[c]
10-Year Flood	8.45	3.0
100-Year Flood	10.04	3.5
500-Year Flood	11.46	5.2

a. North American Vertical Datum of 1988 (NAVD88).
b. Boston tide gage station 8443970 (FEMA, 2013).
c. USACOE, 1979.

During a 100-year storm event, it is estimated that the pumping station will control basin levels to an elevation 3.5 feet, which is below the level at which damage will occur. For the 500-year storm event, basin levels will be held to an elevation of 5.2 feet and minimal damage will result. This assumes, however, that the basin will not be drawn down before the storm and the boat lock gates are not opened during low tides to release river water into the harbor (FEMA, 2013). These are strategies that can be implemented to lessen flooding potential in the Charles River Basin.



Major Road
Minor Road
Town Boundary
Esplanade - New Basin Complex
DCR Fee Interest
DCR Other Legal Interest
Other Protected Open Space
Open Water
BioMap2 Core Habitat, Aquatic Core
FEMA National Flood Hazard Layer
100-year Flood Zone
500-year Flood Zone

Charles River Esplanade - New Basin Complex
Water Resources

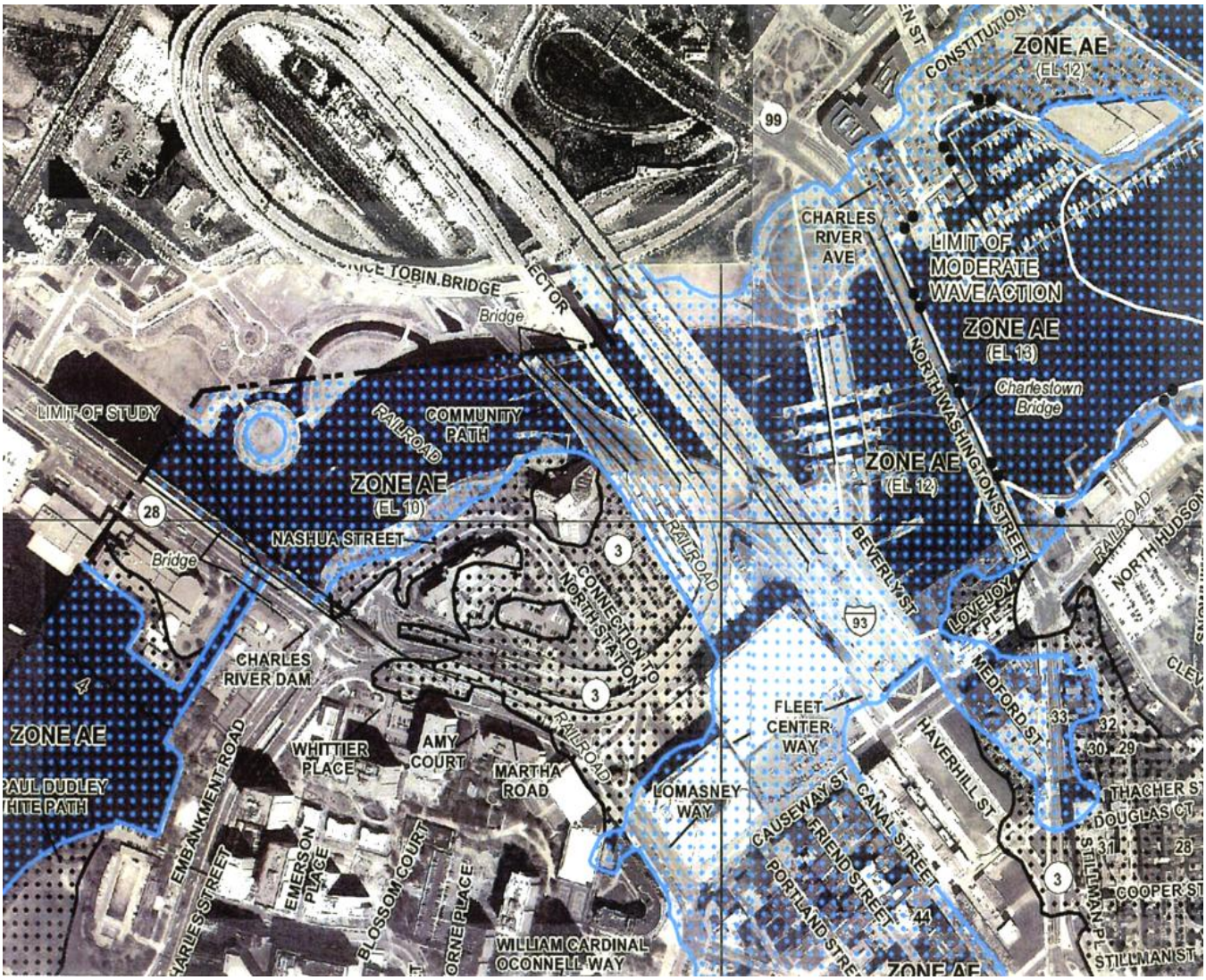
0 0.25 0.5 Mile

Geographic data provided by MassGIS and DCR GIS.

dcr Massachusetts

The following Preliminary Suffolk County Flood Insurance Rate Map places the New Charles River Dam in Flood Hazard Zone AE (El. 12). During a 100-year storm event, the base flood elevation at the New Charles River Dam is estimated to be approximately 12 feet NAVD88. This is slightly above the 11.6 foot NAVD88 crest height of the dam. The Preliminary Flood Insurance Rate Map released by FEMA on November 15, 2013 indicates that 100-year flood waters will flow over and around the dam with an estimated flood elevation of 10 foot NAVD88 in the New Basin between the Old and New Charles River Dams. During a 100-year storm, 12-foot NAVD88 base flood elevations are possible on Beverly Street, Lovejoy Wharf, under the Zakim Bridge and the North Station area (FEMA, 2013). The 500-year flood elevations (indicated in black) extend into the Nashua Street area and the North End.

Climate change will increase coastal Boston's vulnerability to flooding because higher sea levels will allow waves and storm surges to reach further inland than in the past. In addition, storm surge flooding may be compounded by increased rainfall and associated runoff in extreme events such as in a 20 year storm. There also appears to be a link between hurricanes and ocean surface temperature suggesting that hurricane frequency and intensity may increase as well (IPCC, 2012).



Map 3. Preliminary Suffolk County FEMA Flood Insurance Rate Map, November 15, 2013

Water Quality

The water quality of the lower Charles River has been a matter of public concern for over 150 years. In 1872, the Boston Board of Health described the sewage contaminated tidal flats as:

"*Large areas have been at once, and frequently, enveloped in an atmosphere of stench so strong as to arouse the sleeping, terrify the weak, and nauseate and exasperate nearly everybody….*" (City of Boston, 1878).

Construction of the first Charles River dam in 1910 covered the tidal mud flats with a freshwater basin, substantially improving aesthetics of the Lower Basin. However, the lower Charles River still experienced combined sewer overflows (CSOs). CSOs occur when stormwater and waste water are conveyed through the same pipe, and the pipe capacity is exceeded during major storms. Under current EPA and Mass DEP Section 303(d) regulations, the Lower Charles River Basin from the Boston University Bridge to the New Charles River Dam is designated as an impaired waterway due to excessive concentrations of total phosphorous, Chlorophyll-a, nutrient/eutrophication biological indicators, excess algal growth, secchi disk transparency, taste and odor (DEP, 2014).

Stormwater runoff from urban watersheds typically contains a variety of contaminants, including fecal bacteria, phosphorus and lead. Fecal bacteria pose risks to the health of swimmers and boaters, phosphorus promotes excessive algal growth, and dissolved metals can be toxic to fish and other aquatic species. While bacteria may originate from CSOs, the majority of the contaminants derive from the buildup of particulate matter on streets, parking lots, roofs and other urban impervious surfaces during dry weather and their subsequent transport during rainstorms. Long periods of dry weather before rainstorms tend to result in high contaminant concentrations in stormwater runoff (Breault, et. al., 2002).

By the 1960s, CSO discharges had become quite frequent given large increases in sewage flows and impervious surfaces during the 1900s. The increased frequency was attributed to increased sanitary sewage flows from the growing population in the service area. Stormwater runoff volumes were also increasing because of the expansion of impervious area in the contributing watersheds.

In 1965, the Charles River Watershed Association (CRWA) was created to ensure the long-term health of the River and its tributaries. When the CRWA was created, the Charles River was considered too heavily polluted for swimming, boating or fishing. The destruction of wetlands, which naturally filter pollutants and excess nutrients out of the water, as well as the construction of 20 dams and 4 wastewater treatment plants, had reduced the River's ability to naturally clean itself, and contributed to a growing concern over the River's health (CRWA, 2013).

The sewage collection and treatment systems for the Charles River watershed have recently undergone a period of major reconstruction. In 1985, a Federal court directed the Massachusetts Water Resources Authority (MWRA) to rebuild the region's sewage treatment and storm water infrastructure to meet the requirements of the Federal Clean Water Act. In response, the MWRA completed a new wastewater treatment facility at Deer Island in 1997, and a 9.5-mile long outfall tunnel in 2000.

In 1995, the U. S. Environmental Protection Agency (EPA) launched the Clean Charles River Initiative to make the Charles River both fishable and swimmable. The cooperation of numerous federal, state and local agencies as well as strong participation from citizens, nonprofit groups and private institutions has greatly reduced the bacteria in the Charles River. Discharges from CSOs and the number of illicit sewer connections to municipal storm drains have been reduced significantly (EPA, 2013).

The MWRA, Boston Water and Sewer Commission, City of Cambridge and Town of Brookline have completed a number of projects to reduce CSOs to the lower Charles River. The MWRA operates facilities that screen and chlorinate CSOs prior to discharge into the River or treatment at Deer Island. In 2000, the MWRA's Cottage Farm CSO Facility, located on the Charles River northwest of the BU Bridge, was upgraded to optimize treatment system performance and minimize CSO discharges into the River. In 2001, the Prison Point CSO Facility, located north of North Point Park, was upgraded to maximize in-system storage and convey more flow to Deer Island (MWRA, 2013).

The MWRA and local municipalities have also completed six CSO control projects along the Charles River: Cambridge Hydraulic Relief (2000), Independent Floatables Controls and Outfall Closings Project (2001), Stony Brook Sewer Separation (2006), Cottage Farm Brookline Connection and Inflow Controls (2009), Bulfinch Triangle Sewer Separation (2010) and Brookline Sewer Separation (2013) (MWRA, 2013).

During the same period, communities along the Charles River have continued programs aimed at reducing pollution in separate stormwater discharges, including identifying and removing illicit sewer connections to their storm drain systems. The CSO and stormwater related improvements, together with sanitary sewer overflow control programs in upstream communities (above the Watertown Dam), have resulted in significant and steady water quality improvement to the Charles River Lower and New basins (MWRA, 2013).

Table 7. EPA Water Quality Grades

Year	EPA Grade[a]	State Standards Met[b]	
		Boating	Swimming
2013	A-	96%	70%
2010	B+	86%	66%
2005	B+	97%	50%
2000	B	92%	59%
1995	D	39%	19%

a. General standards for the EPA grade were as follows:
A = always met standards for boating and swimming
B = met standards for all boating and some swimming
C = met standards for some boating and swimming
D = met standards for some boating and no swimming
b. Figures represent the percentage of time that state bacterial standards are met.

Each year, EPA has issued Charles River Report Cards summarizing progress made to bring the lower Charles River, from the Watertown Dam to Boston Harbor, to full ecological health (Table 7). The lower Charles River has improved dramatically since the launch of the Charles River Initiative in 1995, when the lower Charles River met state bacterial standards for boating 39% of the time and for swimming 19% of the time. In 2013, the lower Charles River met state bacterial standards for boating 96% of the time and swimming 70% of the time. During dry weather, the lower Charles River met boating standards 97% of the time and swimming standards 84% of the time in 2013 (EPA, 2014).

As shown in Table 8, regular water-quality monitoring has shown that the lower river continues to be affected by bacteria concentrations in excess of State swimming and boating standards especially after major storms. Improved management of stormwater runoff and CSOs will be required to meet State water-quality standards after major storms. The USGS has quantified the contaminants entering the river from above the Watertown Dam, and tributary streams and storm drains below the Watertown Dam (Breault, et. al., 2002; Zarriello and Barlow, 2002).

Table 8. 2012 Monthly E. Coli Samples[a]

Sampling Site	Avg. Dry Weather	Avg. Wet Weather
Western Avenue	145	254
Muddy River at Commonwealth Ave.	94	1,748
Harvard Bridge	53	313
Longfellow Bridge	69	158
New Charles River Dam	28	68
State Boating Standard	630	630
State Swimming Standard	126	126

a. 2012 monthly concentrations of Escherichia Coli (E. Coli) reported in Most Probable Number per 100 milliliters (MPN/ 100ml). This unit is equivalent to the cfu/100 ml unit used for the state standards (CRWA, 2013).

Bacterial loads to the lower river are dominated by wet-weather inputs from Stony Brook and Muddy River with substantial additional bacterial inputs from areas above the Watertown Dam. Improvements of stormwater infrastructure under construction in the Stony Brook and Muddy River watersheds, and improved stormwater management in the watershed communities are expected to further reduce wet weather bacterial loads.

Today, cleanup efforts continue and the River is now safe, on most days, for secondary contact recreation such as kayaking and sailing. Nevertheless, the River is still not pristine. The main cause of water pollution is stormwater runoff. After rainstorms, storm water carries pet and wildlife waste, trash, sediments, oil and grease, and other contaminants from paved surfaces to storm drains that discharge directly into the River when storm flows exceed the capacity of the metropolitan sewer treatment system. This pollution adversely impacts the river's fish and

wildlife, and affects the quality of recreation activities.

Phosphorus

Phosphorus is a natural part of any aquatic system and is essential for photosynthesis and primary plant production. In freshwater systems like the Charles River, phosphorus is usually the limiting nutrient, meaning that the growth of aquatic plants and algae is typically limited by the relatively low natural supply of phosphorus (CRWA, 2013).

Phosphorus naturally enters rivers and other fresh water bodies through erosion of rocks and soils, and decomposition of organic matter. Phosphorous is found in vegetative waste and becomes water borne through the decay of vegetative matter into both dissolved components (e.g., phosphates) and suspended particles. Today, human activities add excess phosphorus to the Charles River.

The primary human sources of phosphorus to the Charles River are stormwater runoff, discharges from upstream wastewater treatment plants and CSOs. Of these, stormwater runoff is the largest contributor. Phosphorus found in fertilizers, detergents, loose sediment, automobile exhaust, animal waste and other sources is carried into the River by stormwater runoff (CRWA, 2013). Internal loading of phosphorus from river sediments is another significant source of phosphorus in the Lower Basin (Breault, et. al., 2000).

Table 9. 2012 Total Phosphorus Samples[a]

Sampling Site	Total Phosphorus (Mg/L)
Western Avenue Bridge	0.057
Harvard Bridge	0.067
New Charles River Dam	0.069
Action Limit[b]	0.024

a. Average of 2012 quarterly total phosphorus samples collected by the Chares River Watershed Association (CRWA, 2013).
b. EPA Ambient Water Quality Criteria recommended for rivers and streams in Nutrient Ecoregion XIV.

The CRWA monitors the River for total phosphorus. As shown in Table 9, total phosphorus in the Lower and New Charles River Basins substantially exceed EPA action limits for rivers in this ecoregion (CRWA, 2013).

The addition of phosphorus into freshwater systems can cause eutrophication, a condition of excessive plant growth caused by nutrient inputs. Algal blooms are often a result of phosphorus-induced eutrophication and can have severe effects on river ecology. When phosphorus stimulates algae and other plants that float on the water surface to grow and cover a large area, submerged vegetation suffers from a lack of sunlight and dies. The decomposition of large amounts of organic material depletes the River's dissolved oxygen supply, essentially suffocating oxygen dependent organisms such as fish.

Cyanobacterial Bloom (Julie Wood, CRWA)

High levels of phosphorus combined with high temperatures, low water levels, and water stagnation are responsible for the cyanobacteria blooms that occur in the River during warm summer months. Additionally, phosphorus-induced blooms of toxin-producing photosynthetic organisms, such as cyanobacteria, can have a wide range of potential biological impacts throughout the ecosystem (EPA, 2011).

Certain strains of cyanobacteria produce toxins, putting any animals coming into contact with the water at risk. While it is generally uncommon for humans to ingest a lethal amount of these toxins, dogs and other animals prone to drinking river water are more vulnerable. However, humans can still experience discomforting symptoms from contact with cyanobacteria. Exposure to these toxins can cause skin rashes and irritate the nose, eyes or throat, and if ingested can lead to liver and nervous system damage (CRWA, 2013).

The DCR, EPA, MWRA and MassDEP are working with municipalities and other sources of discharges

to reduce their contribution of phosphorus to the Charles River. Techniques to reduce phosphorus in stormwater include the construction of stormwater infiltration chambers, use of permeable pavement to enhance the return of storm water to the soil, the use of high efficiency street sweepers, use of zero-phosphorus cleaning products, and low-impact stormwater treatment systems to collect and treat stormwater runoff before it reaches the River.

Salt Wedge

Water quality in the Lower and New Basins is also influenced by a bottom layer of salt water (a "salt wedge") which is the result of sea water from Boston Harbor entering the basin during operation of the boat locks in the New Charles River Dam. Salt water intrusion into the basin is low in early spring, but by the end of August it extends as a layer along the entire bottom of the Basin. Because of its greater density salt water remains at the bottom of the River, below the fresh water which flows continuously into the River from upstream areas. As a result, the Charles River Lower and New Basins are stratified, containing horizontal layers of fresh water at the surface and salt water at the bottom which do not mix vertically (Breault, et. al., 2000).

Water depths in the Lower and New Basins range from 9 to 38 feet. The average top of the salt-water layer occurs at a depth of approximately 15 feet in the summer (DEP, 2007). The salt wedge, which extends as far as 4 miles upstream during the summer boating season and river low-flow periods, depresses dissolved oxygen concentrations in the bottom water. The fresh water layer contains plenty of dissolved oxygen, while the bottom layer of salt water is oxygen deficient.

Although the new dam was designed to reduce the infiltration of harbor water into the Basin, its present-day operation results in large volumes of harbor water entering into the Basin during times of high-recreational boating use and anadromous fish migrations. When the gates of the locks are opened to allow boats or migrating fish into or out of the Basin, freshwater flows out of the Basin over the same volume of harbor water infiltrating the Basin. It has been estimated that about half of the volume of water in the lock enters the Basin during each lock cycle (Breault, et. al., 2000).

The presence of the salt wedge can have profound effects on geochemical conditions within the Lower and New Basins including: (1) increased salinity, (2) decreased oxygen concentrations, (3) increased production of hydrogen sulfide, (4) sequestration of trace metals, and (5) increased internal loading of nutrients, such as phosphorus. All of these changes affect organisms that live within or pass through the basins, especially benthic organisms and fish (Breault, et. al., 2000).

The salt wedge in the basins is not a stagnant mass of saltwater residing only in the deepest parts of the channel. Rather, it varies in area and salinity throughout the year. Changes in the area and salinity of the salt wedge depend upon the natural flow of water through the basins and operation of the boat locks.

During spring storms, water is pumped out of the bottom of the New Basin and the locks are opened at low tide to allow water to flow out of the basins into Boston Harbor to prevent flooding. The combined effect of the high discharge of fresh water from upstream, the pumping of water at depth out of the New Basin, and the opening of the locks at low tide can completely flush the salt wedge out of both basins (Breault, et. al., 2000).

Conversely, during the summer boating season, the large number of lock cycles, reduced upstream flow, and reduced pumping needed to prevent flooding result in the advance of the salt wedge upstream to the vicinity of the Harvard Bridge by mid-August (Breault, et. al., 2000).

Water Color and Clarity

Regardless of the bacteriological quality of the river, if the water does not meet state standards for water clarity (105 CMR 445.000), swimming may not be allowed in the Charles River. During the spring and summer of 2000, the EPA monitored the color and clarity of the Charles River to identify the main factors affecting water clarity (EPA, 2003). The Lower Basin was monitored at three sites once a month from March through September of 2000. Many factors can affect water clarity, these include: suspended matter (organic and mineral), algae or plankton, and color (dissolved organic matter such as tannins).

Table 10 shows the mean secchi disk transparency for three locations in the Charles River Lower Basin

from March to September 2000. The secchi disk is a circular disk used to measure water transparency. The depth at which the disk is no longer visible is taken as a measure of water clarity. Depths less than 1.2 meters were in violation of the Mass. DPH standard for public swimming beaches at the time of the EPA investigation.

Table 10. Average Secchi Disk Depth[a]

Sampling Site	Mean Secchi Dish Depth (meters)
Magazine Beach	0.9
Stony Brook	1.1
Old Charles River Dam	1.5
Mass. DPH Standard[b]	1.2

a. Average of 2000 monthly Charles River Lower Basin secchi disk measurements (EPA, 2003).
b. Mass. DPH standard for public beaches when the EPA study was conducted. This has been changed to a narrative standard.

Magazine Beach met the standard only once. The Charles River at the Stony Brook CSO sampling site met the standard twice, and the sampling site between the Longfellow Bridge and the old Charles River Dam met the standard for all six months (EPA, 2003).

The EPA found that total suspended solids (TSS) greatly influenced water clarity in the Lower Basin. The greater the concentration of total suspended solids, the lower the visibility through the water column. TSS in the Lower Basin declined in May and June from the values reported in March, a period of increased runoff, and then increases again during July and August (EPA, 2003). As snow and ice melt in late winter and early spring, sand used to de-ice slippery roadways and parking lots can become suspended in the resulting melt water. This melt water can ultimately raise TSS levels in the River (CRWA, 2013).

As shown on Table 11, the Harvard Bridge sampling site exhibited the highest TSS values. The area between the Longfellow Bridge and the old Charles River Dam apparently serves as a settling basin as demonstrated by the lower TSS values at the New Charles River Dam.

Table 11. 2012 Total Suspended Solids (TSS)

Sampling Site	TSS (mg/L)[a]
Western Avenue Bridge	<5.3
Harvard Bridge	<5.6
New Charles River Dam	4.8
Action Limit[b]	15.0

a. Average of 2012 quarterly lower Charles River total suspended solids samples (CRWA, 2013).
b. Action Limit during herring spawning season (spring) based on CRWA historical data analysis (CRWA, 2013).

Chlorophyll a is the principle photosynthetic pigment in algae and vascular plants on the River and is used to determine the concentration of algae in the water column. An abundance of algae can lead to anoxic conditions in the River and harm fish and other aquatic fauna. Algae growth is fueled by excess phosphorus in the River, so the chlorophyll a concentration is often high when there is an excess of phosphorus in the system (CRWA, 2013). Although chlorophyll a was high in the Lower and New Basins, it was not the only factor contributing to low water clarity (EPA, 2003).

Table 12. Chlorophyll a Concentrations[a]

Sampling Site	Chlorophyll a (ug/L)
Western Avenue Bridge	20.6
Harvard Bridge	15.7
New Charles River Dam	20.5
Action Limit[b]	3.7

a. Average of 2012 quarterly Chlorophyll a samples (CRWA, 2013).
b. EPA Ambient Water Quality Criteria recommendation for Rivers in Nutrient Ecoregion XIV (CRWA, 2013).

The EPA found that water color did not substantially affect water clarity in the Lower Basin. The tea-like color of the water was found to be the result of naturally occurring organic acids originating from wetland areas in the watershed and total suspended solids. Color was most intense downstream of wetland areas during June particularly in the upper Charles. Trends in color intensities followed trends in soluble tannic acid and total organic carbon concentrations (EPA, 2003).

Algae concentrations (measured using chlorophyll a) and total suspended solids together contribute to decreased water clarity in the Lower Basin, however the phenomena appears to be most strongly linked to total suspended solids. Phosphorus and algal blooms, as indicated by abundant Chlorophyll a, are high at times in the Lower Basin. Reduction of phosphorus discharges are needed to help reduce the

affects they have on algal abundance and the related contribution to reduced water clarity (EPA, 2003).

Sediment Contamination

The bottom habitat of the Lower and New Basins is contaminated by a number of inorganic and organic compounds which have accumulated since construction of the old Charles River Dam. Construction of the old Charles River Dam created a settling basin for the Charles River Watershed. The creation of this basin, combined with large sediment loading as a consequence of the urbanization of the watershed over the past century, has resulted in deposition of more than 53 million cubic feet of sediment between the Watertown Dam and old Charles River Dam since 1908. The thickness of bottom sediments deposited since 1908 range from less than one foot below the Watertown Dam; to almost two feet near the BU Bridge; to over five feet behind the Old Charles River Dam (Breault et. al., 2000).

During the summer of 1998, the USGS collected and tested 94 sediment surface and 3 sediment core samples from the bottom of the Charles River between the BU Bridge and the new Charles River Dam. Inorganic metals and organic compounds were found in the sediment samples at sufficiently high concentrations to cause potentially severe biological effects to benthic organisms living in and on the river bottom (Breault, et. al., 2000).

The potential for adverse biological effects of contaminated sediment was assessed using EPA sediment quality guidelines Probably Effect Levels (PELs). PELs are concentrations above which adverse biological effects are frequently observed (Ecosystem Conservation Directorate Evaluation and Interpretation Branch, 1995).

While some inorganic elements are essential for life, most inorganic elements are toxic to living organisms at sufficiently high concentrations. The potential for adverse effects on benthic organisms (concentrations above the PEL) at the 94 surficial sediment sampling sites located in the Complex is estimated to be frequent for about 82% of the samples tested for inorganic elements. The element with the largest percentage samples exceeding PEL is mercury (96.5%); followed by lead (92.5%); silver (88.3%); copper (87.2%); zinc (86.2%); cadmium (86.1%); nickel (73.4%); and chromium (52.1%) (Breault, et. al., 2000).

Because many biological systems are not well adapted to the effects of chlordane, DDT and PCBs (polychlorinated biphenyls), they may be toxic at very low concentrations. The potential for adverse effects on benthic organisms in the Lower and New Basins was frequent for 59.1% of the sediment samples tested for organic compounds. The PEL for polycyclic aromatic hydrocarbons (PAHs) was exceeded in the largest number of samples (100.0%); followed by total PCBs (80.0%); total chlordane (40.0%); and total DDT (16.7%) (Breault, et. al., 2000).

Massachusetts does not have state standards that establish levels of sediment contamination that are safe for human contact. Although best management practices (BMPs), and bans of certain compounds (chlordane, DDT, PCBs and lead in gasoline) have been implemented, the fact that inorganic elements and organic compounds are chemically stable and are not readily broken down, suggests that the contaminants will continue to be present at elevated concentrations in the bottom sediment of the Charles River Lower and New Basins for many years (Breault, et. al., 2000).

Water Temperature

The Kendall Power Plant, a 256 megawatt electric generating facility, is located on the Broad Canal in Cambridge. The power plant uses water from the River for non-contact cooling. Until 2011, this plant withdrew an average of 70 million gallons a day from the Charles River and discharged it back into the River at temperatures up to 105º F. The plant's water usage was up to five times greater than the flow of the Charles River during summer low flow periods (DEP, 2006).

Thermal discharges from utility plants such as the Kendall cogeneration facility can have significant impacts on river ecosystems. When water is withdrawn for cooling, the aquatic life in the water (including fish eggs and larvae, as well as adult and juvenile fish) can be killed or injured. Heat from the generating plant creates the potential for heat-shock to in-migrating herring and Atlantic shad adults, and out-migrating juveniles of these species (DEP, 2006). High temperatures can impact the rates of metabolism and growth of aquatic organisms, rate of

plant photosynthesis, solubility of oxygen, and the sensitivity of aquatic organisms to disease, parasites and toxic materials (EPA, 2012). In addition, high water temperatures can contribute to excessive algae growth and blooms, which can cause public health risks.

In 2011, the Kendall Power Plant permit was modified to dramatically reduce its withdrawals from and thermal discharge into the River. The permit modification requires the plant to install and operate a back pressure steam turbine and an air-cooled condenser, which together will enable the plant to reduce its river water use by 95% to 3.2 million gallons a day. The modified equipment will capture most of the heat generated by the plant and distribute it as steam through a new pipeline to be built across the Longfellow Bridge. The modified permit also requires the plant to closely monitor river flows and temperatures to ensure that the plant's heat discharge does not warm the river to levels that are harmful to fish populations and the aquatic habitat in the River.

Because the Kendall Power Plant will need time to comply with the revised permit conditions, the EPA and MassDEP have imposed a compliance schedule. These orders require that the plant proceed with a construction schedule that will closely parallel the Longfellow Bridge construction schedule, and require interim flow limitations.

Fish Community

The Charles River supports a varied fish community of about 20 resident and migratory species (CRWA, 2003). The river is home to bluegill, redfin pickerel, redbreast sunfish and largemouth bass. Important migratory species in the Charles River include alewife, American eel, white perch, rainbow smelt, Atlantic tomcod, American shad, striped bass and blueback herring. The Charles River supports one of the largest blueback herring runs in Massachusetts, and is being used as a donor population for restoration efforts in the Neponset and Ipswich Rivers. River herring can typically be observed spawning in the river from mid-May to mid-June. Rainbow smelt, the first to arrive each spring, begin spawning in mid-March below the Watertown Dam. American shad and white perch also use the River for spawning habitat, whereas striped bass enter the Charles to feed.

Anadromous fish begin life in freshwater, then migrate to the ocean to spend the majority of their life. Eventually, they return to freshwater rivers or to the brackish upper reaches of estuaries to spawn and lay eggs. In the autumn, most of the juveniles head back downstream to more brackish water. Anadromous fish that currently migrate between Boston Harbor and the Charles River include American shad, blueback herring, alewives, striped bass and rainbow smelt. Anadromous shortnose sturgeon and Atlantic sturgeon historically were present in the Charles River, but have been extirpated.

Catadromous fish species begin life at sea and then migrate to freshwater, where they live for most of their adult lives. Eventually, they return to the ocean to spawn and die. The catadromous American eel is born at sea, then migrates to freshwater lakes and ponds, eventually returning to the sea to spawn and die. Each spring tiny juveniles or "glass eels" can be found moving up the Charles River.

Migratory fish and their habitat have diminished over the last several hundred years throughout the Charles River Watershed and Boston Harbor. Dams, habitat alterations, pollution and overfishing have led to declines in migratory fish numbers.

To facilitate fish migration, the New Charles River Dam was equipped with a fish-way when it opened in 1978. However, there are several limitations to the effectiveness of this fish-way. The fish ladder is located between the high and low sluiceways. When the sluiceways are in operation (when the Harbor tide is lower than the Basin), water readily empties into the Harbor through the 160-square-foot sluiceway opening. This water flow tends to drown out the fresh water signal from the fish ladder and pushes migratory fish away from the area. In addition, fish that enter the fish ladder may become trapped and die. Each spring, 200-400 fish die in the fish ladder.

Given the unsuccessful fish ladder, DCR and the Division of Marine Fisheries have developed a locking protocol to open the locks to allow migrating fish to pass between the Charles River and Boston Harbor. The locking protocol was designed to maximize usage by rainbow smelt, river herring and American shad during their spawning runs (DEP, 2006). The lock in the old Charles River Dam

is left open to facilitate fish migration along the River.

Fish that are able to survive in the Charles have to cope with degraded habitat features, such as contaminated sediment. In 1999, the EPA surveyed largemouth bass, carp and yellow perch from the Charles River basin for mercury, trace metals, PCBs, pesticides and dioxins. Although these contaminants were commonly detected in the fish, concentrations in the target species were below the Human Consumption Action Levels of the U.S. Food and Drug Administration (FDA) with the exception of PCBs. Some carp fillet samples exceeded the FDA tolerance limit for PCBs in fish tissue of 2.0 parts per million. This limit is used by the FDA to trigger removal of food products from the market (EPA, 2001).

In May of 1966, based upon FDA tolerance limits, the Massachusetts Department of Public Health issued a carp consumption advisory for the lower Charles River between Newton and the old Charles River Dam. Carp samples collected between the Longfellow Bridge and Museum of Science were well above the FDA tolerance limit. The bottom feeding nature of carp and their high fat content provide a pathway for PCB bioaccumulation into carp tissue (EPA, 2001).

Habitat conditions for fish and other aquatic species have improved in many parts of the lower river system in recent years. However, serious challenges remain, including the control of phosphorus levels, algae blooms, remediation of contaminated bottom sediments, and the salt wedge in the River.

In recent years, the Massachusetts Department of Fish and Game, and the U.S. Fish and Wildlife Service have released over 25 million shad larvae into the Charles River. Beginning in 2011, adult shad were observed returning to the river to spawn. The goal is to establish a healthy shad population of 30,000 in the Charles River.

Vegetation

The Charles River Lower and New Basin parks are not an untouched natural landscape. The landscape has been actively shaped by humans for more than two centuries. Most of the riverbank within the RMP focus area has been armored by seawalls or riprap to retain the embankment soils.

The vegetative communities along the river can be categorized into three types: open parkland (approximately 93%), vegetated riverbanks (approximately 5%), and urban woodlands (approximately 2%). There are no wetlands, certified vernal pools or state-listed rare plant species documented within the Complex at this time.

The predominant open parkland consists of open mowed turf with scattered trees and planting beds that has aesthetic appeal and recreational value, but provides minimal wildlife habitat. A limited number of plant species have been used along the river and adjacent parkways. Appendix D contains a list of plants recommended for use along the parkways, riverbanks and parklands.

Within the small number of tree species that has been planted, some are poorly suited to the park's needs and should be phased out. The bushy, full form of the American linden, for example, blocks water views. Mature Norway maples require better soil than the parkland can provide and outcompete native vegetation. Many of the Lower Basin's trees show signs of stress due to intensive park use leading to soil compaction or damage from mowers.

Over time, security and maintenance issues have reduced the number of shrubs in the Lower Basin landscape. The judicious use of shrubs in the parkland, however, can improve the character of particular areas, provide wildlife habitat, screen intrusive views, facilitate maintenance where grass maintenance is difficult, and control use where short-cut paths have degraded park areas.

Mown grass is currently the universal ground cover throughout the parkland. Many park areas need mown turf to support recreational use and visual character. However, alternative treatments such as tall meadow grasses or ground covers should be considered to increase habitat value, reduce maintenance costs, increase visual diversity and protect trees from mower damage.

The width of pathways is often inadequate for the amount of traffic they carry, particularly where parkways crowd the river bank. Some stretches of paved pathway are only five feet wide, barely enough room for bicyclists to pass one another. In many of these stretches, users are spilling off the paved edges onto bare earth. Some joggers tend to make their own pathways off the paved surface,

which create "goat paths" that cause additional erosion and root compaction.

"Goat Paths" on Cambridge Esplanade

Large events, temporary staging areas and general overuse by visitors have left the soil severely compacted and destroyed the turf in many areas. Large, poorly sited trees have turned desirable grassy areas, once bathed in sun, into shady areas where turf cannot grow.

The riverbanks west of the Cambridge seawall, in the North Point Park lagoon, along most of the Boston Esplanade and in the Nashua Street Park contain over four miles of vegetative strips along the river embankments. These riverbank plants include shrubs, wetland plants, grasses, sedges, ground covers and rushes that are adapted to wet conditions (see Appendix D). These riverbank strips are mown once a year to open up views to the river, discourage the growth of woody vegetation and control the spread of invasive plants.

The riverfront vegetative strips act as riparian buffers that protect water resources from nonpoint pollution, and provide bank stabilization and wildlife habitat. Riparian buffers act to intercept sediment, nutrients, salts, and other materials in surface water runoff before it reaches the River. Riparian vegetation slows floodwaters and rainwater runoff helping to stabilize riverbanks, protect adjacent properties and recharge groundwater. Slowing rainwater runoff allows the riparian buffer to trap sediments that would otherwise degrade the River. Wider buffers with shrubs and trees are more effective than narrow, grassy buffers.

Wildlife species require food, water and cover. Well managed riparian buffers generally support larger populations of wildlife because the buffer provides many habitat requirements. In a stratified buffer, different habitat zones exist vertically, including herbs, shrubs and intermediate height trees. Included with the leaf litter at the soil-water interface are insects, isopods, spiders and mites. These organisms are a food source for fish, reptiles, mice and birds. The herbs and shrubs provide habitat for insects, birds and mammals. The bushes and tree canopy serve as habitat for birds, bats, and squirrels. Various bird species generally show a preference for certain habitats and food sources (e.g., grasslands, shrubs or woodlands).

A small urban wild exists on the Cambridge side of the River between the BU Bridge and DeWolfe Boathouse. It contains a thick stand of volunteer shrubs and trees. Such mixed stands provide niches for wildlife and require minimal maintenance. A flock of white domestic geese nest in this woodland. Vegetation in a portion of the nesting area has been damaged by vehicles parking illegally in an area adjacent to the BU Bridge.

White Goose Nesting Area (Friends of the White Geese)

Non-native invasive plant species are recognized as one of the greatest threats to the integrity of natural communities and direct threats to the survival of many indigenous plant species. Plants introduced to this continent often have no predators or native species here that will control their populations. This may give them a distinct advantage over native species in their new habitat. Most introduced species are not harmful to native plant communities. However, a few species have become serious threats to native ecosystems. The Massachusetts Invasive Plant Advisory Group (MIPAG) has identified 33 invasive, and 29 likely invasive plant species in

Massachusetts that cause environmental harm by becoming dominant and/or disruptive to native plant communities (MIPAG, 2002).

Some of these invasive species (e.g., Purple loosestrife, Japanese knotweed and *Phragmites*) are growing along the riverbanks of the Lower and New Basins. These invasive plants are crowding out native species and blocking access to the water's edge in some areas.

There are preferred methods of removal for each invasive species that depend on their particular biology. The removal of the target species by hand (i.e., pulling or cutting) is usually the least destructive method to the surrounding vegetation. This method is preferable and can be employed if the invasion is confined to a relatively small area and the plants have small root systems. However, large-scale invasive species populations or plants with extensive root systems cannot be easily removed mechanically. In these cases, herbicides or biological control organisms may be more effective.

Non-native *Phragmites*, also known as Common reed, crowds out native plants and grows as a monoculture. *Phragmites* is a very adaptable plant with many characteristics that give it a competitive edge over native plants. It sheds its broad lower leaves creating a thick litter that deprives native vegetation of sunlight and prevents germination by native plants. It secretes a substance that suppresses other plants and has an extensive rhizome system.

Mechanical treatments such as repeated mowing have yielded little success. Cutting above ground portions of the plant or burning has no effect on the below ground resources, and *Phragmites* shows a remarkable capacity to rebound vigorously. Despite ongoing research, no biological control agents have been identified. A selective control protocol called "bundle, clip and drip" has resulted in positive results. In this method, hundreds of stems are bundled, cut and sprayed with glyphosate simultaneously (Simmons, 2013).

Wildlife

The landscape also provides wildlife habitat for dozens of animal species that enrich the experience of park users. Water quality has improved dramatically in recent years, creating better habitat for wildlife and attracting visitors to the River. Birds, small mammals and amphibians inhabit the parkland along the River.

Song birds, pigeons, Canada geese, White geese, mallards, gulls and Cormorants can be seen along the river corridor. Some species of birds flourish even under these adverse conditions. In recent years night herons and blue herons have returned to the Charles River basin.

A growing population of resident Canada geese presents a management challenge. In large numbers, they can destroy turf by overgrazing. Their droppings create a public nuisance, affect water quality and can be a public health hazard. Goose droppings degrade water quality by serving as a source of phosphorus, which is already excessively abundant in the Charles. Canada geese produce from 0.5 to 1.5 pounds of droppings per day (Gosser, Conover and Messmer, 1997).

In recent years, The Esplanade Association has funded a Geese Be Gone program in the Boston Esplanade. The program uses dogs to discourage geese from nesting in the Esplanade. However, there are still less people sunbathing on the island because of goose droppings.

There are two different populations of Canada geese in Massachusetts. The first is the migratory population which passes through in the spring and fall. The second is the resident population, descendants of captive geese used by waterfowl hunters. When live decoys were outlawed in the 1930s, many captive birds were released. With no pattern of migration, these geese began nesting locally (MassWildlife, 2012).

Canada geese are herbivores. During spring and summer, they selectively graze on plants that are high in protein, such as grass shoots, seed heads and aquatic vegetation. Canada geese have many natural predators. Raccoons, skunks, foxes, crows, and snakes prey on their eggs; snapping turtles, foxes, bobcats, hawks, coyotes and raccoons prey on goslings; and coyotes, bobcats and people prey on the adults (Gosser, Conover and Messmer, 1997).

Well maintained lawns at houses, golf courses and mowed parks bordering water provide an excellent source of food. With the above factors, lack of natural predators in urban areas and local hunting restrictions, resident goose flocks grew. In 1983, MassWildlife biologists estimated 10-12,000 of the

Canada geese were probably year-round resident. By 1997, surveys estimated 38,000 resident Canada geese statewide (MassWildlife, 2012).

2.2. CULTURAL RESOURCES

The land within DCR's forests and parks is a storehouse of cultural resources; its historic buildings, structures, archaeological sites and landscapes are reminders of the important role these lands have played in this nation's history. Scattered across the landscape, this ensemble of buildings, structures and sites tell the story of our common heritage. Their protection and preservation is an integral component of DCR's mission.

The RMP development process has resulted in an improved body of knowledge on the cultural resources of the Charles River Esplanade - New Basin Complex. Data have been field verified and collected using a handheld GPS, recording spatial data (location) as well as condition, materials, threats and recommendations.

Cultural resources that are over 50 years old are considered potentially historic and evaluated for significance. DCR uses the nationally accepted standards for evaluating historic significance, primarily the National Register of Historic Places. DCR treats properties as historically significant if they meet the criteria for listing on the National Register, even if the property has not been formally nominated or listed. DCR's Office of Cultural Resources coordinates all regulatory compliance related to state and local laws protecting historic and archaeological resources located on DCR property.

This section describes the known and potential cultural resource areas in the Complex including pre-Contact and post-Contact archaeological resources, and historic buildings, structures and landscapes. An overview of significant events in the planning unit's history is presented in Table 4. Section 4.4 provides specific recommendations for cultural resources which require additional research, documentation, stabilization or preservation. All cultural resources are to be managed in accordance with the DCR Cultural Resource Policy, and Best Management Practices for Protecting Cultural Resources (DCR, 2014).

Archaeological Resources

Most of the known pre-Contact sites in the Boston Basin are located close to coastal zone estuarine environments, major rivers and ponds, with most settlement and subsistence activity located where major rivers enter Boston Harbor. The Esplanade Complex is located within a small portion of the 9.5 mile tidal estuary of the Charles River. The primary attraction of this location was the seasonal availability of an endless supply of fresh fish. During their spring runs salmon, herring, alewives and shad would swim upstream and spawn in freshwater lakes. During other times of the year, smelt, tomcod, winter flounder and sturgeon made the estuary their breeding ground and nursery. In addition, abundant shell fish beds were located in the nearby marshes. In later prehistoric times, groups planted and tended gardens in the fertile soil along the Charles.

A short distance upriver, archaeological evidence suggest prior to historic damming above the head of the estuary, at the first set of falls on the Charles River, this area had the greatest variety and the longest records of use through time. Tools and implements recovered are similar to those which have been dated to the Paleo Indian period, between 9,000 and 11,000 years Before Present (B.P.) and additional archaeological evidence suggest that Native Americans returned to this riverside location from that time through each succeeding period of prehistory (Early, Middle and Late Archaic; Early, Middle and Late Woodland).

Despite the extensive land-use history there are currently only thirteen recorded pre-Contact archaeological sites within the Complex area; one in Cambridge, four in Charlestown, and eight in Boston. Because of the impacts of historic development and urbanization, much of what we know of these first people is based on data gathered from artifact collectors and information derived from those collections. More recently, systematic archaeological surveys have taken place within the limits of the complex revealing very site-specific information about the land-use and peopling of this area long ago. Not surprisingly, many of these sites are directly related to fish procurement and processing.

Two sites identified as "shell heaps" or shell middens, contained thousands of discarded shells, including the remains of meals and other artifacts. Two campsites, one unverified Contact Period village site, one stone tool-making workshop, two sites with no recorded information, and a fish weir (wooden fence-like fish traps) site are represented. The earliest site dates to the Middle Archaic period 8,000 years-6,000 B.P. and the most recent to the Contact Period.

Historic Resources

The Esplanade - New Charles River Basin Parks Complex encompasses a rich array of cultural resources. The significance of these resources has been recognized through the listing of the Charles River Basin Historic District on the National Register of Historic Places and the designation of the Charles River Esplanade as a Boston Landmark. These designations include resources on the old Charles River Dam and those located along the banks of the river extending west to the Boston University Bridge, reflecting the 100-year architectural and historical legacy of landscape design, recreation and tidal/river management in the city.

The old Charles River Dam was constructed 1903-1910 at the mouth of the Charles River basin in order to stabilize water levels behind it and control the river's outflow and tidal influx. The project was overseen by the Charles River Basin Commission, who hired Guy Lowell, an architect and landscape architect, to design the dam and its appurtenant buildings.

The dam and its structural features and five original buildings, officially completed in 1910, today remain largely intact despite the many changes that have occurred on the dam during the last century. On the Cambridge side of the dam, the eight sluices that controlled water passage are still in place below Charles River Dam Road, and the cut granite block walls of the dam structure, including the arched sluice openings, are still visible above the water level on both sides. The internal steel sluice gates were recently removed as part of a 2010 rehabilitation of the Craigie Dam Bridge. The connecting sluiceway on the upstream side of the dam is covered by the Museum of Science parking garage.

The open parkland that originally existed between the sluiceway and the lock on the Boston end of the dam was lost with the opening of the Museum of Science in 1951 and its subsequent expansions. The only intact feature of this landscape is the pavilion, which still stands at the southeast corner of the park. The open shade shelter was designed by Guy Lowell, built in 1909, restored in the late 20th century, and named to honor Bradford Washburn, long-time director of the museum. Today it is used for hosting museum-related events.

West of the Museum of Science's parking garage stand two buildings designed by Lowell for the Metropolitan Park Police: the Stable and the Boat House. Both feature brown brick exteriors, hipped roofs, flared eaves with exposed rafter tails, dormers, and corner quoins. The Stable faces Land Boulevard with symmetrical wings framing an entrance courtyard. It is currently undergoing a major exterior rehabilitation, including the installation of a new slate roof. The Boat House opens on to Lechmere Canal with three boat bays framed by metal pilasters. The Boat House roof, still sheathed with its original slate, is in poor structural condition, and all door and window openings have been temporarily covered. The north and east walls are covered with extensive vine growth.

The lock at the east end of the dam is constructed of granite block walls with parged concrete coatings. Although the lock is not in need of structural repair, the heavily deteriorated and spalling parging surface is aesthetically displeasing.

Two buildings were designed by Guy Lowell to service the lock, located on land added to the edge of Charlesbank. The most prominent of these is the Lower Lock Gate House, located at the northeast end of the lock and directly adjacent to the Charles River Dam Road and the Craigie Drawbridge. It is a two-story, hipped-roof structure constructed of brown brick with a four-story observation tower beside the lock and later additions to the rear. Originally designed as a residence for the lock superintendent and drawbridge tender, the building was transferred to the Park Police in 1913 and now serves as a barracks for the Massachusetts State Police.

Placeholder for Map 4 – Lower Basin Major Cultural Resources and Infrastructure.

Placeholder for Map 4 – Lower Basin Major Cultural Resources and Infrastructure.

Towards the southeast end of the lock stands the Upper Lock Gate House, a single-story, L-shaped structure with materials and architectural detailing similar to the Lower Lock Gate House. It was built to house the sliding lock mechanism at the south end of the lock. The building is currently mothballed and is in need of roof repairs.

Between these two buildings stands the Stop Plank House (also known as the Garage), constructed in 1937. It features a hipped roof, yellow brick exterior, and four garage bay openings on the east façade. DCR's Office of Flood Control Management currently occupies the building. The slate shingle roof is in need of repairs.

Spanning the lock at Charles River Dam Road is the Craigie Drawbridge. The existing double-leaf bascule bridge dates from 2011 (the 1910 drawbridge had previously been replaced).

Charlesbank extends from Leverett Circle to Charles Circle, and was the first public park on the river. Designs by Frederick Law Olmsted Sr. and altered by Guy Lowell's design for the dam, the park was expanded by Arthur Shurclilff in the 1930s. The design of today's Lederman Park reflects the work of Arthur Shurcliff, who redesigned the parkland in 1949 as part of the construction of Storrow Drive. These elements include the pathway along the river's edge and lines of trees along the perimeter with open recreational fields in the center.

Northeast of the ball fields is the Lee Pool complex. This includes the Lee Pool building, a one-story brick structure constructed in 1951 that shows the influence of the International Style with its horizontal bands of windows, flat roof overhangs, and rectilinear massing. Behind the building, the outdoor pools and concrete bleachers remain intact. The pool complex has been closed to the public since the late 1990s and is now used for materials and equipment storage by DCR and TEA staff.

North of the complex is a small, one-story wood concession building with a sloped trapezoid-shaped roof dating from the 1960s that is closed and no longer used by DCR. This stands adjacent to a fenced park area featuring an oval concrete wading pool and plaza built in 1951 that remains in active seasonal use, and has been largely unchanged since its construction.

The river edge behind Lee Pool and extending to the old lock remains defined by a granite seawall, part of which dates back to the 1860s.

The Embankment. Formally named the Storrow Memorial Embankment in 1936, the Embankment section of the Boston Esplanade extends from the Longfellow Bridge west to the Harvard Bridge. Once part of the Charles River tidal basin, this area has undergone three alterations through a series of fillings of the basin to create parkland along the river's edge. A granite seawall constructed in the 1870s (still visible along the south side of Storrow Drive) defined the river edge along the Back Bay neighborhood until the 1900s. The wall is still intact above-ground from Clarendon Street to the Charlesgate on-ramp, and from Bowker Overpass to just beyond Granby Street. The wall has been compromised in many locations by deterioration of the mortar joints and invasive vegetation growing within many of the joints.

The first parkland, known as the Boston Embankment, was established in 1910 by the Charles River Basin Commission atop a 100' strip of fill added north of the seawall. The promenade was significantly expanded in the 1930s by the Metropolitan District Commission with additional fill to create a park officially dedicated as the Storrow Memorial Embankment, following the landscape design of Arthur Shurcliff. This work established the core of today's Esplanade. Plantings consisted of trees spaced along the major pathways, with informal clusters of trees and low bushes at key intersections and focal points. Most of the shrubs have disappeared from the parkland, while the trees have matured to create a much more shady environment than originally existed. The water's edge was defined by a natural slope reinforced with granite blocks set into the grade, which remain in place today. Many landscape features still exist from this latter period of construction, including the Dartmouth Street, Gloucester Street, and Commissioners Landings, the Eliot Memorial; the Music Oval; and the Storrow Lagoon.

The dominant feature of the 1930s-era Esplanade at its east end is the Music Oval, an open lawn edged by a paved path, tree plantings and various memorials. Temporary band shells had been built on the Esplanade since 1929, and the present Hatch Shell was constructed in 1940 at the north end of the

oval, designed by Richard Shaw. The structure is distinctive for its concrete half-dome shell with interior teak-faced sound baffles. The shell is surrounded by a one-story, flat-roofed support structure faced with pink granite panels. Art Deco influences are evident in the detailing of the side entrances, the stepped granite fronting the main stage, and massive bronze lanterns flanking the opening. A one-story, flat-roofed restroom building built in the 1960s is located just to the northeast of the Hatch Shell. An addition to the restroom building housing utilities was added when the Hatch Shell was renovated in 1991. The structures have been maintained fairly well, but there is evidence of deterioration in the concrete roof panels and seams on the shell.

The Music Oval is surrounded by a number of memorials honoring individuals and events. While some date from as recently as the 1980s and 1990s, most were installed in the 1950s, including bronze figures on granite plinths depicting David Ignatius Walsh, Charles Devens, General George Patton, and Maurice J. Tobin. All are in good condition.

South of the Music Oval is a pedestrian bridge linking the Esplanade to David Mugar Way near Beacon Street. Named in honor of Arthur Fiedler, the popular Boston Pops conductor, the concrete bridge was constructed in 1954 and is notable for its minimalistic design aesthetic and salmon pink/orange paint color. The concrete is spalling and cracking in many locations and requires extensive repair.

Commissioner's Landing is located just north of the Hatch Shell, consisting of a long granite wall at the river's edge featuring neoclassical piers and balustrades and a central set of stairs stepping down to the water. The wall is flanked by two small plazas that extend out into the water and now serve as entrances to recently rebuilt docks. The granite elements are in poor condition and are in need of repointing and cleaning. The lower tiers of the central stairs are in serious need of repair, as the granite slabs have shifted out of place from a combination of the impacts of freeze-thaw cycles, invasive vegetative growth, and erosion.

Flanking Commissioner's Landing are two buildings currently used by private organizations. To the south is the Union Boat Club, constructed in the Georgian Revival style in 1909. To the north is the Community Boating boathouse, constructed in 1941 as a one-story brick structure and expanded with a hip-roofed second floor addition in 1987. A major reconstruction of the docks and appurtenant structures occurred in 2008.

Between Community Boating and Commissioner's Landing stands the Charles Eliot Memorial, a squat square obelisk and base constructed of granite and centered in a circular plaza of granite slabs. Installed in 1939, it was designed by Arthur Shurcliff to honor the landscape architect of the metropolitan park system. The memorial has recently been cleaned and the landscape around it is being improved through a partnership with The Esplanade Association.

The construction of Storrow Drive in 1951 required extensive land takings in the parklands. To mitigate the loss, additional fill for parkland was added. Designed by Shurcliff and his son Sydney, these changes included the expansion of the existing island at the Lagoon all the way up to the Hatch Shell. This essentially created two distinct strips of parkland separated by a chain of waterways and connected by three new pedestrian bridges. Plantings on the newly filled areas continued much of the landscape character of the 1930s Esplanade, though with slightly more informal plantings and denser collections of trees.

The easternmost three pedestrian bridges between the islands and embankment all date from 1951-52 and are nearly identical in design, featuring concrete construction with smooth exterior finishes, arched openings, and granite pavers on the decks. Each exhibits minor spalling, cracking, and leaching of salts that require repair, along with sporadic graffiti.

The bridge that connects to the island next to the Hatch Shell is distinct for the Edwin U. Curtis Memorial that is located at its south end. The memorial was designed by Guy Lowell and first installed on the Esplanade at Clarendon Street in 1924, then later incorporated into the footbridge at its present location. It consists of a plaza of granite pavers with two u-shaped niches with benches carved out of the granite walls. Granite stairs leading up to the bridge are flanked by two stone urns on tall pedestal bases. The niche benches have lost their sealant in between sections, resulting in movement of the sections and wide gaps opening up.

The two westernmost pedestrian bridges are part of the 1930s-era Esplanade design. While similar in construction and scale to the later bridges, these are faced with granite blocks. Their deterioration is similar to that of the other bridges, with the added threat of invasive vegetation encroaching on the abutments. These bridges provide a link to the island and mark each end of the oval Storrow Lagoon, which was built as part of the 1930s Embankment project. Three sides of the Lagoon are edged with cut granite stones, many of which have been displaced by freeze-thaw cycles. Mortar joints have deteriorated and are filled with invasive vegetation. The construction of Storrow Drive resulted in a slight encroachment on the south side of the Lagoon in order to provide a bicycle path on that side of the water body.

The other major features remaining from the 1930s-era Esplanade are the Dartmouth Street and Gloucester Street Landings. At the water's edge, the two landings are identical with granite balustrades and central stairs flanked by two piers, in the same neoclassical style as Commissioner's Landing. The granite elements are in poor condition and are in need of repointing and cleaning. Some stairs have become dislodged, and panels are missing from the piers. Both landings also feature a grove of regularly spaced trees behind the main path and a plaza of granite pavers.

Adjacent to the Dartmouth Street Landing is the Dartmouth Street Sanitary, a one-story, hip-roofed brick building constructed in 1952-53 with influences of the International Style in its design. Recently renovated, it is currently in good condition.

Centered in the Gloucester Street Landing tree grove is a memorial originally dedicated to honor James Storrow built at the same time as the landing in 1936, consisting of a circular granite platform engraved with compass points and a map of the Charles River Basin. A bronze tablet was added to the center of the memorial in 1948 to honor both James and Helen Storrow.

Along the Esplanade between Gloucester Street Landing and the Music Oval, a number of other memorials have been placed. The Oliver Wendell Holmes Memorial consists of a semicircular granite bench with entrance plaza and a central pillar once topped with a sundial. The memorial was first positioned near the Holmes residence on Beacon Street in 1914; it was moved to a location near Dartmouth Street Landing in the early 1950s due to construction of Storrow Drive. The joints between walls and bench sections and floor slabs have lost most of their mortar and many of the elements are shifting out of position.

Between Berkeley and Clarendon Streets stands the Lotta Fountain, built in 1939 and named after its benefactor, Lotta Crabtree. It consists of a granite walled plaza with side benches and a center pillar topped with a sculpture of a dog. At the base of the pillar is a tiled water basin with a sculpted spout. The fountain is no longer functional, and the granite features are in need of cleaning and re-pointing.

At the east end of the island is a memorial to Arthur Fiedler that dates from 1984, featuring a stylized representation of his head formed out of horizontal sheets of aluminum. It remains in good condition.

Bay State Road. The westernmost section of the Esplanade, extending from the Harvard Bridge to the Boston University Bridge, is a much narrower section of parkland with fewer historic resources of note.

The 1910 Boston Embankment extended beyond the Harvard Bridge to Charlesgate, the area where the Muddy River joins the Charles. The parkland was extended west to the Boston University Bridge by adding fill in front of the embankment and old seawall according to the designs of Arthur Shurcliff in the 1930s, as part of the adjacent Storrow Memorial Embankment construction. The construction of Storrow Drive in the 1950s claimed most of this strip of parkland. In response, the Metropolitan District Commission established a new greenspace atop fill to the north, also designed by Shurcliff and Shurcliff. This work established the undulating shoreline that exists today, and added a new swath of parkland upstream of the mouth of the Muddy River. The landscape character of this section is slightly less formal than the rest of the Esplanade, with a more naturalistic collection of trees, including more evergreens, and low shrubs along the river's edge.

The Charlesgate area of the Esplanade was transformed by the construction of the Bowker Overpass in 1966. This new elevated roadway through the Back Bay Fens required the construction of several on- and off-ramps from Storrow Drive

that claimed much open space and transformed the character of what remained.

During the construction of the Boston Embankment in 1910, the Fens Gate House was erected just to the east of the Muddy River to serve the junction of a new sewer line beneath the embankment and a conduit extending from the Back Bay Fens. The granite block building, designed in the Renaissance Revival style, features its original hipped tile roof, copper gutters, and yellow brick chimney. Most of the building is covered with vine growth and the roof and gutters are in poor condition. It is now surrounded by access ramps for the Bowker Overpass and is visually disconnected from the adjacent parks. To the west, on the other side of an on-ramp, stands a stone footbridge over the Muddy River and adjacent curved river walls that were constructed to span the outlet of the Muddy River for the Boston Embankment.

Along the pedestrian path just west of the Harvard Bridge at the Bowker Overpass is a granite railing constructed atop a concrete seawall. Built in the 1950s, the railing features formal neoclassical detailing in its piers and balustrades that is very similar to that of the three landings along the Storrow Memorial Embankment. The railing is in need of cleaning and re-pointing.

Cambridge Esplanade. The parkland on the Cambridge side of the Charles River was designed and developed by the City of Cambridge beginning in 1884. The area between the Lechmere Canal and Broad Canal was termed "The Front," while the area on either side of the Harvard Bridge was called "The Esplanade."

Initial plans for "The Front" designed in 1894 by Charles Eliot were never implemented. The granite seawall along this section was constructed in the late 1890s, creating open parkland between the river and Commercial Street (present-day Land Boulevard). Cambridge Parkway was constructed about 1930 to parallel Commercial Street through the parkland and terminate at First Street. The road was extensively reconfigured in the 1980s and 1990s, including a reduction in width from two lanes to a single lane, resulting in a loss of historic integrity. This parkland of "The Front" was sold by the City of Cambridge between 1946 and 1950 to private developers, except for a small greenway along the seawall and a triangular park at its east end. The concrete path along the sea wall and adjacent grassy strip lined with Norway maples and linden trees retains some of the historic character of the parkland, as established by the early 1940s. The grassy strip, now more of a swale, is heavily worn and impacted by pedestrians and cyclists.

The eastern terminus of "The Front" is the Lechmere Canal. Constructed in 1874 by the Cambridge Improvement Company to support local industries, the canal originally was L-shaped. Its northern half was filled in the late 1960s, and its new terminus was reconfigured into a new park in 1987 that extended to the Land Boulevard bridge. South of the bridge, granite canal walls and cap stones are still visible above the water line, but these likely were built at the same time as the construction of the adjacent river seawall in the late 1890s.

The Broad Canal, located just east of Main Street and the Longfellow Bridge, was constructed in 1805 by digging out marshland as part of a larger effort to establish an industrial port. It was reduced in length from 3,700 feet to its present 1,000 feet in the 1960s. Original stone canal walls are intact but in deteriorated condition along both sides of the canal, now more visible due to the recent construction of a public walkway atop piers in the canal.

At the mouth of the canal are two bridges that carry First Street and Land Boulevard over the waterway. The First Street Bridge was built in 1924 and the Land Boulevard Bridge was built in 1957. Both are single-leaf, multi-trunnion Strauss bascule drawbridges with overhead counterweights. The lifting mechanisms have been inoperable since the 1990s. Management responsibility for the Charles River bridges was recently transferred to MassDOT.

Just west of the Broad Canal is the north end of the Longfellow Bridge, which connects Main Street to Charles Street on the Boston side. This significant landmark, completed in 1906, is now under the care and control of MassDOT, who is undertaking a comprehensive rehabilitation of the structure.

The Cambridge Esplanade was first established by the Charles River Embankment Company, who in 1883 began construction of 1,000 feet of the existing seawall in the vicinity of present-day Massachusetts Avenue. The vision was to establish a 200-foot wide "Esplanade" along the water's edge, with a new high-end neighborhood behind it. This work

coincided with the construction of the Harvard Bridge between 1887-1891. The Cambridge Park Commission took over control of the property in 1893 upon bankruptcy of the Embankment Company, and subsequent extensions of the seawall and backfilling continued into the early 1900s. The area was left largely undeveloped for twenty years until construction of Charles River Road and the relocation of MIT from the Back Bay to its present location in 1916.

Early conceptual plans for the Cambridge Esplanade by Charles Eliot depicted a proposed greenspace between two roads lined with formal tree plantings and paralleling the river's edge, with another line of trees and greenspace along a pedestrian walkway at the edge of the seawall. This layout extended between present-day Amesbury Street and the Longfellow Bridge. This boulevard design was eventually constructed as Charles River Road in the early 1900s, but only to as far as present-day Fowler Street, where it became a four-lane road along the river. Charles River Road was re-named Memorial Drive after World War I, and its form remains mostly unchanged except for alterations that occurred with the construction of the Boston University Bridge in 1928, the neoclassical Memorial Drive Underpass at Massachusetts Avenue in 1931, the William J. Reid Overpass in 1939, and a new viaduct west of the Longfellow Bridge in the 1950s. DCR undertook a major project in the early 2000s to make improvements to Memorial Drive, including the removal of one travel lane and a riverside parking lane to increase the parkland between the road and pedestrian walkway along the seawall. Other recent work includes replacement in kind of the decorative fencing along the top of the seawall and replacing the concrete sidewalks.

Today, the greenspace along the pedestrian path is heavily degraded by joggers and cyclists, leaving long expanses of exposed impacted soil. There are sporadic signs of instability in the granite blocks of the seawall and deteriorated mortar joints, and in many areas vegetative growth in the mortar joints is compromising the stonework.

Constructed just off the seawall in the river basin along the Cambridge Esplanade are several boathouses operated and maintained by private entities. Among these is the historic Walter C. Wood Sailing Pavilion, built in 1936 for MIT and reconstructed in 1976, featuring a neoclassical stone entrance structure at the edge of the seawall.

The Cambridge Esplanade terminates at its west end at the Boston University Bridge. The area beyond the end of the seawall features more informal plantings, and extensive invasive vegetative growth, particularly in the vicinity of the Grand Junction Railroad corridor, requires better management. The landscape has also been heavily impacted by construction work related to the recent restoration of the Boston University Bridge by MassDOT, which is now responsible for managing the bridge.

2.3. RECREATION RESOURCES

The Charles River Lower Basin and New Basin provide a vibrant mixture of recreational resources serving adjacent urban neighborhoods and institutions as well as visitors from the metropolitan area and beyond. The banks of the river support a wide range of activities from picnicking, sunbathing, scenic walks and dog walking to playgrounds, wading pools, tennis courts and baseball fields. The 18-mile Dr. Paul Dudley White Bicycle Path is used for distance biking, inline skating, running and walking, as well as road races and walkathons. The river itself supports sailing, rowing, yachting, canoeing, kayaking, boat tours and fishing. The Hatch Shell hosts over 70 free public concerts and special events each year.

User Surveys

During preparation of the 2002 Master Plan for the Charles River Basin, a telephone survey was conducted of 500 households and students in college dorms that lived in zip codes bordering the Charles River Basin between the Watertown Dam and the Museum of Science . More than sixty percent of those surveyed used the Basin more than once a week for strolling, relaxing, attending concerts or special events. Peak-use times were afternoons and weekends. Summer use surpassed use during other seasons (MDC, 2002).

The survey asked respondents to list and rank how they used the Basin. The top ten responses in order of frequency were:

- Walking for pleasure
- Attending concerts or events
- Relaxing in the park
- Driving on the parkways
- Running or walking for exercise
- Biking
- Picnicking
- Enjoying the outdoors with children
- Inline skating
- Informal sports

Ninety percent of the respondents felt that the Boston area would be less appealing without the Charles River Basin. Eighty-six percent felt the parks and paths were well maintained. Seventy-three percent felt the Basin is a great place to be with children. Half of all respondents, however, feel that the level of automobile traffic spoils their enjoyment of the parkland and that crossing the parkways is dangerous and difficult. Fifty-five percent felt that the Basin's pathways were congested, and thirty-six percent do not feel safe in the parks at night (MDC, 2002).

Some of the changes users desired include:

- Better night lighting (91%)
- Additional bathrooms (86%)
- Better maintenance (88%)
- Easier and safer pedestrian access to the basin (86%)
- Separating pathways by user types (86%)

Since the survey was conducted in 2002, DCR has upgraded lighting along portions of Memorial Drive and the Boston Esplanade. In 2010, the Dartmouth Street Sanitary was refurbished and reopened.

During the spring and summer of 2007, The Esplanade Association (TEA) conducted a Park User Study of visitors to the Boston Esplanade located on the Boston side of the river between the BU Bridge and the old Charles River Dam. The Park User Study used three methods to collect data about visitors encountered in the Boston Esplanade:

- Interviews with 346 randomly selected visitors as they exited from the park.
- Counts and categorizations of 25,592 visitors entering the park.
- Ten full walk-through observations of use patterns of 6,553 people in all areas of the Boston Esplanade (Vizza Consulting, 2008).

Exit surveys found that 38% of the visitors to the Esplanade came from the five adjacent zip codes including Beacon Hill, Back Bay and the West End. Approximately 24% came from other Boston and Brookline neighborhoods, and 10% came from Cambridge (Vizza Consulting, 2008).

Exit interviews indicate that most of the Esplanade users are adults not accompanied by children, only 9% of the users were families. There are fairly equal proportions of men (53%) and women (47%). All ages were represented, although there is a trend toward younger adults under age 35 (48%). The ethnic identity of visitors is predominantly white (84%) with 10% Asian, 2% Black and 2% Hispanic (Vizza Consulting, 2008).

Offered a choice of whether the Esplanade is a "major, moderate or small factor" in a person's enjoyment and appreciation of Boston, 85% of the Boston residents said it is a "major factor." There was no difference in response between Boston residents who live in the five closest zip codes versus other Boston residents. Visitors gave many reasons for why it is a major factor in their appreciation of the city, including the natural green space, scenic beauty, a good place to exercise, an escape from the city, and accessibility (Vizza Consulting, 2008).

Table 13. Participation in Recreation Activities

Activity	A Lot[a]	Some[b]	Total
Walking	63%	29%	92%
Running/Jogging	39%	15%	54%
Sitting, Reading, Picnic	31%	31%	62%
Biking, Roller Skating	29%	15%	44%
Dog Walking	8%	7%	15%
Playground	7%	8%	15%
Concerts	5%	40%	45%
Sail Boating	5%	3%	8%
Movies	2%	7%	9%
Baseball Fields	1%	3%	4%
Tennis	1%	2%	3%
Model Sailing/Fishing Club	1%	2%	3%
Ice Skating	1%	1%	2%
Gondola Ride	0%	1%	1%

a. More than 5 times in the past year.
b. 1 to 4 times during the past year.

Counts taken at the ten entrances along the Esplanade suggest that 7,000-14,000 people visit during the course of a typical good-weather day, not counting special events. Exit interviews indicated that 92% visit in the summer, 80% in the spring, 72% in the fall, and 50% in the winter, but not as often. Walk-through observations estimated that the average total number of users in the Esplanade at a single time was 621 during weekdays and 676 on weekends, not including any events, concerts or ball games (Vizza Consulting, 2008).

Ten percent of those interviewed were visiting the Esplanade for the first time. Most of the respondents (62%) come to the Esplanade at least 15 times a year, and about 39% visit at least 60 times per year. The most frequent users are those who live in bordering neighborhoods, Brookline and Cambridge (Vizza Consulting, 2008).

Among visitors who came to the Esplanade at least twice during the past year, 92% said they sometimes came to the park in the past year to take a walk, 62% came to sit-read-picnic, 54% cane to run or jog, 45% came to a concert, and 43% came to cycle or roller blade. At least 68% of the random sample interviewed use the park for at least three different types of activities (Vizza Consulting, 2008).

About half of the visitors (52%) gave a high rating for their overall satisfaction with the park, 45% a medium rating, and a few a low rating (3%). However, visitors were more satisfied with access to the park (61%) and safety during the day (70%). About half were satisfied with maintenance of the paths (45%), appearance of the landscape (41%) and park cleanliness (34%). Fewer visitors were satisfied with the drinking fountains (11%), food services (10%), informational signage (9%), and the public restrooms (5%) (Vizza Consulting, 2008).

Table 14. Visitor Satisfaction Ratings

Park Feature	High	Medium	Low
Overall Satisfaction	52%	45%	3%
Safety During the Day	70%	26%	4%
Access to the Esplanade	61%	25%	14%
Maintenance of Paths	45%	41%	14%
Landscape Appearance	41%	46%	13%
Cleanliness, Litter Control	34%	51%	15%
Drinking Fountains	11%	22%	67%
Food Services (if used)[a]	10%	24%	66%
Informational Signage[b]	9%	17%	24%
Public Restrooms (if used)	5%	21%	74%

a. 15% did not know there was a café.
b. 43% had not seen any signs and could not rate this feature.

Overall, 67% of park users cited something that negatively affected their visit. The principal activity conflict was the problem of sharing a path between cyclists and pedestrians. Other sources of annoyance included the geese and geese droppings, the traffic on Storrow Drive, the need for improved landscape maintenance and the desire for more functional amenities (e.g., water fountains and restrooms) (Vizza Consulting, 2008).

Given a list of ten possible improvements to the Esplanade, visitors expressed the greatest interest in the need for kayak-canoe rentals (58% high/very high interest), re-opening of the swimming pool (51%), and healthier trees and grass (58%). Women (65%) had a higher interest than men (53%) in kayak and canoe rentals. There was some interest in enforcing the dog leash rule (11%) and designating some paths for pedestrians only (13%) (Vizza Consulting, 2008).

Lower Basin Recreation Resources

Dr. Paul Dudley White Bicycle Path. The multi-use path is a 17.5 mile loop that runs on both sides of the river from the Museum of Science to Watertown Square. The path runs on concrete sidewalks or striped asphalt paths. The bike path and the bridges that cross the river form a route for as many as 10,000 cyclists, pedestrians and runners an hour (Halvorson, 2013). In many areas users have created informal dirt paths through the park landscape.

Some of the neighborhoods surrounding the Lower Basin have well-established bicycle and pedestrian links to the park. However, fragmented or unsafe connections discourage walking and bicycling to the river. In 1999, DCR and Mass DOT commissioned a Connectivity Study to evaluate the conditions and needs of the pedestrian and bicycle facilities along the Charles River Basin. The report provides recommendations for connectivity improvements along the Basin for DCR, Mass DOT and the adjacent municipalities to implement in the future (Halvorson Design Partnership, 2013). Improved pedestrian and bike connections across the Longfellow Bridge are being implemented as part of the MassDOT bridge rehabilitation project.

BU Boathouse Area. This section of Memorial Drive, extending from the end of the Cambridge seawall near Fowler Street to Boston University Bridge, has panoramic views of downtown Boston, sunny southern orientation and broad river banks. Currently its eroded condition and exposure to traffic discourage use.

Heavily compacted soils threaten the health of trees. Crowds watching the rowing races in the spring when the ground is soft have trampled and severely damaged the turf near the Hyatt Regency Hotel. Storm water running off the parkway has eroded the bank. Granite blocks that armor the shoreline have collapsed over the years and now tip toward the water.

The broad bank has a dual path system, promoting separation of foot and wheeled traffic. However, the poor condition of the two pathways discourages use. The existing paved path lies too close to the road and is exposed to traffic. Its six-foot width is insufficient to handle daily pedestrian and bicycle traffic, creating user conflicts. The existing informal dirt path along the water is uneven and unkempt.

In 1998, Boston University entered into a 25-year lease to construct and operate the DeWolfe Boathouse for its crew teams and public rowing programs. BU also uses the building for competitions with other schools and group social events. The boathouse holds 68 rowing shells, locker rooms and a large workout area. The boathouse is located at the starting line for the annual Head of the Charles Regatta and 500 meters downstream from the finish line of the 2,000-meter race course used by the local universities. It has both an interior and exterior balcony providing excellent views of crew races, the Boston skyline and Boston University. The building is in excellent condition and is well maintained (DCAM, 2012a).

Cambridge Esplanade. The Cambridge Esplanade, located along Memorial Drive between the Longfellow Bridge and the west end of the seawall at Fowler Street, contains some of the best-known views of the river with the Boston skyline in the background. Shade trees are planted thirty feet on center in four rows along Memorial Drive providing a formal front yard for MIT.

Soil compaction from off-path runners and bicycles is killing trees and damaging turf along the river. Trees lining Memorial Drive along the MIT campus are well maintained and thriving. The narrow pathway along the river is constrained by the seawall railing and benches. The pathway is seriously overcrowded. Conflicts among pedestrians, skaters and bicyclists cause some joggers and bikers to use the planting zone wearing paths through the turf along the esplanade.

The sidewalk on the river-side of Memorial Drive is in poor condition and is very narrow considering its use as a two-way shared use path. The recent rehabilitation of the BU Bridge included a curb extension on the Cambridge end of the bridge to accommodate a wider pathway.

In 2002, the Historic Parkways Initiative developed a two-phase plan to re-establish the formal boulevard character of the Cambridge Esplanade, improve pathway circulation along the river and improve parkway intersections. Phase I improvements completed in 2004 included:

- Removal of a travel and a parking lane on the eastbound (riverside) of Memorial Drive between Fowler Street in the west and Longfellow Bridge in the east to expand parkland adjacent to the river.
- Landscape and pathway improvements by the Longfellow bridge.
- Reconstruction of the Massachusetts Avenue Underpass bridge deck and restoration of the historic underpass.
- Installation of historic lighting on the BU Bridge.

- Reconstruction of the Harvard Bridge deck and railings.
- Planting of new trees;
- Sidewalk widening and railing repairs on the Cambridge Viaduct.
- Reconstruction of the roadway drainage system, including additional environmental controls, between Fowler Street and the Longfellow Bridge.

Major improvements are planned for the path system along Memorial Drive as part of the Memorial Drive Phase II project. For most of this section there will be a 10-foot, two-way paved shared use path adjacent to the roadway with a separate 6-foot stabilized aggregate path along the river. Memorial Drive Phase II improvements have been designed and permitted. However, the construction of Phase II improvements has not been funded. Proposed Phase II improvements include:

- Landscape improvements between the Cambridge Viaduct and Fowler Street including 300 new trees, 12 shade shelters and 34 Shurcliff benches.
- Reconstruction of concrete walkways and hand railings along the seawall between the Cambridge Viaduct and Fowler Street.
- Construction of a multi-use pathway between the Cambridge Viaduct and the Boston University Boathouse separating pedestrian and bike traffic.
- Installation of historic lighting from Fowler Street to the BU Bridge.
- Stabilization of the riverbank between Fowler Street and the BU Bridge.
- Construction of stormwater improvements from Fowler Street to the BU Bridge.

The MIT Harold W. Pierce Boathouse, completed in 1966, houses the MIT rowing program. A pile-supported pier supports the Boathouse which contains an eight-oared moving water indoor rowing tank, 64 ergometers and a fleet of over 50 rowing shells. The boathouse was completely refurbished in 2004.

Constructed in 1935, the MIT Walter C. Wood Sailing Pavilion is the oldest university sailing pavilion in the world. MIT has recently installed a new floating dock at the Sailing Pavilion to accommodate approximately 100 sailboats and sailboards. Northeastern University, Wellesley College and a number of high school teams utilize the MIT Sailing Pavilion for their practices.

The Charles River Yacht Club has operated a private boat club at 100 Memorial Drive since 1934. The Club offers 72 slips with water, electric and ice services for its members. To promote a cleaner river, the Club provides free septic pump out and removal services to all vessels using the Charles River Basin. Permanent floats can accommodate yachts up to 60 feet in length.

The Harvard Sailing Pavilion is located on a barge in the river. The barge supports a two-story structure. Half of the sailing center contains changing rooms, rest rooms, and a boat repair shop while the other half houses the sailboats. The boats are hauled out on racks using a crane. They are hung vertically and moved via a ceiling-mounted monorail. Three floating docks are used to tie up boats once they are in the water.

Sailing center membership is available to any member of the Harvard community and its affiliates. Public access is limited to spectators at regattas hosted by the club and occasional use of the bathrooms and water fountains. The pavilion is maintained in good condition (DCAM, 2012b).

Broad Canal. The canal was developed in 1805 to provide warehouse and docking facilities to serve the port of Cambridge. Broad Canal represents one of the last vestiges of the river's industrial past. The seawall along the south side of the canal is lined by a walkway and Kendall Square office buildings that open onto the path. Charles River Canoe and Kayak operates a seasonal kayak and canoe rental concession on a landscaped terrace located at the head of the Canal. The Kendall Power Plant is located on the north side of the Canal. A wooden boardwalk parallel to the north seawall, provides access along the north side of the Canal.

The mouth of Broad Canal is located at one of the most inaccessible stretches of the Lower Basin for pedestrians, joggers and cyclists. To get to the Broad Canal, visitors on the Cambridge esplanade must cross four lanes of high-speed traffic. The Longfellow Bridge rehabilitation project will widen the paths under the bridge along Memorial Drive, and create new traffic signals and crosswalks to link

the Broad Canal path to Cambridge Parkway. The two drawbridges, now permanently lowered, provide five feet of clearance between the water and the underside of the bridges, blocking the entrance of the canal for larger boats.

East Cambridge Front. This area is approximately 2,200 feet long and 80 feet wide. Cambridge Parkway is a one-way drive 20 feet wide with parking on the land side only. The adjacent Lechmere Canal area was redeveloped in the early 1980s. The Charles River Boat Company operates out of the Lechmere Canal in front of the Cambridge Side Galleria. It provides sightseeing tours around the Charles River Basin and Boston Harbor, sunset cruises and architecture tours.

Despite stunning views of the Lower Basin, Longfellow Bridge and the Boston skyline, the riverfront here fails to draw large numbers of visitors due to a lack of visitor amenities and poor pedestrian access. Multiple parallel pathways dominate this narrow strip of parkland, leaving little open space for picnics and sunning. The depressed swale between the walkway and the bike path further discourages use of the turf area.

Lechmere Park, at the mouth of Lechmere Canal, is not well connected to other areas in the Basin, including the Museum of Science. The nearby Royal Sonesta Hotel has expressed interest in supporting public programs here.

DCR operates a public mooring area for 40 boats north of the Longfellow Bridge. Public access to the float for the public mooring field is minimal and not well marked. Charlesgate Yacht Club, founded in 1946, operates a private 71-boat club on floating docks adjacent to the Cambridge Parkway. The boat slips accommodate vessels ranging from 17 to 50 feet in length.

Boston University Beach. The parkland adjacent to Boston University is difficult to access, underused and underdeveloped. As a result of soil compaction, trees in the BU Beach area are generally in poor condition and in need of pruning or replacement. Poorly graded, the area does not drain well.

Built in 1928, the Boston University Bridge rises high to clear the Grand Junction railroad tracks below. There is no direct link between the BU Bridge and pathways along the river. On the south side of the bridge, a set of stairs drops down on the south side of Storrow Drive, tempting pedestrians to cross illegally at this point. It is possible to travel downriver a quarter mile to the BU Overpass, but this circuitous path is neither ADA accessible or marked.

One of the most significant gaps in the path system is the lack of a connection from the BU Bridge to the Esplanade below. The Grand Junction Railroad Bridge, a double-barreled crossing with active tracks on one side and an abandoned roadbed on the other, is rarely used. This bridge links the two river banks at a much lower elevation than the BU Bridge, presenting an opportunity for a future pedestrian link across the river.

As the City of Cambridge moves forward with plans for the Grand Junction Railroad multi-use path, a connection from the Boston side of the path along the existing rail bridge over the Charles River and the BU Bridge upstream sidewalk is a high priority. In addition, a sloping path from the end of the rail bridge to the path along the Boston side of the Charles River would provide an important link between the river and the BU Bridge.

Between the BU Bridge and the Harvard Bridge there are two pedestrian overpasses over Storrow Drive that provide access to the Esplanade path system and the adjacent Boston University campus. However, the overpass behind BU's Mugar Library is only accessible by stair and is not ADA-compliant. The overpass near Silber Way does have ramps, but it is difficult for bicyclists on Commonwealth Avenue or Bay State Road to find.

The narrowness of this section provides little escape from the noise generated by Storrow Drive traffic. At several spots, the park barely contains enough room for the asphalt path that links the downriver Esplanade with upriver destinations in Allston and Cambridge. This pathway is particularly narrow where it passes on a boardwalk beneath the BU Bridge.

The only organized activities in this area revolve around the BU Sailing Pavilion and an outdoor Fit Park exercise area. The BU Sailing Pavilion is used to store boats, boat repair and instruction with lockers and dressing areas. It is open to the BU community and the public. It has no restrooms or water, and it is not ADA accessible (DCAM, 2012c). Its proximity to the Grand Junction Railroad Bridge

poses a challenge to novice sailors. At this pinch point in the river, novice sailors using the dock conflict with passing rowers and are occasionally blown up against the railroad bridge.

Charlesgate - Muddy River. The Muddy River forms a crucial but largely hidden open space link connecting the Charles River to the Back Bay Fens and the Emerald Necklace. The Emerald Necklace path system provides far-reaching bicycle and pedestrian connections linking several neighborhoods in Boston and Brookline. In 1965, construction of the Bowker Overpass severed the Charlesgate link between the Emerald Necklace and the Charles River pathway systems. This feature is hidden beneath the Bowker Overpass.

The barren, dark, poorly maintained land beneath the overpass is hostile to pedestrians and cyclists. It also stands as a significant visual barrier between Kenmore Square and the Back Bay. Pathways buried beneath the overpass no longer provide a direct connection to parkland along the river for runners, pedestrians and bicyclists.

In a plan developed by the Solomon Foundation in conjunction with the Connectivity Study, a new12-foot wide multi-use path would link the Esplanade paths and Harvard Bridge sidewalks to Beacon Street by way of an isolated 2.5-acre park overlooking the river. Reestablishing a Charlesgate greenway will help make bicycle and walking trips possible between inner-city neighborhoods along the Emerald Necklace and the banks of the Charles River. MassDOT has agreed to fund design and construction of the proposed multi-use path.

Proposed Charlesgate Multi-use Path (Solomon Foundation)

Harvard Bridge Area. The Harvard (Mass. Ave.) Bridge funnels cyclists, joggers and walkers from both Back Bay and Cambridge into the Esplanade on an ADA-accessible pedestrian/bike ramp. The alignment of Storrow Drive has squeezed the width of the Esplanade to 16 feet for almost one-quarter of a mile from the Harvard Bridge past the Bowker Overpass ramps. The Storrow Drive/Bowker Overpass alignment has also isolated a 400-foot long "island" of parkland located between Storrow Drive west- and eastbound lanes from the river parkland.

The Stoneman Playground and outdoor exercise area is located in the Esplanade east of the Harvard Bridge. In 2001, The Esplanade Association raised funds to install the Stoneman Playground. These facilities are in excellent condition and are well used by park visitors.

The Island, Lagoons and Landings. Running from the Harvard Bridge to the Music Oval, this area contains a long, narrow island that defines lagoons and the Canoe Passage, all introduced by Arthur Shurcliff to buffer the river's wave action. The Storrow Lagoon, with its shallow sheltered water, was designed for ice skating, model boat sailing, rowing and canoeing. Given milder winters, ice on the lagoons has not been thick enough to support ice skating. The island contains mostly lawn and only a few man-made elements. Five arched pedestrian bridges connect the island with the mainland.

Encroachments by Storrow Drive have reduced the southern side of the Storrow Lagoon to a strip of land too narrow to support healthy tree growth. Squeezed between the roadway and the lagoon, this area is a noisy, exposed pinch point for cyclists, runners, skaters and pedestrians.

The grounds, pathways and approaches to the water's edge in the lagoon area suffer visibly from neglect. Much of Shurcliff's original planting scheme has given way to ad hoc improvements over time. On the mainland, an extensive wooded area along Storrow Drive features numerous memorials, now in disrepair. Storrow Drive's proximity discourages use throughout this area. Traffic noise has created an unpleasant area where people pass through, but few linger.

Storrow Drive has severed the direct link between the Back Bay neighborhood and the Dartmouth and Gloucester Street overlooks. Their strong architectural form still provides a transition from the urban streetscape to the more natural parkland. Both the Dartmouth and Gloucester Landings need significant upgrades. Design plans for renovation of both landings are 90% complete.

The Fairfield and Dartmouth Street pedestrian bridges over Storrow Drive are in good condition and provide ramps for bicycle and universal access. The overpasses at Fairfield Street and Dartmouth Street need better bicycle and pedestrian connections to Beacon Street. Both streets are one way for that block, however, bicycle demand is two-way. Counter-flow bike lanes would improve the connectivity to the river from the Back Bay neighborhood.

With help from The Esplanade Association, the Dartmouth Street Sanitary restrooms were refurbished and reopened in 2010.

Hatch Shell Area. The Hatch Shell is the best known structure on the Esplanade. Its distinctive Art Deco architectural style forms a beautiful centerpiece for the entire park and serves as a summer stage for numerous large events, including concerts, dance lessons, festivals, and the nationally televised Fourth of July concert and fireworks.

The Music Oval, pathways and riverbank near the Hatch Shell experience tremendous use for concerts, walkathons and special events. Many events that do not rely on the Hatch Shell have been staged from the music oval. Overuse of the grassy Music Oval has compacted the soil, damaged its turf and destroyed vegetation. Event staging areas are poorly located and largely open to view. Ad hoc ground treatments, gravel and pavement introduced to facilitate event set-up, create visual clutter and a sense of disorganization behind the Hatch Shell.

The Esplanade Association (TEA) has launched a capital campaign to raise $4 million to restore the Hatch Shell area. TEA has hired a landscape firm to design and permit restoration of the Music Oval turf.

Anthem Hospitality took over operation of Café Esplanade in 2013 and has invested more than $95,000 in capital improvements to upgrade the premises. The Cafe's menu includes lobster rolls, soups, paninis and gourmet desserts as well as children's value meals. The Café has expanded its programming to include art exhibits, a permanent "piano in the park" for public use, weekly acoustic and poetry nights, Saturday soul music brunch and Sunday jazz brunch. The Cafe is scheduled to open from April into November. Anthem Hospitality will also provide food services during special events and is permitted to provide food carts along the Esplanade.

In 2011, Friends of the Esplanade Playspace raised private funds to construct a new playground west of the Esplanade Café. The Playspace, the work of Halvorson Design Partnership, is well used and in excellent condition.

Gondola Venezia, a realization of Arthur Shurcliff's original vision for use of the Esplanade lagoons, has operated in the Esplanade lagoons since 2001. The lagoons and canal provide an appropriate venue for gondola rides. The boats operate May through November, Wednesday through Sunday from 2 p.m. until midnight. The program serves approximately 2,000 people a year.

The Arthur Fiedler Footbridge, built in 1953, is an important entry point from the Beacon Hill and Back Bay neighborhoods, and the Hatch Shell area, Union Boat Club and Community Boating. It is used by visitors parking in the Boston Common Garage or walking from nearby Red and Green Line MBTA stations.

Pedestrian and bicycle connections to the Fiedler footbridge are disrupted by Beacon Street and the complicated traffic movements of several Storrow Drive on- and off-ramps. The narrow footbridge, with its spiraling access ramps, four blind turns, and steep rise and fall, does not meet ADA requirements. It is poorly configured for the high volumes of foot and bike traffic it handles.

"Esplanade 2020: A Vision for the Future" advises that this gateway be made as flat and wide as possible, separate bikers from walkers, and frame views from Beacon Street to the river and the Hatch Shell. The TEA report proposes that the Storrow Drive tunnel be reconstructed to place Storrow Drive in an underpass, eliminate redundant ramps, and provide an at-grade pedestrian and bicycle entry from Beacon Street (TEA, 2012).

Bicycling, inline skating and running have come to dominate the Esplanade in recent years. Two parallel paths run almost the entire length of the Esplanade from the Harvard Bridge to the Lee Pool, a distance of about 8,000 feet. These dual paths provide a convenient way to separate fast and slow traffic. The striped route running parallel to Storrow Drive is the first choice of most high-speed bikers. The majority

of recreational users prefer the paths along the water's edge.

The Union Boat Club is a rowing club founded in 1851 before the first Charles River dam was constructed. The clubhouse on Chestnut Street is used for squash and fitness programs. The rowing program is housed in a multi-gabled building constructed in1909. The boathouse is set back from the river, allowing public access to the riverbank and public dock adjacent to the boathouse. It is primarily used for the storage of rowing shells, support equipment and club activities. Approximately 100 of the Club's 700 members participate in the rowing program. A competitive rowing camp is available each summer for a dozen high school students.

For the past 20 years, an ancient Chinese Dragon Boat Club has used the Union Boat Club for weekday practices. The program has storage space in the Union Boat Club. They have an annual festival that takes place in Riverbend Park near Harvard University, where a number of Chinese Dragon Boat teams come together to race.

Commissioners Landing, a landmark Beaux Arts architectural feature, is badly deteriorated. The steps of Commissioners Landing have been seriously undermined and have collapsed into the river. Large chunks of granite cladding have also fallen off. These conditions constitute an immediate public safety hazard and are among the most visible signs of disrepair in the Lower Basin. Construction documents and permits to renovate Commissioners Landing are complete, but funding is not currently available for these renovations. In 2008, one dock was replaced at the Union Boat Club and a new dock was added downstream at Commissioners Landing.

Commissioners Landing (DCR)

The wooded area behind the landing was designed as a formal complement to the landing, but its state of disrepair suggests a lack of care that makes the area uninviting. The trees are in poor condition, the ground largely devoid of vegetation and the soil compacted. The area between the landing and Storrow Drive has become the default set-up location for special events at the Hatch Shell.

Recently renovated Eliot Memorial Plaza, with its clear sightlines to the Community Boating docks, provides a gathering area that better integrates Community Boating with the park. The project will also demonstrate ways to improve landscape maintenance of the Esplanade. This includes tree care, soil remediation, installation of the historic shrub sub layer that has been lost over the years, and sustainable maintenance practices. Construction was funded by private contributions ($380,000) and DCR ($190,000).

Since 1937, Community Boating has operated one of the oldest public sailing programs in the country. The program provides sailing opportunities for all by minimizing economic and physical obstacles to sailing. The program serves approximately 4,500 members from 30 communities. Approximately 200 adults use the facility each weekday with 400 participating each day on weekends. Its high school program serves approximately 100 students per day each spring and fall. During the summer, 200 to 400 youth participate in its youth sailing program. Free or reduced memberships are available to low-income families. Community Boating also provides a universally accessible sailing program that serves about 350 people using modified sailboats.

The boathouse is a two-story building with a lobby, boat garage, storage and dressing rooms on the first floor. The second floor, added in 1987, has a large community room and several offices. DCR is responsible for major repairs to the boathouse and docks. In 2011, the Community Boating wooden docks were completely replaced. The Esplanade Association raised $335,000 toward the $2.8 million project. The boathouse has a non-operational elevator for second floor access, a 27-year old leaky roof, and deteriorating brick exterior.

Charles Circle. The Charles Circle pedestrian bridge is the most heavily traveled pathway into the Esplanade. The Charles/MGH Red Line station serves as a principal point of access to the park,

especially for activities that attract large numbers of visitors. The bridge is narrow, badly deteriorated and not ADA-compliant.

In the spring of 2013, construction began on rehabilitation of the Longfellow Bridge as part of Mass DOT's Accelerated Bridge Program. The project will widen the sidewalks and add buffered bike lanes in both directions across the bridge. The existing pedestrian overpass from Charles Circle to the Esplanade is scheduled to be replaced with a wider ADA-compliant pedestrian bridge as part of the bridge rehabilitation project. Please see Section 2.4 for a more detailed description of the Longfellow Bridge project.

In 2012, DCR awarded a five-year permit to LAZ Parking for operation the 300-space parking lot adjacent to Charles Circle under the Storrow Drive entrance and exit ramps. The winning $1.0 million per year bid was substantially greater than the previous $120,000 per year permit. Off-peak parking rates are provided to programs and events held on the Esplanade.

In August 2014, legislation was signed into law authorizing the state to lease land located between Storrow Drive and the Massachusetts Eye and Ear Infirmary (MEEI) to the hospital. MEEI has proposed the construction of a 1,065 space underground parking garage, a public park above the garage and a 240,000 square foot 15-story addition to its existing facility over Charles Street. The legislation also authorizes MassDOT to relocate both sides of Storrow Drive under a single bridge arch increasing the width of the Esplanade by 75 feet at a critical choke point. The parking garage could be entered directly from Storrow Drive in either direction alleviating traffic in Charles Circle. The Act requires MEEI to pay full market value for the parcels to be leased.

Parkland created by relocating Storrow Drive under a single bridge arch (Esplanade 2020).

Charlesbank. This area is dominated by active recreation facilities, including three baseball fields, four general use or soccer fields, two tennis courts, a spray fountain, a playground and the Lee Pool. Many of these facilities were developed in 1951 upon completion of Storrow Drive. Charlesbank feels cut off from the rest of the Lower Basin, in part because its pathways bottleneck at either end. The river path exposes pedestrians to traffic on both sides as it passes through a parking lot next to the Lee Pool and through a second parking area under the Longfellow Bridge. The Blossom Street Overpass connects the West End neighborhood directly to Charlesbank.

In 2005, The Esplanade Association, Hill House and Red Sox Foundation raised over $2 million to renovate the Teddy Ebersol's Red Sox Fields. Used by baseball, softball and soccer programs, Teddy Ebersol's Red Sox Fields serve as a major recreational resource for the city. The Ebersol family also made a generous donation to ensure that the fields are maintained. The well maintained fields remain open to the public during daylight hours. Teddy Ebersol's Red Sox Fields may not be used for organized walks, staging of concerts, tents or other events and uses that may damage the fields. Lederman Park, located south of Teddy Ebersol's Red Sox Fields, provides shade and calm.

The Lee Pool has been closed for 15 years. Though still structurally sound, the complex's electrical and mechanical systems have deteriorated. The pool bathhouse is used to store equipment and material for maintenance of the Boston Esplanade and New Basin parks. The spray pool is in need of repair. A small parking lot north of the pool serves the tot lot, spray pool and ball fields. The Lower Basin DCR parking lot and tennis courts, with their high fencing. and asphalt surface, is a developed node marking the end of the Boston Esplanade.

New Basin Recreation Resources

New Charles River Basin. The New Charles River Basin Master Plan proposed development of riverfront parks along the "lost half mile" of the Charles River to connect the mouth of the river to the Cambridge and Boston Esplanades (MDC,1995). Continuous promenades, walkways and bicycle paths were proposed to connect the upstream esplanades with the Boston Harbor Walk, and link the riverbank paths to adjacent neighborhoods.

Promenades along the water's edge and narrow intermediate paths were proposed for pedestrian use. Bike paths for faster bicyclists and roller bladders were designed along the upper edge of the parks adjacent to bordering city streets. New ADA-accessible foot bridges were proposed to make it possible to travel unimpeded across the railroad tracks and intervening waterways.

New Charles River Basin Master Plan (DCR)

In the execution of the Central Artery/Tunnel Project (CA/T) federal regulations required mitigation for the impact of the highway work on existing and planned parks. New highway bridges also required the use of land owned by the MDC.

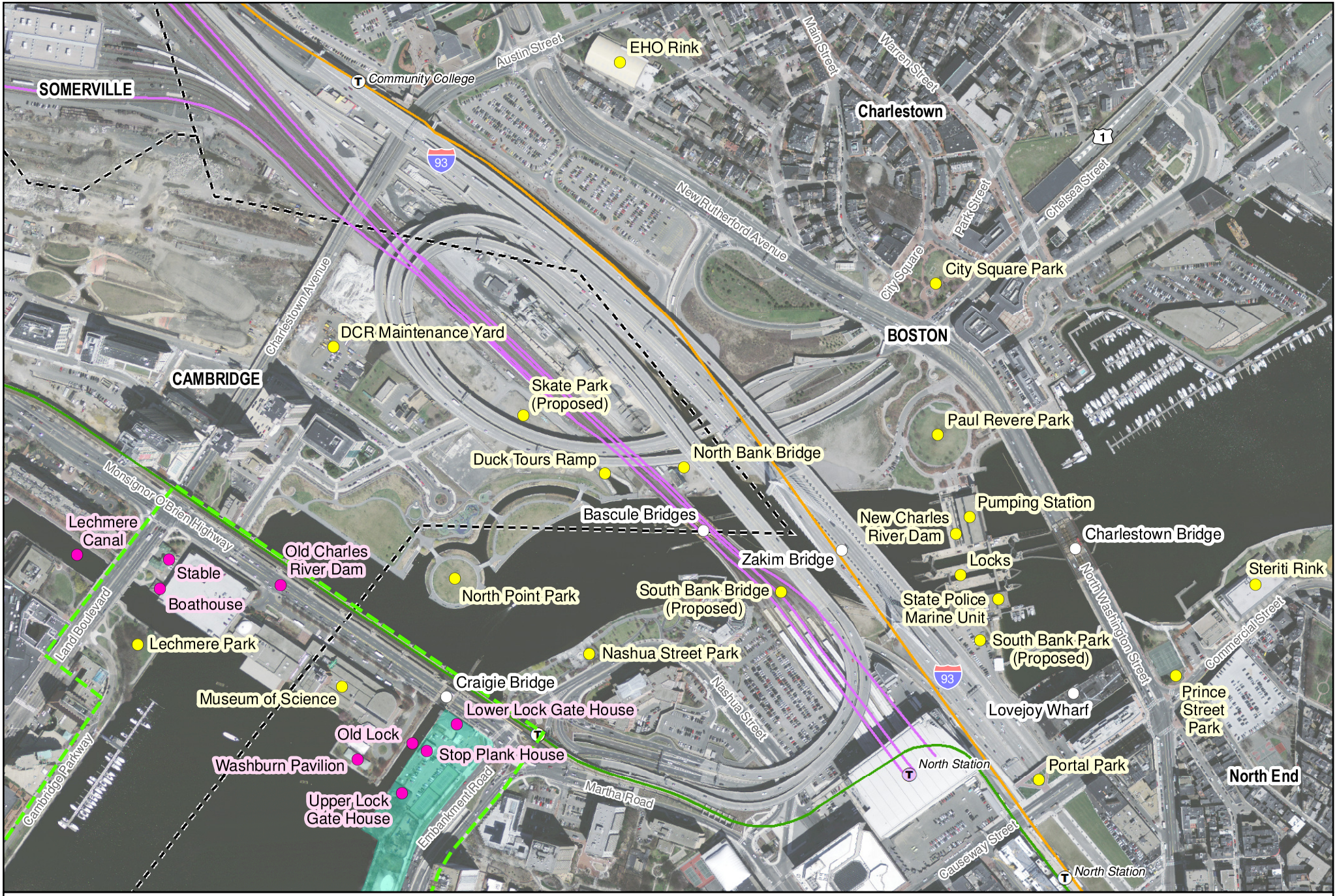
The CA/T Project therefore agreed to construct a network of parks, pedestrian and bicycle paths in the New Charles River Basin to mitigate impacts of the highway project, initiating implementation of recommendations from the New Charles River Basin Master Plan (MDC, 1995). Upon completion of the CA/T Project, the New Charles River Basin Trust Fund was established to complete the required parks, connecting pathways, and the renovation of historic buildings.


Lower Lock Gate House and Stop Plank House

Old Lock Area. This area functions as a principal entry to the Boston Esplanade from the north and east, yet few visitors recognize it as parkland. Heavy traffic on the Charles River Dam Road and the I-93 ramps prevent the Esplanade and Nashua Street parks from functioning as a single, continuous open space.

The historic lock buildings are vacant or house nonpublic uses. DCR, MassDOT and State Police staff parking takes up much of the area. No directional signage points visitors to the parks. The area lacks both identity signage and interpretive panels to orient visitors.

The Upper Lock Gate House is a vacant, single story 3,450 square foot masonry structure completed in 1910. It is in fair condition following temporary repair of the roof. Some windows are missing and the building systems are not operational.



- Major DCR Cultural Resource
- Major DCR Infrastructure
- Non-DCR Landmark
- MBTA Subway Station
- MBTA Commuter Rail Station
- MBTA Green Line (Subway)
- MBTA Orange Line (Subway)
- MBTA Commuter Rail Line
- Town Boundary
- Boston Landmark Boundary
- Charles River Basin National Register District

Charles River Esplanade - New Basin Complex
New Basin Major Cultural Resources and Infrastructure

0 0.1 0.2 Mile

Geographic data provided by MassGIS and DCR GIS.

dcr Massachusetts

The Stop Plank House is a masonry building constructed in 1937. It contains approximately 2,200 square feet plus a storage loft. The building is generally in fair condition, although the slate roof needs replacement. Leaks are causing ongoing deterioration to the structure. Building systems are old, and there are no thermal insulation, fire protection or life safety systems. The garage is used by the DCR Flood Control Program.

The Lower Lock Gate House is a two-story masonry building with a four-story tower containing approximately 10,500 square feet of floor space. The building envelop is in fair condition although it lacks thermal insulation. The building mechanical, plumbing and electrical systems are in fair condition. There is no fire protection system and the building is not ADA accessible. Vehicle access, circulation and parking take up most of the site (DCAM, 2011).

The Lower Lock tower is used by Mass DOT personnel to operate the Craigie Drawbridge. The original lock gate and chain drive structure, out of service since the opening of the new dam downstream in 1978, remains in place in the ground floor of the building, adjacent to a large, nearly empty boiler room. Massachusetts State Police use the remainder of the building. The Lower Basin Barracks serves portions of Boston, Cambridge and Somerville including I-93, Storrow and Memorial Drives.

The Massachusetts State Police are reducing the total number of state police stations statewide from 36 barracks to 25. As part of this consolidation, the Upper and Lower Basin stations will be combined into a single renovated station at the Lower Lock Gate House. Approximately 60 State Police personnel will be assigned to the combined station.

DCAM has developed a preliminary 22,300 square foot building program for the Lower Basin Barracks that may exceed the space available in the Lower Lock Gate House. The proposed program may require an addition to the building and possible use of the Stop Plank House (DCAM, 2011). The Designer Selection Board has selected Finegold Alexander + Associates to document MassDOT and State Police building requirements, evaluate building alternatives, prepare schematic design plans and cost estimate to bring the Lower Basin Barracks up to State Police requirements.

Leverett Circle Pedestrian Bridge. The complex intersection at Leverett Circle is difficult for pedestrians and bikers to navigate. The new ADA-accessible Science Park Green Line station is one of only two points where the transit system brings riders close to the Esplanade. Moving from the station to the park is difficult. MassDOT has recently retained a design firm to prepare plans to reconstruct the pedestrian overpass at Leverett Circle, which will link Science Park Station to the Old Lock Area and the West End neighborhood. The Connectivity Study has recommended at-grade improvements to help bicyclists and pedestrians navigate the at-grade crossing between the Boston Esplanade and Nashua Street Park (Halvorson Design Partnership, 2013).

Proposed MOS Charles River Exhibit Gallery

Museum of Science. The Museum of Science is located on an 8.8-acre parcel leased from DCR on top of the original Charles River Dam. One of the world's largest science centers and Boston's most attended museum, the museum introduces about 1.5 million visitors a year to science, technology, engineering and math. Since moving to its current site from the Back Bay in 1951, the Museum of Science has expanded in stages across the original 1910 dam.

Starting in 2013, the museum has been undergoing a major campaign to upgrade the physical structure and develop new educational content. This $250 million campaign will upgrade nearly half of the exhibit halls and open a new exhibit on the Charles River. The Charles River Gallery is scheduled to open in 2015, creating a new three-story entry exhibit on the Charles River basin and watershed. In the lower lobby, the Charles River exhibit will engage visitors of all ages and backgrounds in understanding the natural and engineered worlds and

their delicate interrelationship. With the Charles River Gallery, indoor exhibit space will connect with the outdoors to illustrate the link between the natural and human-made worlds in and around the Museum of Science.

Capitalizing on the Museum's unique location spanning the Charles River, the new gallery will overlook the river and skylines with 50-foot high windows. The gallery will be a place of discovery with fish and animal habitats; plant exhibits; water features; interactive maps and learning tools; and access to an outdoor garden space offering the Museum's first indoor-outdoor experience. Visitors will be able to see, touch and experience the natural and engineered elements that have merged in the river and environs. The Gallery will tell the story of the basin's natural habitat and the highly engineered development of Boston and Cambridge through interactive programs interpreting the river, its history and its ecosystems.

Completion of the parking garage for the museum in 1971 complicated the connection between the north and south banks of the river. Currently, the primary bicycle path runs from Land Boulevard in Cambridge, over the river along the Charles River Dam Road connecting to a bicycle path along Embankment Road in Boston. In this area, the path runs along a narrow sidewalk adjacent to busy Charles River Dam Road.

The Connectivity Study proposes an alternative route for this link from the north to the south banks of the river utilizing a pair of new footbridges along the upstream side of the Museum of Science. One pedestrian bridge would be located where Lechmere Canal and the River join, and the second would span the Old Lock (Halvorson Design Partnership, 2013).

Proposed Museum of Science Pedestrian Bridges (DCR)

The Lechmere Canal footbridge would be a curved bridge connecting the Cambridge Esplanade, over the Lechmere Canal, to the Museum of Science parking garage. A cantilevered or pile-supported walkway would connect the bridge to the existing path behind the Museum of Science. A second drawbridge will then be necessary to cross the Old Lock connecting to the existing paths behind the Museum of Science along the Boston Esplanade (Halvorson Design Partnership, 2013). A drawbridge is required to meet U. S. Coast Guard vessel height requirements through the Old Lock.

Historic Stable (Rose Melino)

Historic Stable and Boat House. Located along the Land Boulevard side of the 1910 dam, the historic stable and boathouse buildings once housed a MDC police barracks with horse and boat facilities to patrol the Charles River Reservation. Both buildings are vacant. The boathouse is badly deteriorated. Funding to stabilize both structures and renovate their exteriors is available in the New Charles River Basin Trust Fund.

A $1.6 million contract is underway for the Stable structural repairs, exterior renovations and lead abatement. A designer has not been retained to design and permit repairs to stabilize the Boat House which has significant structural deficiencies.

Green Line Extension. Mass DOT has recently submitted a New Starts grant application to the Federal Transit Administration to extend the Green Line approximately 4.5 miles from Lechmere Station in Cambridge through Somerville to Medford. The $1.5 billion project includes a new community path for cyclists and walkers that would connect the Minuteman Bikeway in Arlington with

the new Lechmere Station. Some station platforms will be lengthened to accommodate longer, four-car trains. The project will also include structural improvements to the Green Line viaduct located on the downstream side of the Old Charles River Dam.

North Point Park is an 8.5-acre park located on the Cambridge side of the river downstream from the Museum of Science. Opened in 2007, the park was created as mitigation for construction of the CA/T Project. The park includes two small islands connected by bridges that provide a canal system for kayaks and canoes. The park contains diverse opportunities for enjoying the river including formal river promenades and boat docks. There are broad sloping lawns, a performance area, perimeter promenades, bicycle and pedestrian paths and a play space with a spray pool and pergola. Boston's Duck Boats enter the river here.

North Point Playground and Spray Pool

The park is adjacent to the 45-acre North Point Neighborhood development project. The project includes construction of 2,900 housing units, 2 million square feet of laboratory and office space, several public parks and 200,000 square feet of retail space overlooking the Charles River. Proximity to North Point Park with connections to the Boston and Cambridge Esplanades is a major marketing feature for this $2 billion private project.

Charles River Skate Park. The Charles River Conservancy has begun construction of a 40,000 square foot skate park on the northern part of North Point Park under the I-93 highway ramps. The skate park is designed to provide four tiers of difficulty for skateboarders, BMX riders and inline skaters. The skate park will have seating for spectators and the capacity to support community clinics and events, as well as competitions. The Conservancy raised $4.5 million to remediate the contaminated site, design, permit and construct the skateboard park.

Proposed Charles River Skate Park

Private funding included a $1.5 million donation from Vans, which plans on hosting two skating events per year at the park, an $800,000 donation from the Lynch Foundation, $1.75 million raised from various donors and $450,000 in public funds. The public money includes $100,000 from the Boston Redevelopment Authority, $200,000 from the City of Cambridge and $150,000 in state funding. DCR will operate and maintain the completed skate park. Vans has agreed to donate $25,000 annually to DCR for skate park maintenance.

North Bank Pedestrian Bridge (Karl Haglund)

North Bank Bridge. The bridge is a 700-foot long sinesoidal pedestrian bridge over the Millers River and MBTA railroad tracks connecting pedestrian and bicycle paths in North Point and Paul Revere Parks. Completion of the North Bank Bridge in 2012 provided continuous pedestrian and bike access along the north bank of the New Basin connecting the Charles River Esplanade to Boston's Harbor Walk. The pedestrian bridge and other site improvements under the Zakim Bridge were built

using $25,345,900 of American Recovery and Reinvestment Act funds.

The Connectivity Study recommends improved crosswalks at the Museum Way signal to enhance pedestrian and bicycle connections between the North Point Park and Land Boulevard (Halvorson Design Partnership, 2013).

Millers River Walkway (Brown, Richardson & Rowe)

Millers River. There is a short surviving section of the Millers River that lies beneath the I-93 ramps between Charlestown and Boston Sand and Gravel. It is the remnants of an oyster filled expanse of water that extended past Bunker Hill College and the MBTA Green Line train storage shed almost to the Cambridge Court House. During design of the Central Artery/Tunnel (CA/T) project, the Charles River Watershed Association and the Conservation Law Foundation led efforts to protect the remaining day lighted section of the Millers River.

Chapter 91 permit requirements mandated that the CA/T project construct pedestrian access along the previously inaccessible riverbank from Rutherford Avenue in Charlestown to the Charles River. A pedestrian walkway containing colorful light poles, interpretive historical panels and reintroduced wetland vegetation was opened in 2012 as part of the CA/T project. The walkway provides a series of artworks, interpretive graphics, paving designs and lighting elements designed by Ross Miller that lead pedestrians through structural piers that support I-93.

Paul Revere Park. Located where the Charles River meets Boston Harbor, 5-acre Paul Revere Park extends from the Charlestown Bridge upstream to the Zakim Bridge. Completed in 1999 and 2012, the park expanded a small open space created near the New Charles River Dam in 1978.

The park features a large, grassy oval with a stage for performances and a playground. Interpretive mosaics depict Paul Revere's famous ride and Robert Frost's poem "The Gift Outright." A fishing pier with fish cleaning stations is located on Boston Harbor below the New Charles River Dam. The park provides a pedestrian boardwalk under the Charlestown Bridge connecting to the Boston Harbor Walk along the Charlestown waterfront. The park entry road provides bicycle and vehicle access under the Charlestown Bridge to the Freedom Trail in Charlestown with connections to the USS Constitution, Charlestown Navy Yard, Bunker Hill Monument and City Square. Paul Revere Park is also accessible to the North Station area by crossing the Charles River Dam and locks.

Paul Revere Park (DCR)

Paul Revere Park is in good condition. Some lawn and planting bed restoration work is needed. There is no wayfinding signage in the park directing visitors between the North Station area, Charlestown and North Point Park.

Nashua Street Park is located on the southern bank of the Charles River between the Green Line viaduct on the west and the MBTA Bascule Bridges on the east. Opened in 2004, this 2-acre park extends the historic Boston Esplanade below the 1910 dam to the rail yard behind North Station. Nashua Street Park provides public access to the shoreline and creates linkages to adjacent areas for walkers and bicyclists.

Nashua Street Park (Halvorson Design Partnership)

A 12-foot wide multi-use path along the river's edge and a 10-foot wide pathway within the interior of the park are separated by two large raised lawn areas. The park has become a popular destination for skateboarders due to its extensive low granite walls. Raised landscaped planting beds are maintained along the roadway to separate the park from Nashua Street traffic.

At the center of the park is a paved plaza with a spiral granite sculpture that features fog mist and fiber optic lighting. A 70-foot wide granite stairway, reminiscent of the granite landings on the Boston Esplanade, provides access to the water's edge. Vertical stone seat walls have been built on either side of the stairway. Future dock facilities are proposed that flank the stairway and provide access for small boats. The landing is dedicated to the cabinet secretaries of the Commonwealth's environmental agencies over the past 40 years.

Proposed Bascule Bridge River Crossing. The "Drawbridge Walkway," is planned over the river connecting North Point Park in Cambridge to Nashua Street Park in Boston. A pedestrian walkway and bike path attached to the upstream bascule commuter rail bridge is currently under design by the MBTA. A boardwalk currently exists on the upstream side of the North Station trestle from the upstream bascule bridge to the Nashua Street Park. The MBTA has agreed to design, construct and operate the Drawbridge Walkway. A total of $3.2 million is available in the New Charles River Basin Trust Fund for design and construction of the walkway.

Proposed South Bank Bridge. On the Boston side of the river, the South Bank Bridge, serving cyclists and pedestrians, is planned to cross over the MBTA train tracks behind North Station connecting Nashua Street Park with the Lovejoy Wharf area. The pedestrian bridge is under design with construction scheduled to begin in 2016. A total of $14.7 million is available in the New Charles River Basin Trust Fund for design and construction of the bridge.

Proposed South Bank Park. The proposed 3-acre South Bank Park is located on the southern bank of the river as it enters Boston Harbor. The site is currently linked to Paul Revere Park and Charlestown by an existing pedestrian walkway across the new Charles River Dam and Locks. In the future, the Drawbridge Walkway and South Bank Bridges will connect the South Bank Park to North Point and Nashua Street Parks, completing the park system between the Boston Esplanade and Boston Harborwalk.

Visitors entering South Bank Park from the North Station area will pass through Portal Park, the point where the Central Artery rises out of the tunnel to climb over the iconic Zakim Bridge. The raised planters of Portal Park interpret the Bulfinch Triangle, an area adjacent to Causeway Street that has been undergoing a major transformation after removal of the overhead MBTA Green Line and Central Artery highway structures.

South Bank Park will provide an entrance from the North Station area to the New Basin parks. The North Station area is well served by public transportation as both the MBTA Orange and Green Lines, northern commuter rail and Amtrak lines converge at North Station providing public transit Construction of South Bank Park is a mitigation requirement for the CA/T project that MassDOT has agreed to fund, design, permit and construct.

Construction has begun on the 2.1-acre Lovejoy Wharf site adjacent to the proposed South Bank Park. The existing brick nine-story North Washington Street Building adjacent to the Charlestown Bridge is currently being renovated to provide 187,000 square feet of office space for the Converse world headquarters and 45,000 square feet of ground floor retail. The Converse building will include a pedestrian stairway from the Charlestown Bridge sidewalk to the wharf and harbor walk below. The adjacent structure on Beverly Street has been razed and is scheduled to be replaced with a 14-story residential building with 100 housing units and parking.

Lovejoy Wharf Rendering

Chapter 91 permits require the Lovejoy Wharf developers to invest $15 million to a create public open space on Lovejoy Wharf. The wharf improvements will connect to the existing pedestrian walkway under the Charlestown Bridge, built as part of the reconstruction of Prince Street Park in the North End.

The developer has replaced the existing wharf, and will provide a 250-foot long floating dock and 0.7 acres of landscaped waterfront open space. The project will include a new waterfront plaza, restaurants and retail space, and floating docks for marina space and water shuttles. The open space will be available to the public for formal and informal gatherings, seasonal vending carts, and public music, art and dance events to enliven the waterfront. In addition, Chapter 91 permits for 226 Causeway Street require the 226 Causeway Street Trust to provide public restrooms and $23,000 per year to support maintenance of the New Basin parks.

Visitors to Boston cross the Charles River at North Washington Street as they follow the Freedom Trail to Charlestown. In 2013, the Freedom Trail recorded over four million visitors and the Charlestown Navy Yard attracted nearly two million visitors. At this crossing, pedestrians and cyclists squeeze together along a narrow sidewalk adjacent to heavy vehicular traffic. The City of Boston is planning to reconstruct the North Washington Street Bridge including wider sidewalks and separation of bicycle lanes.

Commuters and residents typically walk or bike from the North Station area to Charlestown and Cambridge on a narrow walkway across the Charles River Locks. Opportunities may exist for upgrades to the existing locks crossing (e.g., new safety gates, better railings, non-slippery surfaces and a wider walkway) to accommodate pedestrian and bicycle travel. In addition, there is no way-finding signage to direct visitors between the North Station area, Charlestown and the New Basin parks.

The BRA has recently announced the Causeway Street Crossroads Initiative to transform the road corridor into a pedestrian-oriented boulevard to support the growing North Station area and reconnect the West End and North End neighborhoods. North Station and TD Garden, amongst Boston's largest generators of pedestrian activity, are both located along Causeway Street. The initiative will improve traffic operations and safety, provide significant upgrades to existing bicycle accommodations, and improve pedestrian amenities and convenience.

North End Parks

Prince Street Park, located at the corner of North Washington and Commercial Streets, provides two tennis courts, an indoor ice skating rink, wood pier and a ¼ mile long harbor walk extending from the walkway under the Charlestown Bridge eastward to Langone Park. The Freedom Trail currently passes along Commercial Street as visitors walk from the North End to Charlestown over the Charlestown Bridge.

In September 2013, the City of Boston received a $15.5 million TIGER grant to create safe, attractive and easy-to-navigate pedestrian and bicycle connections between the public transit system and the City's historic sites. As part of this project, the City has proposed relocating the Freedom Trail from Commercial Street to the harbor walk located behind Prince Street Park. The City is designing a paved bicycle-pedestrian path that runs along the western edge of Langone Park, follows the harbor walk behind the Steriti Rink and Prince Street Park west to the boardwalk under the Charlestown Bridge, across the harbor walk under construction along Lovejoy Wharf to the New Charles River Basin.

The wooden pier is in poor condition and has been closed to the public. There is local interest in using the pier for a public marina and water taxi station.

Steriti Skating Rink. The Steriti Rink, owned and operated by DCR, provides indoor ice skating, skate rentals and a snack bar from late November to mid-March. The rink contains an indoor bocce court, and

has spectacular floor to ceiling views of Boston Harbor and Charlestown. The Rink is an easy walk from North Station. On street parking is limited, but validated parking is available at a private garage on Commercial Street. The rink is heavily used by Boston and North End ice hockey teams. Free public skating is offered 2.5 to 3.0 hours on weekdays, and 4 to 7 hours on weekends. In addition, the Boston Common Skating School provides skating lessons.

The rink is in good condition, requiring minor repairs to the cooling system. A Friends Group has submitted a partnership proposal to design upgrades to the bocce court and provision of separate restroom facilities for use when the rink is closed.

Charlestown Parks

City Square Park is a quiet one-acre oasis surrounded by busy roadways. The park is located at the site of Charlestown's historic Market Square, which was laid out in 1629 and remained a vital gathering place until an elevated train was built through it in 1901. By 1960, Tobin Bridge traffic emptied into the square and two new elevated highways were constructed over it blotting out the square. In 1992 the elevated highways were replaced by a tunnel under City Square and a new park was designed to restore the historic square.

City Square Park (Halvorson Design Partnership)

In October 1996, City Square Park opened as an oasis of green lawn areas formally landscaped with more than 70 varieties of trees, shrubs and flowers, gas lamps, artwork and a central fountain. Hammered cooper and cast bronze sculptural pieces with associations to Charlestown's rich history adorn the park. Historic personages from Charlestown are commemorated on the portrait medallions at each of the park gateways. Today the Friends of City Square Park assist with park maintenance and sponsor special events in the park.

O'Neil Skating Rink. The O'Neil Rink, owned and operated by DCR, provides indoor ice skating, skate rentals and a snack bar from late-November to mid-March. The rink is well maintained and has on street parking. The rink is heavily used by area ice hockey teams. Public skating is offered 2 hours a day Tuesday through Saturday, and 4 hours on Sundays. The rink mechanical systems and dasher boards were fully renovated in 2013. Given the rink's heavy use, there is a need to expand the locker and team rooms.

Special Events

In 2013, over 100 special events and 30 photo shoots were held in the Charles River Esplanade - New Basin Complex. Special events included charitable walks and runs, regattas, fitness events, concerts and performances, social gatherings and art exhibits. Some of the larger recurring events include:

July 4th Celebrations have been held at the Hatch Shell since 1973, when David Mugar conceived of energizing the Boston Pops Esplanade concert with Tchaikovsky's 1812 Overture, cannons and fireworks. Boston 4 Celebrations, a non-profit organization, is responsible for coordinating all phases of the celebration. Each year approximately 500,000 people view the fireworks display from both sides of the Lower Basin, boats in the water, and the Harvard and Longfellow Bridges. Approximately 100,000 – 150,000 people view the celebration in the Esplanade, with about 9,000 to 10,000 visitors inside the Music Oval.

The Hatch Shell location is strongly identified with the July 4th celebrations. The Lower Basin has good public transit and pedestrian access for this major event. As attendance has grown, the venue has become too small for the event.

It is a tight fit to organize a large event in the Hatch Shell area. Pictures from 25 years ago show a much more open space, with people able to spread around and still see the celebration. The trees have filled in so much, it gets harder to see the fireworks back by Storrow Drive. As a result, the crowd has moved closer to the water, by the lagoons.

There is also a conflict between staging the production and visitors using public restrooms

behind the Hatch Shell. Electric power, internet and telephone service at the Hatch Shell is not sufficient to support major productions.

Boston Landmarks Orchestra. Since 2001, the orchestra has presented free summer concerts at the Hatch Shell. Collaborating with arts, cultural, education and social service organizations, the orchestra seeks to ensure that great music is available to audiences across ethnic, economic and cultural boundaries. It also offers family concerts and educational programs at no cost in the neighborhoods of Greater Boston. More than 50,000 people attended Landmarks events in 2013.

Head of the Charles Regatta. The Head of the Charles Regatta is the largest rowing competition in the world. The 3-mile race course begins at Boston University's DeWolfe Boathouse in Cambridge, and ends at Artesani Park in Allston Brighton. The race brings more than 300,000 spectators to the banks of the river. In 2013, the Regatta hosted 55 competitive races with 9,000 athletes.

American Cancer Society Walk. For the past 20 years, the American Cancer Society (ACS) stages its largest walk in the country around the Lower Basin. The walk is 5.7 miles long starting at the Hatch Shell. There are between 35,000 and 40,000 participants, coming from all over Massachusetts. The ACS has 110 buses that drop off at Storrow Drive and are parked at Bunker Hill Community College. Over 2,000 people participate in the walk, raising $3 million most of which stays in the state.

American Diabetes Association. The Association has used the Esplanade for a walk for the past 15 years. Over 2,000 people participate, mostly from within the 128 corridor. Participants park in the Boston Common garage and meet in the Music Oval before walking around the Lower Basin.

Boston Model Sailing Club. The Club is a volunteer organization that was revived in 2002 by The Esplanade Association. From 25 to 250 people attend model sailing events, with anywhere from 10 to 75 people sailing. Free sailing events are held in the Esplanade lagoons during warm months of the year. The Club's equipment is stored in the Dartmouth Street Sanitary. The area where the program operates is a little desolate. Improvement of the Dartmouth Street Landing and the provision of food carts would add vitality to the venue.

2.4. MAJOR INFRASTRUCTURE

Vehicular Bridges

The historic Charles River bridges provide critical connections in and out of Boston and Cambridge for a wide range of users, including businesses, universities, hospitals, bicyclists, pedestrians and drivers. The bridges are important evacuation routes and serve numerous recreational users along the Charles River. In 2009, care and control of the Charles River Bridges was transferred from DCR to the Massachusetts Department of Transportation (MassDOT).

The MassDOT Accelerated Bridge Program has allocated over $400 million to renovate seven structurally deficient bridges in the Charles River Lower Basin. Bridge rehabilitation projects completed or currently underway within the Charles River Esplanade - New Basin Complex include the Boston University Bridge, Longfellow Bridge, Craigie Dam Bridge and Craigie Drawbridge.

Improved bicycle and pedestrian crossings, and enhancements to bridge approaches are included in the Charles River Basin bridge projects. DCR has been working closely with MassDOT to design safe ways on and off of each bridge that connect to existing pathways and bike lanes

In 2009, DCR and MassDOT jointly commissioned a study as part of the Accelerated Bridge Program to evaluate the conditions and needs of the pedestrian and bicycle facilities along the Charles River Basin from Watertown Square to the Boston Harbor Walk. The "*Charles River Basin Pedestrian and Bicycle Study for Pathways and Bridges"* (the "Charles River Connectivity Study") identified connectivity gaps that exist where physical or other constrains impede bicycle and pedestrian travel throughout the network of paths, intersections and bridges along the Charles River Basin. The report provides conceptual design recommendations for connectivity improvements for DCR, MassDOT and the adjacent municipalities to incorporate in the future. The recommendations show each project's priority, relevant jurisdictions and potential funding sources. Some of the recommendations can be implemented in the short term, while others will require further study and will need to be incorporated into long-term planning and fundraising (Halvorson Design Partnership, 2013).

Boston University Bridge. The BU Bridge carries Route 2 over the Charles River between Boston and Cambridge. Built in 1928, it was originally named the Cottage Farm Bridge. From 2009 to 2011, the bridge was fully renovated by the Mass DOT Accelerated Bridge Program. The project included a full deck replacement, rehabilitation of the downstream sidewalk, superstructure repairs and installation of a stormceptor system. The stormceptor system treats stormwater from the bridge significantly improving the water quality of stormwater discharged from the bridge. The project preserved original historic elements of the bridge and created two dedicated 5-foot wide bike lanes adjacent to the sidewalks.

Grand Junction Railroad Bridge. This steel truss bridge carries the Grand Junction Railroad over the Charles River. The railroad is occasionally used by freight trains. In June 2010, Mass DOT purchased several CSX rail lines located in eastern Massachusetts, including the Grand Junction tracks from the Beacon Park Rail Yard in Allston, through Cambridge to North Station.

The Grand Junction Railroad is the only rail connection in Greater Boston between the train lines that flow in and out of North and South Stations. The 8-mile line begins at the Brighton rail yard, crosses the Charles River under the BU Bridge, and follows a serpentine path through Cambridge, East Somerville, Everett and Chelsea before entering East Boston from the north.

As a result of this acquisition, a proposal was developed to route some additional MBTA Framingham/Worcester Line trails via the Grand Junction to North Station. The proposal includes a new station near Kendall Square and avoids train congestion at South Station. Mass DOT is currently conducting a detailed study to evaluate the construction feasibility, costs, benefits and impacts of this proposal.

Harvard (Mass Avenue) Bridge. The Harvard Bridge is a steel girder bridge carrying Massachusetts Avenue (Route 2A) over the Charles River. It is the longest bridge over the Charles River at 2,165 feet. The bridge was completely rebuilt by the MDC between 1986 and 1990. The original girders, bracing and deck were replaced as part of the project.

Longfellow Bridge. The Longfellow Bridge is one of the most architecturally distinguished bridges in Massachusetts. This 2,135-foot steel and granite structure was completed in 1908. The bridge connects Cambridge Street in Boston with Main Street in Cambridge, and carries the MBTA Red Line and two-way vehicular traffic across the Charles River. The bridge presently carries 28,000 motor vehicles, 90,000 transit riders, and 1,250 pedestrians, joggers and bicyclists each day.

The connections from the Longfellow Bridge to the river paths on both banks have been broken, making the bridge one of the weakest links in the Charles River pathway system. Storrow Drive and the Cambridge Viaduct, designed to pass under the bridge, create difficult pedestrian and bike connections along the river.

On the Cambridge side of the bridge, the viaduct has isolated a piece of the Cambridge Esplanade, including the access stairs to the bridge. These stairs are now stranded on an island between lanes of high-speed traffic. There is no safe connection between the river path and the bridge walkway.

On the Boston side, flights of stairs connect the Longfellow Bridge to the pedestrian bridge, but bicyclists and skaters find them difficult to negotiate. People with physical disabilities find them impossible. Cyclists crossing to Boston currently use the shoulder, which vanishes at the end of the bridge as the roadway expands from two lanes to three.

While the downstream sidewalk on the bridge is of adequate width, it does not connect to the park on either end. Consequently, most people using the Longfellow as part of a loop around the basin use the upstream walkway. Only four feet wide, the sidewalk is too narrow to handle the walkers, runners, inline skaters and bicyclists who use it.

In the summer of 2013, Mass DOT began work on rehabilitation of the Longfellow Bridge as part of the Accelerated Bridge Program. The three and a half year rehabilitation project will address the bridge's current structural deficiencies, upgrade its structural capacity and bring it up to modern code standards. The project will improve multi-modal access and bridge-to-city-street connections to meet federal and state accessibility guidelines. The repairs and modifications will also restore the historic character of the bridge.

The rehabilitation project will widen the upstream bridge sidewalk by 5.5 feet and the downstream sidewalk by 6.0 feet. Separate bike lanes will be provided in both directions across the bridge. The bridge stormwater system will direct the flow of stormwater through landscaped gravel wetlands on each side of the bridge. The gravel wetlands will reduce the amount of sediments, nutrients, oils and specifically, phosphorous in future stormwater discharges from the bridge.

On the Boston side of the bridge, the project will expand the Charles Circle pedestrian entry plazas on both sides of the bridge. Fifteen-foot wide sidewalks will connect the enhanced entry plazas to the upstream and downstream stair towers and widened bridge sidewalks. Twelve foot wide signalized crosswalks will connect the entry plazas to the Charles/MGH Red Line Station, Cambridge and Charles Streets and Beacon Hill. The existing deteriorated Storrow Drive overpass will be replaced with a new ADA compliant 12' wide pedestrian bridge connecting the southern entry plaza to the Boston Esplanade. A new 8' wide paved walkway will be built under the eastern bridge arch connecting the south and north bridge stair towers to both entry plazas. Marked bike lanes will guide bikers to and from the bridge bike lanes across Charles Circle.

On the Cambridge side of the bridge, the project will build 8-foot wide ADA accessible paths connecting the widened bridge sidewalks to the inland side of Memorial Drive. An 8' pathway will be provided under the bridge connecting the two bridge stair towers to the Memorial Drive west bound sidewalk and Cambridge Parkway. The bridge bike lanes are connected to Main Street and a 6' bike lane is provided along the west bound bridge off ramp connecting to the inland side of west bound Memorial Drive. In addition, the Dr. Paul Dudley White Path will be widened to 9' under the Longfellow bridge arch.

Craigie Dam and Draw Bridges. The Craigie Dam Bridge and Craigie Drawbridge carry Msgr. O'Brien Highway (Route 28) between Land Boulevard in Cambridge and Leverett Circle in Boston. As part of the Accelerated Bridge Program, Mass DOT awarded a construction contract in June 2009 for the structural rehabilitation of the Dam Bridge and the complete replacement of the Drawbridge. The project was completed in August 2011.

The Craigie Dam Bridge, constructed in 1906, crosses over 8 sluiceways in the dam. The project included the replacement of all damaged and deteriorated structural members along with the reconstruction of the bridge deck and sidewalks. The pedestrian walkway on the upriver side of the bridge, adjacent to the Museum of Science, was widened to accommodate pedestrians and bicycles.

The Craigie Drawbridge is a twin double-leaf bascule bridge originally constructed in 1910 and replaced in 1962. The drawbridge is raised to allow passage of tall boats through the old lock between the Lower and New Basins. This project included the complete replacement of the bridge superstructure and bridge deck, as well as all lifting machinery and electrical components.

Green Line Viaduct. Built in 1910, the Green Line Viaduct carries the MBTA Green Line across the old Charles River Dam between Science Park and Lechmere Stations. Structural repairs to the viaduct are scheduled as part of the $1.4 billion Green Line extension project.

The project will extend the Green Line 4.5-miles from Lechmere Station through Somerville to Medford. The project includes a $39 million community path for walkers and bikers linking the Minuteman Bikeway in Arlington to a new Lechmere Station. The project also includes plans to improve drainage for the Miller's River which was almost entirely buried in the nineteenth century and causes flooding issues in Somerville's Union Square. Some station platforms will be lengthened to accommodate longer, four-car trains.

Commuter Rail Bascule Drawbridges. A pair of bascule drawbridges carries MBTA Commuter Rail and Amtrak trains over the Charles River to and from North Station. The bridges are the surviving two of four drawbridges at this location. There are four tracks, two on each bridge. The bridges, built in 1931, are 92 feet in length. The MBTA acquired the bridges in 1973 and operates North Shore commuter trains over the former Boston & Maine railroad. North Station is the terminus for all the northern MBTA commuter train routes to Fitchburg, Lowell, Lawrence and Newburyport. It is also the terminus

for one Amtrak route, the Downeaster, which travels to Portland, Maine.

Most of the time, the bridges are down, since there is more train traffic than boat traffic. During summer weekends, the bascule bridges are raised to let pleasure boats pass between Boston Harbor and the Charles River Basin. The MBTA has begun design of new bridges to replace the existing bascule bridges. The MBTA has agreed to add a 12-foot wide multi-use walkway on the upstream replacement bridge to provide pedestrian and bicycle access between North Point Park in Cambridge, and Nashua Street Park in Boston. DCR has agreed to fund the design and construction of the walkway from the New Charles River Basin Trust Fund. Design of the replacement bridges is 60% complete.

Dams

The old Charles River Dam was constructed between 1905 and 1910 to turn the lower Charles River from a tidal estuary into a fresh water basin. The dam eliminated tidal fluctuations and covered severely contaminated tidal flats. The dam consists of a wide earth section, retained both upstream and downstream by granite block walls. It contains eight sluice gates and a ten-foot wide canoe lock that have been covered by the Museum of Science garage, and a navigation lock that has been abandoned. Today, most of the earth section of the dam is occupied by Charles River Dam Road and the Museum of Science.

The dam was designed to maintain the Basin water level 2.5 feet below mean high tide in Boston Harbor. This level was controlled by the operation of eight sluice gates in the dam. However, when the tide in the harbor was high, the gravity sluices could not discharge water. Rainfall in Hurricane Diane in August 1955 caused the Basin level to rise 4.5 feet above its design level for about four days. A rise in excess of 18 inches caused water to flood into adjacent low areas, inundate local streets and back-up through sewers and drains into the basements of buildings located in the flood plain.

The former lock now remains open allowing the river, short boats and fish to flow freely. Taller ships require the opening of the drawbridge, operated by the Massachusetts Department of Transportation. The dam and sluice gates are inspected annually by DCR Flood Control Engineers and maintained in good structural condition.

The New Charles River Dam is a flood control and navigational structure completed in 1978 by the Army Corps of Engineers. The dam is operated by the DCR Office of Flood Control and Navigational Operations. There is a formal operations and maintenance plan for the dam. The Dam is an approximately 36-foot high, 900-foot long reinforced concrete structure. The dam impounds the Charles River Basin and is located at the tidal boundary of the Charles River and Boston Harbor. The dam contains two low-level sluice gate outlets, three navigational locks, six large tide pumps and a labyrinth fishway.

The top of the dam is approximately 150 feet wide. A large brick-faced building containing the tide pumps and DCR Flood Control and Navigational Operations offices is located at the top of the dam. A pedestrian walkway extends along the top of the dam and over the upstream lock gates. The walkway connects Charlestown and Cambridge to the North End and North Station. A State Police boathouse is located south of the navigation locks.

The purpose of the dam is to control the surface level of the upstream river basin and to prevent sea water from entering the Charles River freshwater basin during high tides. The primary outlet control is provided by twin 8-foot by 10-foot sluice gates located at the north side of the dam. The gates are operated within the pump house on top of the dam. Trash racks are located upstream of the gate inlets.

There are wooden deflection walls located downstream of the sluice gates to deflect flows away from the piers of the Charlestown Bridge and Constitution Marina located downstream of the dam. Six pumps are located within the building on top of the dam to convey flow from the Basin to the Harbor during flood conditions. Six diesel-powered, 2700 horsepower engines drive six pumps with a combined capacity of about 3.7 million gallons per minute. The purpose of the pumps is to pump water out of the river basin when the tide in Boston Harbor exceeds the water surface level in the Charles River basin.

The dam contains three navigational locks located near the center line of the dam with one larger (40-feet wide) than the other two (25-feet wide) to

accommodate the occasional passing of a larger commercial vessel. Large steel gates are used to flood and dewater the locks for passing vessels. The three locks can be crossed by pedestrians and is part of the popular Boston Harborwalk. The walkway is the site of the "Charlestown Bells", an interactive art installation by Paul Matisse, consisting of a set of chimes mounted on the railing that passers-by can strike. The work was refurbished in 2013 after it had fallen into disrepair. Embedded in the exterior brick of the dam's stair tower are nine bronze panels that illustrate the history of the Charles River Basin. The panels are the work of Claire Nivola. The dam also contains an abandoned fish passage.

In June 2011, the dam was inspected by GZA GeoEnvironmental, Inc. The dam was found to be in good condition with some minor deficiencies. GZA recommended resetting displaced riprap stones on the downstream slope, repair of the upstream wooden training walls and fender piers, and renovation of the lock gates and associated mechanisms (GZA, 2011).

North Point Maintenance Facility

In July 2012, the Central Artery/Tunnel Project (CA/T) transferred care and control of a 6.6 acre construction staging area to DCR for use as a maintenance yard and public park. The property is located under US-1 highway ramps in Cambridge adjacent to the MWRA Prison Point CSO Facility.

Temporary modular buildings have been installed on a portion of the site to house offices, vehicles and material storage for the River District and Parks Mobile Maintenance crews. The site also contains a 21,400 cubic yard CA/T soil stockpile containing non-friable asbestos materials.

DCR has developed a building program for a new 34,500 square foot consolidated office, trades shop, vehicle storage and maintenance yard for the Charles River Esplanade - New Basin Complex and the statewide Parks Mobile Maintenance crew (LDA Architecture & Interiors, 2012). This facility will also function as DCR's statewide emergency operations and storm center. Funding must be identified for design and construction of the proposed maintenance facility before the project can proceed to design, permitting and construction.

City Square Park (Rose Melino)

SECTION 3. MANAGEMENT RESOURCES AND PRACTICES

The operations and management of DCR properties often requires close coordination between multiple bureaus, offices and programs of DCR, and is highly dependent upon fluctuating operating budgets. Each facility has its own management challenges which are generally influenced by many factors including seasonal or year-round visitor use numbers, staffing availability, condition of recreational facilities, the equipment available for property management, and regulations which the agency must follow. Operational procedures at the Charles River Esplanade - New Basin parks have evolved over the past 95 years. The following section summarizes the current management and operations of the Charles River Esplanade - New Basin Complex.

3.1. MANAGEMENT STRUCTURE

The operation and management of properties within the Charles River Esplanade - New Basin Complex requires the participation of MassParks regional, district and complex personnel, as well as DCR staff from the Bureau of Planning, Design & Resource Protection, Bureau of Ranger Services, Bureau of Engineering, and Office of Partnerships. Supplemental staffing is also provided by personnel from public safety agencies and private partners. Descriptions of these entities and their roles in managing the Complex are provided below.

Region. Administrative, clerical, and support functions are performed by regional staff. The Boston Regional office is located at Carson Beach in South Boston. The Regional Director performs a variety of administrative functions, including supervision of regional staff and District Managers. Clerical and fiscal support (e.g., procurement, payroll, processing seasonal employee paperwork) is provided by the regional Accountant, Business Management Specialist, Clerk and Administrative Assistant.

A Regional Ranger provides support for public education and enforcement of DCR regulations. The Regional Ranger reports to the Director of Ranger Services, supervises District Rangers and trains seasonal Park Rangers. Park Rangers report to the park supervisors, but rely on Bureau of Ranger Services for training and regulation enforcement guidance.

The Regional Interpreter provides support for visitor services, interpretive programs and special events, and training of seasonal Park Interpreters. Seasonal Park Interpreters report to the park supervisors, but

rely on the Office of Interpretive Services for training and technical support.

The Regional Maintenance Foreman, located at the North Point Maintenance Facility, coordinates facility maintenance from a statewide Dispatch Center using appropriate in-house staff or service contractor. The Dispatch Center provides plumbing, electrical, HVAC, overhead door, fencing, pool mechanical system, roofing and painting services.

District. The Boston Region is divided into two smaller management districts. The Charles River Esplanade - New Basin Complex is located within the Rivers District, under management of the Rivers District Manager. The District Manager reports to the Regional Director and is responsible for the management of all properties within the district and the supervision of Field Operation Team Leaders.

The District Manager has the ability to allocate resources within the district in order to improve park operations. For example, staff and equipment from the rinks may be temporarily sent to the Music Oval to assist with a special event that requires staffing levels, skill sets, or equipment unavailable at the Esplanade.

Complex. Each complex has a field operations team, comprised of all personnel assigned to properties within the complex, and one Field Operations Team Leader. The team leader for the Charles River Esplanade - New Basin Complex is a full-time, year round Recreation Facility Supervisor based at the Hatch Shell. The Fields Operations Team and TEA horticulturalists work out of the Lee Pool. The Field Operations Team Leader reports to the District Manager, who in turn reports to the Regional Director.

The **Bureau of Planning, Design & Resource Protection** prepares master plans, resource management plans and trail system plans; develops and updates GIS data; provides technical assistance for the stewardship of archaeological and historic resources; identifies and acquires properties to be added to the DCR system; maintains an archive of park documents; and provides technical support on ecological resources and the monitoring of Conservation Restrictions. The Bureau also plans, designs, and permits park building and landscape capital projects to create new facilities (e.g., the New Basin parks) or enhance existing DCR properties.

Law Enforcement and Public Safety. Public safety and emergency response services are provided by park staff with the support of state and local law enforcement departments. DCR staff is not law enforcement officers, but have limited authority to issue citations in the parks (e.g., parking tickets). DCR rangers provide first aid, search and rescue services, manage traffic and parking, administer the Park Watch Program, and educate visitors about park rules and regulations. DCR Rangers are authorized to issue citations for violations contained in 350 CMR 2.00 through 5.00.

The Massachusetts State Police has primary law enforcement authority on State-owned lands. The State Police respond to vehicle accidents, medical emergencies, assaults, intoxicated visitors, visitor evictions, search and rescue, and burglary incidents. The State Police Lower Basin Barracks is housed in the Lower Lock Building and the Marine Unit is located adjacent to the New Charles River Dam.

The Massachusetts Environmental Police provide primary enforcement of boating, hunting, trapping and fishing regulations. The Environmental Police will also respond to search and rescue, domestic violence, dumping and vehicle law violation issues within State Parks. Local police (i.e., Boston and Cambridge) provide additional law enforcement within their respective jurisdictions.

Bureau of Engineering. The Bureau of Engineering is responsible for the engineering and construction of parkways, utilities, dams, buildings and recreation facilities. The Bureau includes a Regional Engineer who oversees infrastructure maintenance and construction projects in the Boston Region.

The Office of Flood Control Management and Navigational Operations is located within the Bureau of Engineering. This office is responsible for maintenance and operation of the Old and New Charles River Dams, 12 pump stations that pump stormwater out of the Storrow and Memorial Drive underpasses, and 12 flood control dams located upstream on the Charles River. The office is responsible for maintaining the Charles River Basin at a constant water level that is approximately 4-5 feet below mean high tide in Boston Harbor to prevent storm flooding in Cambridge and Boston. The office also operates the New Dam locks to provide boat and fish passage between Boston Harbor and the Charles River.

Office of Partnerships. The Office of Partnerships works with park users and supporters to develop and sustain community-based stakeholder groups. It facilitates external financial assistance for the planning, design and construction of capital projects. The Office manages the DCR partnerships Matching Funds Program, which leverages private contributions to improve DCR-owned and managed facilities. It also serves as a dedicated point of contact for individuals and nonprofit, institutional, and community-based organizations.

3.2. CURRENT STAFFING

The job titles and number of permanent year-round, and temporary seasonal personnel that work at the Charles River Esplanade - New Basin Complex are presented in Table 15. Four permanent year round employees and eight summer seasonal employees are assigned to maintenance and operation of the Boston Esplanade and New Basin Parks. This staff has an administrative office in the Hatch Shell, and uses the closed Lee Pool to store its tools, equipment and materials.

Seasonal recreation facilities (i.e., Steriti and O'Neil Skating Rinks, Lee Wading Pool and the Teddy Ebersol Red Sox Fields) are maintained and operated by 5 year-round employees with the support of 11 winter and 9 summer seasonal employees. The recreation staff operates the ice skating rinks during the winter, and the Lee Wading Pool and the Teddy Ebersol Red Sox Fields during the summer. The recreation staff works out of the Steriti and O'Neil skating rinks.

The Lower Basin Yard staff maintain properties along the Charles River corridor located in Cambridge west of the Charles River Dam Road, Boston south and west of the Boston Esplanade, Brookline, Newton and Watertown. They work out of the North Point Maintenance Yard located in Cambridge. The maintenance yard contains administrative offices, shops, equipment barns and material storage areas for the Rivers District.

Table 15. DCR Operational Personnel Assigned to the Complex during Fiscal Year 2014

Job Title	Year-round	Winter Seasonal (October to March)	Summer Seasonal (April to October)
Boston Esplanade - New Basin Parks			
Recreation Facility Supervisor IV	1	-	-
Recreation Facility Supervisor III	1	-	-
Park Foreman II	1	-	-
Laborer I	1	-	2
Forest and Parks I	-	-	1
Groundskeeper I	-	-	3
Facility Service Worker I	-	-	2
Seasonal Recreation Facilities *(Steriti and O'Neil Rinks, Lee Wading Pool and Teddy Ebersol Red Sox Fields)*			
Recreation Facility Supervisor IV	2	-	-
Recreation Facility Supervisor III	2	-	1
Recreation Facility Supervisor I	1	1	1
Forest and Parks II	-	-	1
Laborer I	-	4	1
Lifeguards (5/21/14 to 9/1/14)	-	-	5
Skate Guards (11/26/13 to 3/9/14)	-	6	-
Lower Basin Yard [a]			
Recreation Facility Supervisor IV	1	-	-
Park Foreman II	1	-	-
Laborer II	4	2	2
Laborer I	2	-	3
Mechanical Equipment Operator II	1	-	-
Tractor Driver	-	-	2
Recreation Facility Repairer	-	-	1

a. Employees assigned to the Charles River Lower Basin Yard maintain facilities within the Charles River corridor located in Cambridge, Boston south and west of the Boston Esplanade, Brookline, Newton and Watertown.

As fiscal challenges require DCR to make some tough staffing decisions, the agency has been reducing its year-round staff and increasing the seasonal staff during peak seasons. This shift from a reliance on full-time permanent employees to seasonal temporary employees impacts long term preventative maintenance, which occurs in the off-season. It also represents a loss of institutional knowledge and memory which becomes increasingly difficult to recreate. The information gathered in this RMP will help to retain some of this institutional knowledge.

Volunteers. Volunteers contribute to the operation and maintenance of the Complex. DCR has adopted a volunteer policy that sets forth the conditions under which organizations and individuals can engage in volunteer projects on DCR properties. Volunteers may perform a wide range of activities including: general clean-ups; providing park visitors with information about the facility; assisting DCR staff with education programs and events; removing invasive plant species; researching historical or scientific information; planting flowers, trees or shrubs; minor trimming or weeding; and organizing events to promote public awareness of park resources.

Some volunteers make one-time or short-term contributions while others make ongoing contributions to the management of park resources. One-time and short-term volunteers are typically associated with youth groups, corporations and special volunteer events (e.g., Park Serve Day).

Organized volunteer groups, such as The Esplanade Association, Charles River Watershed Association, Charles River Conservancy, Friends of City Square Park and other park-user groups provide ongoing support for the maintenance and safe use of the parks located in the Complex.

3.3. CURRENT OPERATING ACTIVITIES

MassParks personnel perform a variety of activities related to the operation and maintenance of the Cambridge and Boston Esplanades, New Basin, City Square and Prince Street parks, and the Steriti and O'Neil Skating Rinks (Table 16). During the ice skating season, the rink staff has two 8-hour shifts. The Bureau of Engineering is responsible for maintenance of the parkways, dams, storm drainage systems and navigational operations. Private landscape contractors maintain the irrigation systems, planting beds, lawns, trees and fountains located in the Teddy Ebersol Fields, New Basin, Prince Street and City Square Parks.

Park buildings and grounds maintenance activities include: cleaning, painting, minor carpentry, electrical and plumbing tasks, mowing grass, removing leaves and branches, picking up litter, emptying trash barrels and graffiti removal. MassParks staff also assists with the set-up, supervision and clean-up for over 100 special events held within the Complex each year.

Administrative activities include: employee scheduling and supervision, report preparation, revenue processing, coordinating volunteer activities, coordinating special events, and budget preparation. Daily operations and management efforts associated with the parks are influenced by several key laws including the Wetlands Protection Act (WPA; M.G.L. c 131 § 40) and its associated regulations (310 CMR 10.00); the State Sanitary Code (105 CMR 410.000); and Massachusetts Historical Commission review (950 CMR 71.00). A list of regulations applicable to the parks located in the Complex can be found in Appendix E.

Table 16. Current DCR Summer Maintenance Activities[a]

DCR Facility	Trash Barrel Pickup	Litter Removal	Playground Maintenance	Mow and Trim	Weed Planted Areas	Weed Paved Areas	Ball Field Maintenance	Graffiti Removal	Bathroom Cleaning	Sweep Pavement	Clean Catch Basins	Comments
Lower Basin Parks												
Cambridge Esplanade	E3	E7	-	E14	E14	E30	-	E30	-	-	A	
Memorial Drive	E3	E7	-	E14	E14	E30	-	-	-	E30	A	
Land Boulevard	-	E7	-	E14	-	E30	-	-	-	E30	A	
Boston Esplanade	E3	E1	E7	E10	E10	E10	-	E30	E1	-	A	
Storrow Drive	-	E7	-	E18	-	E30	-	E30	-	E60	A	
Charles Circle	-	E7	-	-	-	-	-	-	-	E60	A	
Lederman Park	E3	E1	-	E7	E7	E7	E1	-	-	-	A	
Teddy Ebersol Fields	E3	E1	-	E7*	E7*	E7*	E1*	E1	-	-	A	*Landscape Contract
Lee Wading Pool	E1	E1	-	E10	E10	E10	-	E30	E1*	-	-	*During Pool Season
New Basin Parks												
North Point Park*	E3	E7	-	E7*	E7*	E7*	-	E30	-	-	A	*Landscape Contract
Millers River	-	E7	-	-	-	E7*	-	E30	-	-	A	
Paul Revere Park*	E3	E7	E7	E7*	E7*	E7*	-	E30	-	E60	A	*Landscape Contract
Leverett Circle*	-	E7	-	E7*	E7*	E7*	-	-	-	E60	A	*Landscape Contract
Nashua Street Park*	E3	E7	E7	E7*	E7*	E7*	-	E30	-	-	A	*Landscape Contract
Portal Park*	E3	E7	-	E7*	E7*	E7*	-	E30	-	-	-	*Landscape Contract
Charlestown and North End Parks												
City Square Park*	E3	E7	-	E7*	E7*	E7*	-	E30	-	-	A	*Landscape Contract
Prince Street Park*	E3	E7	-	E7*	E7*	E7*	-	E30	-	-	A	*Landscape Contract

a. The following maintenance codes are used: A = Annually, E = Every "X" Days, and * = See Comments. Street and parking lot sweeping, and catch basin cleaning are performed by private vendors retained by the Bureau of Engineering Stormwater Program.

3.4. MANAGEMENT PRACTICES

Natural Resources

Wetland Resources. Wetlands Protection Act (WPA) Regulations (310 CMR 10.00) require that no one shall remove, fill, dredge or alter any wetland or riparian resource areas or buffer zones listed in these Regulations without first filing a Notice of Intent (NOI) with the local Conservation Commission, and obtaining an Order of Conditions under which the work will be performed to protect the specific interests of the Wetlands Protection Act. In compliance with the WPA, DCR has submitted NOIs to the Boston and Cambridge Conservations Commissions for maintenance activities routinely carried out within the buffer zone and Riverfront Area adjacent to the Charles River. Maintenance work within resource areas and buffer zones is conducted in compliance with terms and conditions issued by the local Conservation Commissions.

Stormwater. Activities within the Complex that affect the quantity or quality of storm water are regulated by a U. S. EPA National Pollutant Discharge Elimination System (NPDES) plan and permit that covers multiple DCR properties (DCR, 2007). This permit identifies Best Management Practices (BMPs) that are employed by the DCR to properly manage storm water.

The Bureau of Engineering is responsible for implementing storm water maintenance activities under the NPDES permit including catch basin and drainage system repairs and maintenance, street sweeping and waste management generated from catch basin cleaning, illicit dumping on state property, seasonal leaf collections, residuals and storm debris disposal. The schedule for pavement sweeping and catch basin cleaning within the Complex can be found on Table 16. A total of 585 catch basins and 25 Stormceptors are cleaned annually within the Complex. A total of 24

Stormceptors were installed as part of the Memorial Drive Phase I project and during renovation of the BU Bridge. Stormceptors are designed to optimize the removal of oils and sediments from stormwater runoff.

DCR currently tests its stormwater outfalls along the Charles River on a 5-year rotating sequence. DCR tests for pH, temperature, surfactants, fluoride, and ammonia/ potassium ratio as indicators for possible sanitary sewer, wash water and tap water connections. Each year DCR spends approximately $800,000 within the Esplanade - New Basin Complex to sweep streets and parking areas, clean and repair catch basins, properly dispose of street sweepings and landscape wastes, and monitor stormwater discharges.

Vegetation. The Master Plan for the Charles River Basin (MDC, 2002) contains recommendations for managing vegetation along the Charles River Basin. The plan identifies five types of bank treatments in specific areas to provide a variety of views, physical access to the water, bank stabilization, wildlife habitats, visual interest and screening of parkways for water users. A recommended plant list for each type of bank treatment is provided in (Appendix D).

Shoreline vegetation management plans for the Charles River Basin provide detailed procedures for maintaining scenic vistas, mowing to the top of riprap, controlling erosion, pruning trees and removing invasive plant species within the riparian zone (MDC, 2001 and 2003). The shoreline vegetation management plans have been reviewed and approved by the Cambridge and Boston Conservation Commissions.

Given the absence of documented state-listed rare species within the Complex, Natural Heritage Endangered Species Program review and approval is not required for vegetation management within the Complex at this time.

The Esplanade Association employs a full-time and a seasonal horticulturalist to beautify and improve the health of plants and trees in the Boston Esplanade. Working with volunteers and DCR staff, the horticulturists focus on pruning trees, weeding, planting, managing a composting program and supervising a volunteer program. In 2013, 3,000 volunteers provided 9,000 hours of meaningful work in the Boston Esplanade. Organic park debris from the Esplanade is collected and composted along with vegetable scraps from the Women's Lunch Place. The compost is used to amend soil and to mulch planting beds in the Boston Esplanade. The Esplanade Association has also initiated a compost tea program, in which the compost is brewed into a special tea and sprayed in select areas to further improve the health of trees, turf, plants and soil.

Wildlife. There is no wildlife management plan for the Complex. The *de facto* management policy is to permit most wildlife populations to increase or decrease without human intervention. Wildlife research is regulated through Research Permits issued by DCR Ecology Program.

A population of Canada geese presents a management challenge. In large numbers, they can destroy turf by overgrazing. Their droppings create a public nuisance, affect water quality and can be a public health hazard. In recent years, The Esplanade Association has funded a Geese Be Gone program along the Boston Esplanade. The program uses dogs to discourage geese from nesting in the Boston Esplanade. In a few areas, DCR has planted shrubs to discourage geese access to a recreation area (e.g., Fit Park near Boston University).

Given the location and inadequate attractive fresh water flow coming from the Charles River New Dam fish ladder, DCR and the Division of Marine Fisheries have developed a locking protocol to open the locks to allow migrating fish to pass between the Charles River and Boston Harbor. The locking protocol was designed to maximize usage by rainbow smelt, river herring and American shad during their spawning runs (DEP, 2006).

Cultural Resources

The DCR's Office of Cultural Resources (OCR) supports planning for, and management of, cultural resources on DCR property through project management and resource management planning. The OCR coordinates all regulatory compliance related to federal, state and local laws protecting historic and archaeological resources. The OCR also prepares nominations of DCR properties for inclusion in the State and National Registers of Historic Places.

Any project undertaken, funded, permitted or licensed in whole or in part by the DCR may be subject to review by the Massachusetts Historical

Commission (MHC). Projects with Federal involvement may also be subject to Section 106 of the National Environmental Policy Act (NEPA).

OCR staff assesses regulatory needs and, when applicable, notify the MHC through the filing of a Project Notification Form or an Environmental Notification Form. This is done so that the MHC can make a Determination of Effect of the project on historic and archaeological resources.

Massachusetts law requires the review of all sub-surface disturbances on state property. All projects at the Complex that involve soil disturbance including invasive removals, tree planting and installing sign posts are subject to regulatory review. The OCR staff archaeologist holds state Archaeologist's Permit #2710 to conduct field investigations on DCR property and reviews projects involving soil disturbance on DCR land.

Projects occurring within the Boston Esplanade may require review and approval by the Boston Landmarks Commission due to its designation as a Boston Landmark. Repairs, rehabilitation, demolition, and new construction or plantings must follow the design standards and criteria included in the *Boston Landmarks Commission's Study Report for the Charles River Esplanade* (Boston Landmarks Commission, 2009).

Buildings, structures, landscapes, sites and objects that are a minimum of 50 years old, retain historic integrity and are of significance on the local, statewide or national level may be listed in the National Register of Historic Places. In 1978, the Charles River Basin Historic District was listed in the National Register. Historic resources located within the Complex are identified in Appendix F.

Repairs, rehabilitation and other preservation activities on listed DCR historic resources follow guidelines in the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (NPS, 2001). In addition, maintenance, repair and modification of the Complex's historic parkways are conducted in accordance with DCR *Historic Parkway Preservation Treatment Guidelines* (DCR, 2006).

Recreational Resources

Public use of the Complex is limited to dawn through dusk. Managed and allowed recreational activities are described in Section 2.3.

A variety of recreational activities are regulated by permits. Concerts, charity events, community service projects, weddings, road races and group gatherings that include amusements, barbecues and/or amplified sound are among those recreational activities that require Special Use Permits. Commercial filming, photography and videography are regulated through Filming and Photography Special Use Permits. All Special Use Permits are issued by DCR's Office of Special Events (www.mass.gov/dcr/permits/).

Activities such as school field trips and corporate outings require Recreational Use Permits, which are issued by District operations staff. Scientific research requires Research Permits which are issued by the DCR Ecology Program.

Motor vehicles are not permitted on the Complex's pathways with the following exceptions. DCR, State Police, MWRA, emergency and utility vehicles, may access the park pathways as necessary for management and public safety. Power-driven mobility devices operated by people with a mobility-related disability are allowed on the pathway system. Off-highway vehicles are not permitted anywhere within the Complex.

Infrastructure Resources

Property Boundary. There are no management activities currently related to marking or monitoring boundaries. Significant encroachments, when identified, are resolved through a process outlined in the DCR's guide for encroachment resolution and land reclamation (DCR, 1997).

Buildings and Structures. DCR is responsible for the management, repair and operation of buildings and structures under its care and control (Appendix F). A number of DCR buildings and structures are managed by other state agencies, nonprofit organizations or private tenants. Non-DCR-owned buildings are managed by their owners subject to a land lease or permit. Table 17 lists buildings and structures that are managed and occupied by tenants. Management responsibilities for these buildings are specified in permits, leases or management agreements between the DCR and the tenant.

Agreements between the DCR and its tenants typically identify the term of the agreement, specify associated fees, provide for DCR access, identify the disposition of capital improvements, identify the tenant as the responsible party for obtaining all necessary permits, specify required casualty insurance and include a hold harmless agreement. Specific conditions (e.g., public access and landscape maintenance responsibilities) vary among agreements.

Table 17. Tenant Occupied Buildings

Building	Tenant
BU Sailing Pavilion	Boston University
Fens Gatehouse	MWRA - BWSC
Esplanade Cafe	The Anthem Group
Union Boat Club	Union Boat Club
Community Boating Boathouse	Community Boating
Lower Lock Building	State Police-MassDOT
Charlesgate Yacht Club	Charlesgate Yacht Club
Museum of Science	Museum of Science
Harvard Sailing Pavilion	Harvard University
Charles River Yacht Club	Charles River Yacht Club
Wood Sailing Pavilion	MIT
Pierce Boathouse	MIT
DeWolfe Boathouse	Boston University
State Police Marine Unit	State Police

Roads. The DCR maintains and repairs park surface roads and parkways (Appendix F). MassDOT maintains and repairs above ground ramps (e.g., Charles Circle and Cambridge Parkway ramps) and vehicular bridges that cross over the river. Management of traffic and related systems is supervised by the Parkways Section of the DCR's Engineering Bureau and guided by American Association of State Highway and Transportation Officials standards, the *Manual on Uniform Traffic Control Devices* (U.S. DOT, 2009), and DCR *Historic Parkway Preservation Treatment Guidelines* (DCR, 2006).

Snow removal on DCR parkways and roads within the Complex is performed by both DCR and MassDOT. DCR is responsible for plowing parking lots, access roads and sidewalks within the Complex. An interactive map, which identifies MassDOT and DCR snow management priorities, is available at: http://maps.massgis.state.ma.us/map_ol/dcr_snow_priority.php MassDOT is responsible for plowing Storrow Drive, Monsignor O'Brien Highway and Charles River Dam Road. DCR is responsible for plowing Memorial Drive, BU Bridge, Harvard Bridge, Longfellow Bridge, Cambridge Parkway and Land Boulevard.

The DCR, or its contractors, maintain the reservation's roads and parkways on a regular maintenance schedule. This maintenance generally includes litter removal every 14 days, mowing, trimming and weeding every 18 days, sweeping monthly and cleaning associated catch basins annually.

Parking. The DCR maintains and repairs the Complex's parking areas. Most snow removal is performed by the DCR.

Kiosks and Signs. The format and placement of regulatory and informational signs are governed by the *Manual on Uniform Traffic Control Devices for Streets and Highways* (US DOT, 2009) and guided by the DCR *Graphics Standards Manual* (DCR, n.d.). The design and construction of kiosks are also governed by the graphics manual. Informational kiosks are managed by DCR park staff who updates content multiple times per year.

Memorials and Markers. The placement of markers or plaques at the Complex are prohibited without the written permission of the Commissioner. The DCR Memorial and Commemorative Gifts Policy (#EAP-2006-01) describes the circumstances and protocol for accepting donations to ensure that the gift is consistent with Department standards, park management and design plans; the item installed is needed in the affected facility and properly located; and the gift is properly acknowledged.

DCR Regulations

The DCR has the authority to make and enforce regulations regarding parks, forests and reservations. These regulations are designed to protect public safety, natural and cultural resources, and provide enjoyable user experiences.

Table 18. Selected Regulations in Effect at the Complex (302 CMR 12.00)

Reservation open from dawn to dusk
Forbids offensive disorderly conduct
Forbids obstruction of free passage
Dogs must be on leash 10 feet or less
Requires proper disposal of dog waste
Bicycles may be prohibited in designated areas
No defacement of any sign, structure or tree
No one shall engage in a business without a permit
No injuring or disturbing wildlife or their habitat
No littering or dumping
Must obey posted signs and staff instructions

The regulations that currently apply within the Complex are detailed in 302 CMR 12.00; *Government and Use of the Reservations and Parkways Under the Care and Control of the Department of Conservation and Recreation*. Selected regulations are listed in Table 18. New regulations for DCR parks, forests and reservations are currently under development.

3.5. Interpretive Services

In recent years, seasonal DCR Park Interpreters have not been hired to provide interpretive programs in the Complex. The Regional Interpretive Coordinator will occasionally participate in events held at the Hatch Shell (e.g. Annual Earth Fest Concert or Backstage Tour of the Hatch Shell).

During the summer of 2013, The Esplanade Association provided two free programs to introduce visitors to the Boston Esplanade. Children in the Park brought over 1,200 children from summer camps across Metro Boston for a day of fun, exercise and exploration. Sunday Fun in the Park provided family-friendly activities twice during 2013.

3.6. General Budgetary Information

A variety of state operating, state capital, federal and private funds support the operation, maintenance and development of parks within the Complex.

Operating Budget. The annual state operating budget supports daily operations and maintenance including staff salaries, utilities, supplies, equipment leases, administration, and the maintenance of facilities, vehicles, and equipment. Operational funding is an ongoing issue for the operation of the Complex, as it is throughout the DCR. The agency's overall operating budget has decreased by 22.6% from Fiscal Year 2009 to 2014 while the land managed by DCR has increased by 2.5%.

Retained Revenues. The state operating budget specifies the maximum amount of park revenue from fees, licenses and rents charged by DCR that may be retained by the agency in a given fiscal year. This amount changes yearly.

Revenues from the Charles Circle parking concession, skating rinks, Esplanade Café, Duck Boat Tours and boat clubs located within the Complex are deposited in the state's general fund. DCR may then use (or "retain") up to 80% of these revenues statewide for its operating expenses and improvements to DCR facilities. Retained revenues cannot be used to hire full-time agency personnel. During fiscal year 2013, approximately $1,683,000 in revenues were collected from the Charles River Esplanade - New Basin Complex.

In 2010, DCR and DCAM received legislative authorization to replace one-year yacht club rental permits with 30-year leases and steadily increase the rents to market rates. The legislation requires the clubs to provide in-kind contributions as part of their lease agreements (e.g., picnic tables, public restrooms, bike racks and boating instruction).

Capital Budget. The capital budget supports projects (e.g., construction, repair) and items (e.g., equipment) with an expected lifespan of at least seven years. Capital projects and programs are identified and funded through a five-year capital plan. These plans identify proposed capital projects, their costs, and the year in which they are to be funded. Table 19 contains a list of recent capital expenditures within the Complex.

Capital expenditures include both stand alone capital projects and on-going programs. The on-going capital programs have annual budgets that are divided each year between DCR's facilities statewide (e.g., Rink Maintenance @ $1,000,000/ year, Stormwater System Maintenance Program @ $4,200,000/year, Equipment Purchases @ $1,050,000/year, Public Private Partnership Program @ $1,000,000/ year and Parkway Reconstruction @ $10,500,000 /year).

Table 19. DCR Capital Expenditures during Fiscal Years 2010-2014

Capital Project or Program	Amount Expended
Storrow Drive Tunnel Repairs	$10,075,000.
Replace Community Boating Docks	$3,097,000.
Eliot Memorial Renovations	$490,300.
New Charles River Dam Repairs	$1,999,000.
Rink Repairs and Rehabilitation	$1,087,500.
Repair Catch Basins and Pipes	$750,000.
Hatch Shell Area Repairs	$502,400.
Total Capital Expenditures	**$18,001,200.**

Recent capital projects in the Complex included interim repairs to the Storrow Drive Tunnel, replacing the Community Boating docks and renovation of the Eliot Memorial area. Approximately $18 million of DCR capital funds were spent in the Complex during fiscal years 2010 through 2014 (Table 19).

Central Artery/Tunnel Project Funding. Chapter 91 licenses and Massachusetts Environmental Policy Act (MEPA) approvals for the Central Artery/Tunnel (CA/T) Project required that MassDOT take steps to mitigate negative environmental impacts caused by the construction of new highway crossings over the Charles River. From 1996 through 2012, the CA/T project spent $91,946,711 to design, permit, manage and construct the Charles River New Basin parks (Table 20).

Table 20. Central Artery/Tunnel Project New Basin Expenditures 1996-2012

Project	Amount
Paul Revere Park	$5,440,771.
Nashua Street Park	$9,482,381.
Prince Street Park & Walkway	$4,739,982.
North Point Park	$31,024,482.
North Bank Bridge & Landscape	$25,345,900.
Bridge and Landscape Design	$2,724,891.
CA/T Contract Management	$5,500,000.
DCR Management and Rangers	$2,994,145.
Land Acquisition and Temporary Maintenance	$4,694,159.
Total CA/T Expenditures	**$91,946,711.**

The CA/T Project used a grant of $25,345,900 from the federal American Recovery and Reinvestment Act to construct the North Bank Bridge, expand Paul Revere Park, complete landscape improvements, and reconstruct structurally deficient seawalls under the Zakim Bridge.

Upon completion of the CA/T project in 2012, Mass DOT placed $30.5 million into the New Charles River Basin Trust Fund for DCR's use to complete mitigation measures in the New Charles River Basin not completed by the CA/T project. A total of $4.1 million was expended from the New Basin Trust Fund by the end of fiscal year 2014.

Table 21. New Charles River Basin Trust Fund

Project	Amount
Stockpile Remediation	$3,200,000.
Temporary Maintenance Facility	$2,700,000.
Historic Dam Restoration	$6,100,000.
MBTA Drawbridge Walkway	$3,600,000.
South Bank Bridge	$14,900,000.
Total New Basin Trust Fund:	**$30,500,000.**

Trust Funds. The New Basin Parks are maintenance intensive, particularly the irrigation systems, planting beds, works of art, and water features which are continuously in need of skilled maintenance and repair. Private landscape contractors have been hired to supplement basic maintenance services provided by DCR staff in the New Basin, City Square and Prince Street parks (Table 16). These landscape maintenance contracts are funded from the Urban Parks Trust Fund. Contributions made by abutters and permit holders (e.g., Tudor Marriott Hotel, 226 Causeway Street Trust and Duck Boats) produced approximately $193,600 of income during fiscal year 2013 to support these private landscape service contracts.

3.7. PARTNERSHIPS

There are a number of existing partnerships that provide substantial support to DCR's operational, interpretive and resource protection efforts in the Charles River Esplanade - New Basin Complex.

The Esplanade Association (TEA) was formed in 2001 by a group of concerned Boston residents who recognized the need for a park advocacy group that would work in partnership with the DCR to restore the Boston Esplanade to its former splendor and usefulness. Since its formation, TEA has been the catalyst for raising over $12 million for park improvements. Through a combination of advocacy, fundraising, and recruiting 3,000 volunteers a year, TEA has made meaningful improvements to the horticulture, physical infrastructure, annual events, programming and play spaces on the Boston Esplanade (TEA, 2014).

In 2014, TEA employed a full-time and a seasonal horticulturalist to beautify and improve the park landscape. Working with volunteer and DCR staff, the horticulturists focus on pruning trees, weeding, planting, managing a composting program and supervising a volunteer program. In 2013, 3,000 volunteers provided 9,000 hours of work in the park (TEA, 2014).

TEA raised $380,000 in private contributions for recently completed revitalization of the Eliot Memorial plaza area adjacent to the Community Boating sailing program. In October 2013, TEA launched a $4 million capital campaign for the restoration of the Hatch Shell area. In October 2014, TEA began renovations of the Hatch Shell Oval lawn. The project will create a healthy stand of lawn with irrigation in the Hatch Shell Oval that can better withstand high use and improve the infrastructure for music and video performances at the Hatch Shell. Restoration of the Music Oval includes amending existing soils, adding an irrigation system, improving subsurface drainage and installation of underground audiovisual conduits. The estimated cost of the project is $600,000. The lawn is expected to reopen in early summer of 2015, in time for Fourth of July festivities (TEA, 2014).

During the summer of 2013 TEA offered several free programs in the park. For the fourth straight year, TEA brought over 1,200 children from summer camps across Metro Boston to the Esplanade each Wednesday for a day of fun, exercise and explorations. TEA also held two weekend summer Fun Days focused on family-friendly music, games, yoga, Zumba and fishing activities. Almost 6,000 people participated in Zumba, yoga, Crossfit, boot camp, Run Club and Community Walk programs sponsored by TEA (TEA, 2014).

The Charles River Watershed Association (CRWA) was founded in 1965 in response to public concern about the declining condition of the Charles River. Over the past 50 years, the CRWA has actively led watershed clean-up efforts that have resulted in a remarkable improvement in river water quality. The CRWA has collected and used scientific knowledge of the Charles River to develop innovative solutions to watershed problems.

The CRWA has contributed to safe recreational use of the Charles River through its active involvement in the development of federally-mandated pathogen and phosphorus management plans, volunteer data collection that supports EPA's Water Quality Report Card program for the Charles River, and notification program that informs the public of unsafe water quality conditions. The CRWA also assists the U. S. Fish and Wildlife Service's shad stocking program and hosts an annual river clean-up, which engages between 2,500 and 4,000 volunteers throughout the Charles River watershed each year.

The Charles River Conservancy (CRC) was established in 2000 to renew urban parklands along the Charles River from Boston Harbor to the Watertown Dam. Each year, over 2,000 CRC volunteers help to renew and maintain the Charles River parklands. The CRC raised $4.5 million to design and construct a 40,000 square foot skate park on the northern edge of North Point Park under the I-93 highway ramps. Valley Crest Landscape Development has begun construction of the Lynch Family Skate Park, with an opening in 2015.

CRC recently received a $2.5 million anonymous donation to improve lighting on the Harvard Bridge, the oldest and longest bridge over the Charles River. Armed with the donation, the conservancy held a design contest and selected a lighting plan prepared by Rosales + Partners. The proposed design uses LED energy-efficient bulbs on both the roadway and pedestrian path, adding lighting at a lower level to make the bridge both more attractive and safer.

The Charles River Clean Up Boat has been pulling trash from the river for a decade. The cleanup boat patrols the river from the Watertown Dam to the Zakim Bridge four days a week, May through Columbus Day. Each year, approximately 200 volunteers assist in picking trash out of the water.

The Friends of City Square Park was formed in 1994 to ensure the proper maintenance, preservation, beautification, programming and care of City Square Park, and to encourage an awareness of its history. With more than 250 members, the Friends raise funds for park maintenance and special events. The Friends sponsor a concert series, Paul Revere's Ride, Christmas tree lighting, and spring and fall clean ups in the park.

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Boston Esplanade Lagoon (TEA)

SECTION 4. MANAGEMENT RECOMMENDATIONS

The DCR has a broad and dynamic mission that encompasses resource protection, providing public access to recreational opportunities, and active forest management. This multi-faceted mission often results in complex management challenges. These responsibilities are central to the agency's mission and statutory charge.

To help meet this broad mission, DCR has developed a two-tier system for guiding the management of all state forest and park properties under its care. The two systems, known as Landscape Designations and Land Stewardship Zoning, work in an integrated fashion to accommodate primary ecosystem services while recognizing and providing site-specific resource protection.

Application of Landscape Designation and Land Stewardship Zoning to DCR properties within the Charles River Esplanade - New Basin Complex is summarized in the following sections.

4.1. LANDSCAPE DESIGNATION

Applied statewide to assess and guide management activities throughout the DCR system, Landscape Designations are based on primary ecosystem services, and guide management decisions based upon these services. The designations also communicate the agency's landscape-level management objectives to the public.

As a result of a robust public process called Forest Futures Visioning, DCR established the following designations for properties under its jurisdiction:

Reserves. Properties designated as Reserves provide backcountry recreation experiences and protect the least fragmented forested areas and diverse ecological settings. Successional processes are monitored to assess and inform long-term forest stewardship.

Woodlands. Woodlands demonstrate exemplary forest management practices for landowners and the general public, while supporting the range of ecosystem services that sustainably-managed forests offer, including a diversity of native species and age classes and compatible recreation opportunities.

Parklands. Areas designated as parklands focus on providing public recreation opportunities while protecting resources of ecological and cultural significance.

Specific management guidelines for all three classes of landscape designations are described in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guideline* (DCR 2012*c*).

All properties within the Charles River Esplanade - New Basin Complex are designated as Parklands.

4.2. LAND STEWARDSHIP ZONING

Land Stewardship Zoning and the resource management planning process of which it is a part, addresses the agency's statutory responsibilities in M.G.L. Chapter 21: Section 2F. The legislation requires DCR to prepare management plans that encompass all reservations, forests and parks; provide for the protection and stewardship of natural, cultural and recreational resources under the agency's management; and ensure consistency between recreation, resource protection and sustainable forest management.

Land Stewardship Zoning Guidelines

Land Stewardship Zoning Guidelines define three types of zones to ensure resource protection based upon site-specific field data, and provides guidance for current and future management based upon resource sensitivities. Inventory and assessment of resources during preparation of a RMP is factored into land use management and decision-making, and provides guidance for stewardship of these resources. The process results in zoning of areas and specific sites within DCR properties based on their sensitivity to recreation and management activities that are appropriate for each facility as recognized during the RMP process. In this way, the Land Stewardship Zoning system helps to ensure that recreation and management activities do not degrade various resources and values.

The three Land Stewardship Zones provide a general continuum to categorize resources (relative to potential degradation from human activities) from undisturbed sites with highly sensitive resources, through stable / hardy resources, to sites that have been developed and consistently used for intensive recreation or park administration purposes. The Land Stewardship Zoning system also includes Significant Feature Overlays that may be applied to highlight resource features that have been assessed and documented by professional resource specialists.

Below is a description on the various zones used for Land Stewardship Zoning.

Zone 1

Management Objective. Protection of sensitive resources from management or other human activities that may adversely impact the resources.

General Description. This zone encompasses areas with highly sensitive ecological and cultural resources that require additional management approaches and practices to protect and preserve the special features and values identified in the Resource Management Plan. Zone 1 areas are not suitable for future intensive development.

Examples. Examples identified as being highly sensitive to human activities include rare species habitat or priority natural communities, areas with concentrations of sensitive aquatic habitats, excessively steep slopes with erodible soils, archaeological sites or fragile cultural sites, where stewardship of these resources must be the primary consideration when assessing management and recreational activities in these areas.

Zone 2

Management Objective. Provide for a balance between the stewardship of natural and cultural resources and recreational opportunities that can be appropriately sustained.

General Description. This zone encompasses stable yet important natural and cultural resources. Zone 2 is a very important component to DCR's management responsibilities, because the protected landscape within this zone provides a buffer for sensitive resources, recharge for surface and groundwater, and large areas where existing types of public recreation activities can be managed at sustainable levels.

Examples. Examples include areas of non-intensive use that contain diverse ecosystems, rare species habitat that is compatible with dispersed recreation and sustainable management practices, and cultural resources that are not highly sensitive to human activities.

Zone 3

Management Objective. Provide public access to safe and accessible recreation opportunities, as well as administrative and maintenance facilities that meet the needs of DCR visitors and staff.

General Description. This zone includes altered landscapes in active use, and areas suitable for future administrative, maintenance and recreation areas. The resources in this zone can accommodate concentrated use and require regular maintenance by DCR staff.

Examples. Examples of areas of concentrated use include park headquarters and maintenance areas, parking lots, swimming pools and skating rinks, paved bikeways, swimming beaches, campgrounds, playgrounds and athletic fields, parkways, golf courses, picnic areas and pavilions, and concessions. Examples of future use areas include disturbed sites with no significant ecological or cultural values and not suitable for restoration, identified through the RMP or in a Master Plan as being suitable for intensive recreation or park administration sites. Note that development would be preceded by detailed site assessments to ensure protection of natural and cultural resources.

Significant Feature Overlays

Management Objective. The purpose of the overlays is to provide precise management guidance in order to maintain or preserve the recognized resource features regardless of the zone in which they occur.

General Description. The three land stewardship zones may be supplemented with significant feature overlays that identify formally designated or recognized resources. These resource features have been recognized through research and assessment by professional resource specialists.

Examples. A natural or cultural resource, recognized through professional inventory / research, which cuts across more than one land stewardship zone, such as:

- National Register Historic District
- Areas subject to public drinking water regulations
- Priority habitat for species that are not sensitive to human activities
- BioMap 2 Core Habitat
- Designated Areas of Critical Environmental Concern

A natural or cultural resource, recognized through professional inventory / research, which is located in an area characterized by intensive visitor use. In these cases, the Significant Feature Overlay is used to highlight the potential conflict between resource stewardship and ongoing visitor use, and provide mitigation strategies. Examples include:

- A NHESP Priority Natural Community associated with a summit that is also a popular destination for hikers.
- A barrier beach that provides habitat for rare shorebirds, and is subject to CZM barrier beach management guidelines and coastal wetlands regulations, but also supports thousands of visitors during the summer season.
- A significant cultural site such as Plymouth Rock that is subject to ongoing, intensive visitation.

Management Guidelines. Specific management guidelines are provided by resource specialists and/or by the professional staff of the agency or NGO that assessed the significant resource feature or has a regulatory role for protection of the resource. Examples include MHC requirements for treatment of historic resources within National Register Historic Districts, and NHESP guidelines for Priority Natural Community habitat stewardship.

Applied Land Stewardship Zoning

The following Land Stewardship Zoning is recommended for properties in the Charles River Esplanade - New Basin Complex.

Zone 1. No sections of the Complex have been designated Zone 1.

Zone 2. No sections of the Complex have been designated Zone 2.

Zone 3. The entire Complex has been designated as Zone 3 because it is an altered landscape in active use.

Significant Feature Overlay. No significant feature overlays are recommended for the Complex.

4.3. MANAGEMENT RECOMMENDATIONS

These management recommendations are presented by the five management goals identified for the Complex (see Table 21).

Recommendations are also characterized on the basis of priority (i.e., "H" high, "M" medium, or "L" low) and resource availability. High priority recommendations are those that address regulatory compliance or public health and safety; prevent immediate damage to, or loss of, resources; or repair or replace damaged equipment or systems critical to park operations. They are typically time sensitive. Medium priority recommendations maintain existing resources and visitor experiences. Low priority recommendations enhance resources or visitor experiences; they are not time sensitive.

Resource availability considers both funding and labor. A resource availability of "1" indicates that funding and/or labor are available to implement the recommendation. A resource availability of "2" indicates that funding and/or labor are not currently available but may become so in the near future (i.e., the next five years). A resource availability of "3" indicates that funding and/or labor are not anticipated in the next five years. Resources to implement these recommendations may, or may not, become available after five years.

Table 22. Recommendations for the Charles River Esplanade - New Basin Complex

Recommendation	Priority[a]	Resources[c]	Implementation[c]
Improve river water quality.			
Require that all capital projects employ stormwater best management practices, treatment systems that remove phosphorus from stormwater, and state-of-the-art Low Impact Development techniques to encourage stormwater infiltration and reduce surface runoff into the River (e.g., vegetated swales, infiltration catch basins and stormceptors).	H	1	E,P
Establish and maintain low vegetative riparian buffers using native species along the shoreline to provide wildlife forage and cover; increase stormwater infiltration directly into the groundwater table, restrict the ability of geese to move between water and lawn without flying; and absorb sediments and nutrients before they enter the River.	H	1	P,C,V
Monitor and manage aquatic invasive plants and animals (e.g., water chestnut, fanwort, Eurasian water milfoil, zebra mussels) that can colonize shallow areas along the river's banks.	M	1	W,V
Study the feasibility of using bioremediation organisms to decontaminate bottom sediments.	L	3	E,P,V

Continued on next page.

Table 22. Recommendations for the Charles River Esplanade - New Basin Complex (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Enhance the natural landscape.			
Collaborate with the Division of Marine Fisheries to support an evaluation of diadromous fish migration at the Charles River Dam in order to optimize fish passage, with consideration for the dam's operation, existing hydrologic and hydraulic conditions. Decommission the existing fish ladder to minimize migratory fish kills in the fish ladder.	H	2[e]	P,E
Implement invasive plant best management practices to support native plant populations along the River. Work with stakeholder organizations to develop an Invasive Plant Management Plan for species determined to be "invasive" or "likely-invasive" by the Massachusetts Invasive Plant Advisory Group. Implement the Plan after appropriate review and approval by local and state regulatory authorities.	M	1	P,C,V
Discourage Canada geese from congregating along the riverbanks by mowing the lawn as infrequently as possible and planting less-palatable grass species (e.g., tall fescue K-31 instead of Kentucky bluegrass). Use low vegetative buffers adjacent to the riverbank, solar powered geese beacons and trained dogs to discourage geese from feeding in active recreation areas.	M	1	C,V
Restore vegetation in the White goose nesting area located in Cambridge between the BU Bridge and DeWolfe Boathouse. Keep future connections to the proposed Grand Junction multi-use path on the upland portion of the site away from the riverbank.	L	2	P,C,V
Restore the historic character of the Cambridge Esplanade.			
Construct the previously designed and permitted Memorial Drive Phase II project that will introduce a parallel multi-use path along Memorial Drive to separate pedestrian and bike traffic, install historic lighting and make landscape improvements. Add stormwater improvements to promote stormwater infiltration and implement best management practices to remove nutrients, pollutants and suspended sediments from stormwater.	H	2[e]	E,P
In conjunction with the Longfellow Bridge project, create new traffic signals and crosswalks to link the Broad Canal Path to Cambridge Parkway.	H	2	P,E
Provide contemporary recreation facilities on the Boston Esplanade.			
Esplanade-wide Initiatives			
Work with The Esplanade Association to develop and implement a comprehensive ecologically sustainable landscape management plan for the Lower Basin.	H	1	V,R,C,P
Where feasible, separate bicycle paths from lower speed walking paths throughout the basin, and use softer surfaces on paths for runners and joggers. Work with stakeholder organizations to improve visitor safety through pavement markings, signage, public awareness campaign, changes to pathway surfaces and enforcement.	H	2	P,V,E,R
Work with stakeholder organizations to develop a uniform directional, regulatory, informational and donor recognition signage system for the Lower and New Basin parks to enhance bicycle and pedestrian connectivity.	H	2[e]	R,V,C,P

Continued on next page.

Table 22. Recommendations for the Charles River Esplanade - New Basin Complex (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Provide contemporary recreation facilities on the Boston Esplanade.			
Esplanade-wide Initiatives			
Replace deteriorated Storrow Drive and Embankment Road street lighting with historic LED lighting.	M	2[e]	E
Reconvene the TEA/DCR Landscape Committee to prepare and adopt design standards for all park structures, lighting, railings and furniture in the Boston Esplanade.	M	1	V,P,R
Work with stakeholder organizations to develop an interpretive master plan for the Complex including recommended themes, interpretive signage, program descriptions and staff requirements.	M	2	R,V,P
Work with TEA to introduce an Esplanade public arts program.	L	2	V,R,P
Boston University Bridge			
Create an ADA-accessible pedestrian and bike link from the Boston University Bridge to the Boston Esplanade, incorporating the rail trestle that may be redeveloped as part of the Grand Junction trail project. Provide a paved path under the BU Bridge to provide continuous bicycle and maintenance vehicle access along the river	M	2	V,P,E
Charlesgate West/Muddy River			
Design, permit and construct a new multi-use path connecting the Emerald Necklace at Beacon Street to the Boston Esplanade using the Harvard Bridge multi-use ramp.	H	1	P,V,E,R
Execute a management agreement with the MWRA and the Boston Water and Sewer Commission for restoration and maintenance of the Fens Gatehouse.	H	1	L,V,P
Back Bay Area			
Rebuild the Gloucester and Dartmouth Street gateways, landings and forecourts.	H	2[e]	P,V,E,R
Restore the Boston Esplanade lagoons, canoe-way, bridges and banks. Improve lawns for visitor uses that are appropriate to the park and the river setting.	M	2[e]	P,V,C,P, E
Work with TEA to upgrade the Dartmouth Street Sanitary to provide facilities for the model boat program.	M	2	P,V,E,R
Hatch Shell Area			
Work with The Esplanade Association to prepare a coordinated public/private action plan to implement the Esplanade 2020 Vision for the Hatch Shell area.	H	1	V,P,R,X
Study the development of a consistent and distinctive historic park lighting system. Consider use of an advanced lighting system with built-in surveillance cameras, dimmable lights, WiFi repeaters, speakers and LED information boards.	M	2	E,P,B,R

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Table 22. Recommendations for the Charles River Esplanade - New Basin Complex (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Provide contemporary recreation facilities on the Boston Esplanade.			
Hatch Shell Area			
Work with The Esplanade Association and other interested parties (e.g., Boston Landmarks Orchestra) to understand performance needs, develop a design for improved performance lighting, sound and video systems at the Hatch Shell, and discuss appropriate funding structure.	M	2[e]	P,V,R,C, E
Work with TEA to restore the Lotta Fountain and Oliver Wendell Holmes Memorial.	M	2	V,X,R,P
Boat Haven			
Restore Commissioners Landing and the Grand Promenade on the Boston Esplanade. Build a new events/services court with seating and picnic areas.	H	2[e]	P,E,R
Work with Community Boating to repair the boathouse roof and exterior masonry, and install a lift to provide ADA access to the second floor.	H	2	E
Charles Circle			
Work with MassDOT and the Mass Eye and Ear Infirmary to integrate new parkland into the Boston Esplanade created by relocating the Storrow Drive west bound lanes under the inland Longfellow Bridge arch adding 75 feet of useable riverfront parkland at a critical choke point; and constructing a garage under the Charles Circle ramps with a new surface park that connects the Boston Esplanade to the hospital area and Charles/MGH station.	H	1	V,P,E,R
Lee Pool Area			
DCR undertake a reuse study of the Lee Pool area that incorporates current DCR program needs and considers the feasibility of the TEA Esplanade 2020 Vision for an all-seasons recreation program.	H	2	P,E,R,V
Complete the New Basin parks and pathways.			
Old Lock Area			
The on-going DCAM, State Police, DCR facility study of the Old Lock Area consider the recommendations of the TEA Esplanade 2020 Vision to create a new entry plaza to greet and orient visitors to the Esplanade.	H	1	V,P,E,R
Seek a private tenant under the Historic Curatorship Program for the Upper Lock Gate House to renovate the building for use as a welcome center with visitor services and a food concession with outdoor seating.	M	1	P,E,R,T
Explore the feasibility of relocating DCR staff parking and maintenance facilities from the Old Lock Area to the North Point Maintenance Area.	M	2	P,E,R
Science Park			
Seek legislative authorization to include the historic Upper Lock Gate House, Boat House and Stable buildings in the DCR Historic Curatorship Program.	H	1	V,P,L

Continued on next page.

Table 22. Recommendations for the Charles River Esplanade - New Basin Complex (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Complete the New Basin parks and pathways.			
Science Park			
Stabilize the historic Boat House including structural repairs, exterior renovations and abatement of hazardous materials.	H	1[d]	T,P,E,L
Work with the Museum of Science to provide public access to the river along the upstream side of Science Park from the Cambridge Esplanade to the Boston Esplanade with an at-grade connection to the Land Boulevard sidewalk.	M	2	T,V,P,E, R
North Point			
Remediate the North Point CA/T contaminated soil stockpile.	H	1[d]	P,E
Design and construct a new maintenance facility at North Point for Mobile Services, River District and Boston Region operations personnel.	M	2[e]	P,E,R,C
Retain a horticulturalist to survey and prepare a plan to restore the North Point Park, Nashua Street Park, and Paul Revere Park planting beds and turf.	H	2[d]	P,R
Bascule Bridges			
Fund MBTA design and construction of a multi-use pathway on the upstream side of the Bascule Railroad Drawbridge connecting the North Point and Nashua Street parks.	H	1[d]	P
South Bank			
Design, permit and construct a new 12’ wide multi-use South Bank Bridge over the MBTA railroad tracks behind North Station connecting Nashua Street Park to the proposed South Bank Park.	H	1[d]	P,E
Work with MassDOT to design, permit and construct the South Bank Park connecting the New Basin parks to the North Station area and Lovejoy Wharf Harbor Walk.	H	2[f]	P,E
New Charles River Dam			
Design and construct inundation protections for the Pump Station to protect the flood control pumps from rising sea levels.	H	2[e]	E
Reset displaced riprap, repair upstream wooden training walls and fender piers, and renovate the lock gates and associated mechanisms.	M	2[e]	E
North End Parks			
Work with the City of Boston to create a multi-use trail on the harbor walkway located behind the Steriti Rink and Prince Street Park.	M	1	P,E,R
Repair the Steriti Rink ice refrigeration system.	M	2[e]	E
Conduct a feasibility study for the use of the closed Prince Street Park wooden pier as a public marina and MBTA water taxi station.	M	2[e]	E,P
Provide separate restroom facilities to serve the indoor bocce courts when the Steriti Rink is closed during the summer.	M	2	E,R

Continued on next page.

Table 22. Recommendations for the Charles River Esplanade - New Basin Complex (Continued)

Recommendation	Priority[a]	Resources[b]	Implementation[c]
Complete the New Basin parks and pathways.			
Establish First-rate Management Systems and Practices			
Conduct a review of the annual fees currently in place for leases, licenses, permits and agreements with non-profit or private tenants. Work with each tenant to bring their annual payment in line with fair market value by 2018 and provide amenities for park users (e.g., restrooms and drinking fountains).	M	2	L
Prepare an audit of all Chapter 91 licensure and Section 61 mitigation requirements associated with the Complex to ensure that one-time obligations have been met and all continuing obligations are being met routinely.	M	2	L

a. Recommendations are characterized on the basis of priority (i.e., High (H), Medium (M), or Low (L). High priority recommendations are those that address regulatory compliance or public health and safety; prevent immediate damage to, or loss of, resources; or repair or replace damaged equipment or systems critical to park operations. They are typically time sensitive. Medium priority recommendations maintain existing resources and visitor experiences. Low priority recommendations enhance resources or visitor experiences; they are not time sensitive.
b. Resource availability considers both funding and labor. A resource availability of "1" indicates that funding and/or labor are available to implement the recommendation. A resource availability of "2" indicates that funding and/or labor are not currently available but may become so in the near future (i.e., the next five years). A resource availability of "3" indicates that funding and/or labor are not anticipated in the next five years. Resources to implement these recommendations may, or may not, become available after five years.
c. The following codes identify the party or parties responsible for implementing the recommendation: B = Ranger Bureau; C = Complex operating staff; E = Engineering Bureau; L = Legal Services; P = Planning, Design & Resource Protection; R = Regional and district staff; T = Park Tenant; U = Universal Access Program; V = Volunteer or partner; W = Division of Water Supply Protection; and X = Office of External Affairs and Partnerships.
d. Recommended for New Charles River Basin Trust Funding (see Table 21).
e. Recommended for capital project funding (see Table 23).
f. CA/T project commitment funded by MassDOT.

4.4. RECOMMENDED CAPITAL PROJECTS

The state capital budget supports projects (e.g. construction and repair) and purchases (i.e. equipment) with a per-unit cost of at least $5,000 and an expected lifespan of at least seven years. Capital projects are funded through a five-year capital plan that identifies proposed capital projects, their estimated costs and the year in which they are to be funded. Capital funding is subject to annual appropriation, and approval by the Commissioner of DCR, Secretary of the Executive Office of Energy and Environmental Affairs, and the Governor.

Table 23. Recommended Capital Projects

Project Description	Estimated Cost	Priority	Funding Status[a]
Restore Commissioners Landing and the Grand Promenade.	$3,500,000.	High	2
Design and construct inundation protections for the New Dam Pump Station to protect the flood control pumps from rising sea levels.	$75,000.	High	1
Construct Memorial Drive Phase II pathway and landscape improvements. Consider use of flexible porous paving on jogging trails to prevent development of "goat paths."	$6,500,000.	High	2
Collaborate with the Division of Marine Fisheries to evaluate diadromous fish passage through the dam locks to optimize fish passage with consideration for the dam's operation and existing hydrologic and hydraulic conditions.	$75,000.	High	2
Repair the New Charles River Dam upstream wooden training walls and fender piers, and renovate the lock gates and associated mechanisms.	$3,000,000.	High	1
Repair the Community Boating boathouse roof and masonry exterior, and install a lift to provide ADA access to the second floor.	$250,000.	High	2
Design and install a uniform way finding signage system in the Lower and New Basin parks.	$250,000.	Medium	3
Renovate the Hatch Music Shell to better accommodate performances.	$500,000.	Medium	2
Steriti Rink ice cooling system repairs.	$100,000.	Medium	2
Replace deteriorated Storrow Drive and Embankment Road street lighting with historic pendant LED lighting.	$3,000,000.	Medium	2
Storrow Drive Tunnel Design and Construction	$33,200,000.	Medium	2
Rebuild the Gloucester and Dartmouth Street gateways, landings and forecourts.	$6,100,000.	Medium	3
Design, permit and construct a new maintenance facility at North Point.	$20,000,000.	Medium	2
Feasibility study for reuse of the North End Pier as a public marina.	$100,000.	Medium	2
Restore the Boston Esplanade lagoons, bridges and banks.	$2,000,000.	Low	3
Total Recommended Capital Projects: $78,650,000.			

a. A funding status of "1" indicates that funding is available in the approved Fiscal Year 2015 Capital Spending Plan to implement the recommendation. A funding status of "2" indicates that funding is not currently available, but is included in the FY 2015-2019 DCR Capital Spending Plan. A funding status of "3" indicates that funding to implement these recommendations is not anticipated in the next five years, but may, or may not, become available after five years.