INNER HARBOR CONNECTOR

BUSINESS PLAN FOR NEW WATER TRANSPORTATION SERVICE

Contents


Proposed route of the Inner Harbor Connector ferry
CHARLESTOWN
NAVY YARD PIER 4
EAST BOSTON
LEWIS MALL
NORTH END
LONG WHARF
DOWNTOWN BOSTON
FAN PIER
SEAPORT

The Inner Harbor Connector

There is an opportunity to expand the existing ferry service between Charlestown and downtown Boston to also serve East Boston and the South Boston Seaport and connect multiple vibrant neighborhoods around Boston Harbor. Recent development, especially along the waterfront, has increased the transportation demand of these communities for residents and workers while new restaurants and institutions have also brought more people down to the Harbor.

This document provides a roadmap for initiating and maintaining a new service in Boston's Inner Harbor that connects Navy Yard Pier 4 in Charlestown, Lewis Mall in East Boston, and Fan Pier in the Seaport with Long Wharf in downtown Boston with eventual continuous connections between all of these neighborhoods. The roadway alternatives are congested, and the transit alternatives, with the exception of the Blue Line, are limited. Residents, workers, and visitors want to connect across the harbor between these waterfront neighborhoods, and for people who are walking or cycling, this serves as a floating connection between segments of the Harborwalk.

Many ferry services have operated in Boston Harbor over the past four centuries. Some have been replaced by bridges, tunnels, trains, and buses. Other routes disappeared when ferries no longer served as an efficient travel alternative. Newer services have emerged and evolved to serve new areas with high demand. This proposed route supports increased demand and responds to the opportunity for new water transportation connections.

This plan details how to establish regular, affordable service between four neighborhoods and lays out the needed dock improvements, recommended route configuration, suggested vessels to lease or build, the projected ridership and fares, and four financial pro formas based on different combinations of these proposals. Although the route would likely incorporate or merge with the existing Massachusetts Bay Transportation Authority (MBTA) ferry service between Charlestown and Long Wharf, it should be noted that the plans do not specify or require that the new service be operated by a state entity. Massachusetts Department of Transportation (MassDOT) and the Massachusetts Port Authority (Massport) were both among the funders of this study and hope to work in partnership with stakeholders and champions to support the implementatin of this route.

Launching a new service or even adapting an existing service to better serve ferry customers requires strong business plans and the support of community members and business partners. This study has carefully developed economic models and cost estimates that provide a realistic framework for moving forward with the implementation of this service. In order for ferries to reach their full potential to offer economic and mobility benefits, the service must have public and private support when initiated and then it must attract and retain riders to sustain ridership growth over time.

By starting the conversation about new services with a strong data-driven business plan, it is the intention of the primary authors and stakeholders of this report—including Boston Harbor Now, MassDOT, and Massport—to provide an economically sustainable model for the development of new ferry service.[1] This plan's development was guided by stakeholder input, ridership and financial modeling, infrastructure analysis, and operational expertise designed to provide a common set of data points and assumptions that can be used by all of the parties involved in its implementation. It forecasts ridership, revenues, operating costs, and capital costs. MassDOT and the other funders of this study are committed to partnering with stakeholders who want to implement the new service and to ensuring that communities have reliable transportation options to meet their mobility needs.

1 A complete list of the study's funders can be found on page 75.

Overview

The proposed Inner Harbor Connector would link Charlestown, East Boston, and the Seaport via downtown Boston with ferry terminals at Navy Yard Pier 4, Lewis Mall, Fan Pier, and Long Wharf. Lewis Mall requires major improvements to accommodate ferries, the Navy Yard Pier 4 dock needs some adjustments for bow-loading ferries, a future dock on the east side of World Trade Center/ Commonwealth Pier could also serve the Seaport, and Long Wharf's facilities need to be enhanced and expanded to support a significant increase in vessel traffic.

For the purpose of this business plan, the modeling assumed that the ferries would operate on weekdays from 6:30 AM to 10:00 PM. During peak commute hours, from 6:30 AM to 9:00 AM and again from 3:30 PM to 6:30 PM, six vessels would depart from each terminal every 15 minutes. During the off-peak hours, three vessels would depart every 20 minute while the other vessels are serviced, refueled, or used elsewhere. There would also be weekend service with ferries departing every 20 minutes.

After defining the route and frequency, ridership assumptions and financial plans were developed for leased vessels and custom-built vessels operating on this route with both a $3.50 and a $6.50 fare. Four possible scenarios were studied based on these combinations. Each scenario includes capital costs for the four docks, operational costs that vary by vessel, and operational revenue that varies based on fares and ridership. Across the different configurations, annual ridership with weekday and weekend service is projected to be between 924,000 and 1,594,000.

Proposed Schedule

Weekday Service

6:30 AM – 9:00 AM - Every 15 minutes
9:00 AM – 3:30 PM - Every 20 minutes
3:30 PM – 6:30 PM - Every 15 minutes
6:30 PM – 10:00 PM - Every 20 minutes

Weekend Service

6:30 AM – 10:00 PM - Every 20 minutes

Why Ferries

Boston Harbor has a long legacy of passenger ferries dating from the 1600's when vessels provided connections that were later replaced by bridges, tunnels, and trains. This plan builds on that history without trying to recreate it. Its purpose is to introduce a new ferry route by 2020 with a fresh perspective and clear contemporary reasons for expanding water transportation service in the harbor. The dramatic changes to the Boston waterfront over the recent decades—and not a legacy of ferry service—is why the implementation of this plan is essential now.

Providing effective, reliable, affordable, and accessible scheduled water transportation connections between Charlestown, East Boston, the Seaport, and downtown Boston contributes a range of social benefits. Passengers have direct benefits, including quality of life improvements from a new mobility option. There are also indirect benefits to the broader transportation system, the environment, and economic development. The system will serve residents and workers, increase access to recreation and leisure destinations, and has the potential to provide resiliency and redundancy in case of an emergency.

For people living and working in the neighborhoods served by this new service, access to this ferry can improve their quality of life across multiple metrics. Some ferry passengers will have a faster trip door-to door than on existing alternatives. Depending on parking fees and other transportation costs, ferry customers may have a lower out-of-pocket cost per trip. For some locations, the ferry trip may be more convenient—with fewer transfers, shorter waiting times, and a shorter walk at the ends of the trip—than existing transit options. The ferry is also likely to provide a very reliable trip since existing service has the best on time performance of any mode in the MBTA's portfolio.

Ferry passengers typically report that they find water transportation to be more enjoyable and comfortable than their alternatives. Whether it's the views, amenities, or experience of being out on the water, most passengers find something aesthetically pleasing and compelling about making a trip across the water and spending part of their trip walking to or along the waterfront. Coast Guard safety regulations, designed to ensure safe loading of vessels and safe operations at sea, also provide more space per person on board vessels than what is required for the safe operation of trains and buses.

When ferry docks are proximate to train stations, bus stops, and the terminals of other ferry routes, the entire system benefits from increased connectivity and attracts riders who want to have more options. A new ferry service also provides benefits to people who continue to rely on the trains, buses, and segments of roadways that ferry passengers are no longer using by reducing congestion. Given the relatively small passenger volumes even on thriving ferry routes, these indirect benefits are relatively modest.

By shifting from driving to ferry riding for some or all of their trip, passengers can reduce vehicle emissions; however, routes that primarily serve people who can walk or bike to the ferry terminal or who rely on other forms of transit may not reduce total carbon emissions. Emissions reductions are also dependent on the type of engine used to power the vessel. Still, moving any emissions from roadways in dense urban neighborhoods to the water may have a public health benefit.

Around the Boston region, the clean-up of the Harbor has led to an increase in waterfront development as new residential and commercial buildings have sprouted along the water. Providing ferry services to these growing neighborhoods and districts can increase property values and expand access to jobs, restaurants, and retail. While this kind of transit access can contribute to displacement, it can also serve to connect residents with direct access to jobs in areas that are hard to access now. New ferry routes can also provide additional connections to waterfront recreational opportunities including parks and cultural assets. These new services can allow additional visitors to more easily travel to these areas and may lead to an increase in leisure spending.

In the event of an emergency, each ferry system has unique challenges and opportunities to play a role in the response and recovery. Though ferries do not typically operate during storms, they can be a critical component in waterfront resilience once the flooding and wind have subsided. Rather than planning for any one threat and measuring the fleet's possible impact, Boston can look to examples from New York to San Francisco, where ferries have been used to solve transportation problems in the face of natural and man-made disasters.

Lewis Mall has the potential to provide ferry service to Long Wharf with continuing service on to the Seaport and Charlestown.

Ferries Today

Ferry service in Greater Boston has been operated by a combination of public and private entities or in partnerships between them. The longest operating ferry within Boston Harbor is the Hingham service that began as a private ferry in 1975 before becoming part of the MBTA system in 1984. It has led to housing and commercial development in Hewitt's Cove, though it has taken several decades for those changes to unfold and for ridership to grow to current levels. Since then, new services have been established to serve Charlestown, Hull, Quincy, Salem, and Winthrop with different combinations of municipal, state, and private owners and operators. Over the last thirty years there have been periods of ferry service from the Fore River Shipyard in Quincy, Lewis Mall in East Boston, and Blossom Street Pier in Lynn.

Existing Conditions

In the summer of 2018, there were five public ferry routes providing commuter and recreational service in Boston Harbor. The MBTA operates three year-round commuter services through contracts with Boston Harbor Cruises (BHC). The City of Salem also partners with BHC to provide seasonal ferry service between Salem and Boston. The Town of Winthrop owns and operates their own ferry that connects Winthrop with Central Wharf in Boston, Fan Pier in the Seaport, and Squantum Point in Quincy. There were also two privately run services that connect Boston and Provincetown operated by BHC and by Bay State Cruise Company (BSCC). There has been some ferry service from Lynn in recent years, but there was none in 2018.

Seven ferry routes provided access to the Boston Harbor Islands. Public ferries to six of the Boston Harbor Islands leave from gateways at Long Wharf North and from Hewitt's Cove in Hingham between mid-May and early October. There is also weekend service to Thompson Island from the EDIC Pier on Boston's Reserved Channel from late May to early September.

In January 2019, a new ferry service began between Lovejoy Wharf next to North Station and Fan Pier in the Seaport. The service is operated by BSCC, managed by the Massachusetts Convention Center Authority (MCCA), and funded by major employers in the Seaport. The ferry replaced a consolidated shuttle service that was providing bus service from North Station that regularly got stuck in traffic. It will operate year-round during peak commuting hours—from 6:20 AM to 9:40 AM and from 3:20 PM to 7:00 PM. There are a limited number of seats open to the public for $5.

There are also smaller water transportation services available that respond to a lack of existing ferry connections. A launch boat connected Pier Six restaurant in Charlestown with the Reel House restaurant in East Boston seasonally in 2017 and 2018. The Institute for Contemporary Art (ICA) initiated a seasonal water shuttle service in the summer of 2018 to connect the main museum building in the Seaport with a new venue in the East Boston Shipyard. Both services are expected to continue in 2019. In 2019, a new water transportation service is planned for Encore Boston Harbor Casino in Everett with service to downtown Boston and the Seaport.

Year-round MBTA Ferry Services

	Hingham to Boston	Hingham to Hull to Logan to Boston	Long Wharf to Charlestown
Docks	Hewitt's Cove, Rowes Wharf	Hewitt's Cove, Pemberton Point, Logan Airport, Long Wharf North	Navy Yard Pier 4, Long Wharf Central
Seasonality	Operates year-round	Operates year-round	Operates year-round
Weekday roundtrips	18	19	39
Weekend roundtrips	N/A	14 (only available Memorial Day to Columbus Day)	17
One-way Fare*	$9.25/ride	$9.25/ride	$3.50/ride
Monthly Pass	$308	$308	$84.50
Ridership	827,397 (2016)	337,499 (2016)	317,355 (2016)
Farebox Recovery**	72% (2015)	74% (2015)	58% (2015)
Owner	MBTA leases vessels from BHC	MBTA owns vessels	MBTA leases vessels from BHC
Operator	Boston Harbor Cruises	Boston Harbor Cruises	Boston Harbor Cruises
Funding	MBTA and farebox	MBTA and farebox	MBTA and farebox
Travel Time	35 minutes	Varies, 23 to 55 minutes depending on stops	10 minutes
Notes		Summer stops on Georges Island	

* Discounted fares are available for students, seniors, and people with disabilities.

** The MBTA reported a combined farebox recovery rate of 71% for the three routes in FY2015.

The Champion is one of the MBTA's newest vessels. It launched in 2017.

Seasonal, Non-MBTA Ferry Services

	Salem to Boston	Winthrop to Quincy to Boston	Boston to Provincetown
Docks	Salem Ferry Terminal, Long Wharf North	Winthrop Ferry Dock, Squantum Point, Fan Pier, Central Wharf	Long Wharf South, World Trade Center West, MacMillan Pier
Seasonality	May – October 31	April – November	May – October
Weekday roundtrips	5	4 - 6	1 - 4
Weekend roundtrips	5	3 - 4	1 - 4
One-way Fare	$25 ($8 for commuters)*	8.50 ($6 for commuters)	$59 ($88 roundtrip)
Ridership	61,185 (2016)	20,163 (2018)	
Farebox Recovery	91% (2016)**	58% (2016)	> 100%
Owner	City of Salem owns the vessel	Town of Winthrop	BHC and Bay State Cruises
Operator	Boston Harbor Cruises	Town of Winthrop	BHC and Bay State Cruises
Funding	City of Salem and farebox	Farebox with temporary MBTA support and additional funding	Farebox with market rate ticket pricing
Travel Time	55 minutes	Varies, 25 to 65 minutes depending on stops	90 minutes
Notes	Differentiated pricing for tourists subsidizes the cost for commuters	Saturday connections to Spectacle Island and some sunset cruises	

* Discounted fares are available for students, seniors, and people with disabilities as well as for Salem residents and North Shore residents;
** This farebox comes from BHC and includes ticket and galley revenues.

The Valkyrie is owned by the Town of Winthrop. It began service in 2016.

Best Practices

Every region and local market has its own unique characteristics that shape the existing ferry system – weather, geography, governmental structures, demographics, and density of ridership. Access to connected roadways, reliable trains and buses, and safe routes to walk and bike all play a role in people being able to rely on and connect to ferry service as part of a transportation ecosystem. In a national evaluation of best practices conducted by the consultant team, the three greatest factors in developing a successful service were time and fare competitiveness, system integration, and sustainable funding.

Effective ferry services attract riders and compete with other travel options by providing an efficient and affordable alternative to other modes of transportation. Though driving may cost less than a ferry ticket, parking in downtown Boston often costs more. Potential passengers are more likely to choose a ferry when a new service can save them time, money, or both. The ferry must be competitive with other modes and draw from a sizable population of commuters who could take the ferry on a regular basis. Although there may be a sizable number of recreational riders who use a service, there must be a core group of people who form the base of the service's ridership for it to be sustainable. Potential passengers will drive to a ferry terminal if the service provides them with a faster and more reliable service than driving all the way to their final destination. Other passengers make decisions about taking a ferry if the price is competitive with their other options or adds value to their trip.

National Ferry Systems Studied

NYC Ferry (East River) - New York
San Francisco Bay Ferry (WETA) - California
Golden Gate Ferry – California
Kitsap Ferry – Washington
King County Marine Division – Washington

Ferry services attract more passengers when they are coordinated with other modes and integrated with existing transportation systems. Ideally, ferry schedules are synchronized with transit connections at the ferry terminals to enable those passengers with farther to go to connect with trains, buses, or other ferries. The fare payment system should allow passengers to transfer or to make a choice on a daily basis about which mode of transit best suits their travel needs that day. One of the potential benefits of the new automated fare collection that is being developed for the MBTA is that more operators could choose to use the MBTA fare payment system even if not all of the services are part of the MBTA system. Comprehensive branding and wayfinding clearly identify departure locations and connections and provide clear user directions for new riders. Finally, the service should be incorporated into data systems including websites and smart phone apps so that the ferry is included as an option when planning a trip.

As with many public transit operations in the United States, few year-round passenger ferry services are sustained entirely by passenger fares. Securing stable funding, particularly through the initial years of a new service is crucial to establishing a reliable service that passengers can depend on. Consistent financial support from private and/or public sources ensures that the service can operate continuously as ridership grows. New services should be given a reasonable and clearly established time period in which to grow and mature before decisions are made about their viability. Many pilots measure the success of programs over the course of three to six months, but it can take more time—up to five years after initial implementation—to fully establish a ferry service. Once a service has matured, some additional forms of federal grants become available to support capital investment. If the pilot is well designed, the data sets will be large enough over the time frame to understand trends and adjust service accordingly. Knowing that ferry services will be financially supported for a longer period of time is crucial for justifying capital investment, including needed capital maintenance, and for securing high quality operators. This commitment in

turn attracts passengers, while services with perennial funding deficits are unlikely to persist.

In evaluating ferry systems and services across the country, it is clear that successful ferry services have found the right service delivery model with an effective combination of public and private involvement in vessel ownership and operations. High quality ferry services are sustained by making informed decisions about providing the service and by thoughtfully determining the appropriate hours, days, and seasons of operation. Operational decisions maximize efficiency with thoughtful dock locations, simplified fare collection, and good systems for queuing. Additionally, many ferry services contribute to the resiliency of the transportation system by providing a regular alternative means of travel as well as by contributing to emergency response and recovery programs.

Ideal ferry services use sound environmental practices and strive in particular to be fuel efficient in order to reduce emissions and operating costs. Finally, when operated well, ferry services adhere to measurable performance standards that demonstrate high levels of on time performance and trip reliability, efforts to optimize fuel consumption, reasonable operating costs per passenger, and responsiveness to ridership demand.

For a more detailed analysis of best practices, a separate report prepared in December 2017 can be read at www.bostonharbornow.org/ferryplans/resources.


NYC Ferry


San Francisco Bay Ferry


King County

100 people participated in the three Water Transportation Study Workshops including this one at MassDOT.

3,689 people responded to the stated preference survey online and while riding existing ferry routes.

Comprehensive Study Process

The Comprehensive Water Transportation Study process was designed to iteratively collect structured feedback from the public and pair it with rigorous data analysis and careful decision making. The three largest public engagement efforts were

- Three water transportation stakeholder workshops with 100 participants,
- A stated preference survey that collected 3,689 responses from residents of Greater Boston, and
- A water transportation open house that attracted 150 participants.

Regular updates were provided to MassDOT's Water Transportation Advisory Council (WTAC), which includes state and local elected officials, representatives of state agencies, and other organizations. Additionally, members of the team did smaller presentations to other interested stakeholder groups and shared information about water transportation and the study in advocacy forums.

Collecting Ideas

At the beginning of the process, the Comprehensive Water Transportation Study was designed to cast the widest possible net for possible ferry routes to study. Water Transportation Stakeholder Workshops were held three communities—Salem, Quincy, and at the MassDOT headquarters in Boston. Though they were open to members of the public, invitations were sent to representatives of coastal communities, relevant state agencies, and community members with expertise in ferries and other forms of water transportation. A broad mix of participants from mayors and state-level elected officials to local advocates participated in the three workshops with more than 100 people attending in total.

Workshop participants were provided with existing conditions information and a presentation on effective ferry operations and national best practices before taking part in two breakout sessions to discuss possible dock sites, routes, and selection criteria. Some of the sites discussed did not meet basic criteria for water depth and population density, but the thirty-five sites listed on the following page were discussed at the workshop and a dock assessment was completed for thirty of them. Sites marked with » had regularly scheduled ferry service within Boston Harbor or to Boston in the summer of 2017 when the workshops were conducted. Sites marked with ¨ have a pier that could be used for ferry docking in April 2019, though some of these are subject to tides. The largest change has been the reconstruction of Lovejoy Wharf, completed in January 2019. The docking facilities fully accommodate bow-loading ferries that can fit under the North Washington Street Bridge.

During the second discussion about selection criteria and benefits, participants talked about how ferry service would affect potential users, the existing transit system, and the region more broadly. Ferries were considered particularly important for passengers when they provide a faster trip than other travel options, more consistent trip times compared with more congested alternatives, improved safety, and a pleasant transportation experience. Ferry services were seen as beneficial to the broader transit network when they provide direct access without transfers, when they have the potential to increase the total number of transit riders by providing potential customers with more choices, and when they provide a cost-effective way to fill in service gaps or absorb excess demand. Participants were optimistic that new ferry services could encourage and support waterfront development and redevelopment, provide system redundancy that could be particularly important during an emergency, reduce the number of drivers as they opt to take ferries thereby leading to emissions reductions, and provide health benefits for people who walk and bike to catch the ferry.

The most commonly recommended route was an inner harbor circulator.

For a more detailed report on the feedback provided at the stakeholder workshops, a separate document prepared in September 2017 can be read at www.bostonharbornow.org/ferryplans/resources.

Forecasting Ridership

During August and September of 2017, a stated preference survey collected data on how people in Greater Boston make travel decisions. One team of surveyors rode the ferries in Boston Harbor with tablets collecting responses to the survey and another team passed out postcards with links to the survey at transit stations around the region. Postcards were also available on ferries and from partner organizations who were involved in the study. Email blasts, social media, and an advertisement in the Boston Globe were also used to promote the survey. A few hundred random participants were paid to take the survey. In total, over 3,500 validated survey responses were used to build a ridership demand model for possible ferry services.

The survey asked participants a series of demographic questions about their age and income. It then sorted them into current commuter ferry users, potential commuter ferry users, current island ferry users, or potential island ferry users depending on their home and work zip codes and their recent water transportation usage. The survey went on to ask questions about travel decisions, how people chose to spend money on their trips, and how much they would pay for different combinations of driving and transit. Although more than half of the non-paid participants responded to the survey as though it was a work commute, the survey included shopping, errands, appointments, leisure, visits to friends, and sightseeing as other trips.

Dock Sites Proposed at Workshop

Municipality	Proposed Dock Locations
Gloucester	
Beverly	
Salem	Salem Ferry Terminal »
Lynn	Blossom Street Pier »
Winthrop	Winthrop Ferry Dock »
Chelsea	Mary O'Malley Park
Everett	Encore Boston Harbor
Boston	
- East Boston	Logan Airport Ferry Terminal » Lewis Mall Liberty Plaza
- Charlestown	Sullivan Square/Schrafts Navy Yard (Yard's End) Navy Yard/Pier 4 » Navy Yard Pier 1 ¨
- North Station	Lovejoy Wharf ¨
- Downtown	Long Wharf North + South » Central Wharf ¨ Rowes Wharf »
- Fort Point	Atlantic Wharf (South Station)
- Seaport	Federal Courthouse/ Moakley Fan Pier (ICA) » World Trade Center West » World Trade Center East ¨ Dry Dock #4 EDIC/Marine Industrial Park »
- Dorchester	Columbia Point at Fallon Pier UMass Boston at Fox Point
Quincy	Marina Bay/Squantum Point » Town River Fore River
Hingham	Hewitt's Cove »
Hull	Pemberton Point » Steamboat Wharf
Plymouth	
Provincetown	MacMillan Pier »

» Denotes location with ferry service in the summer of 2017

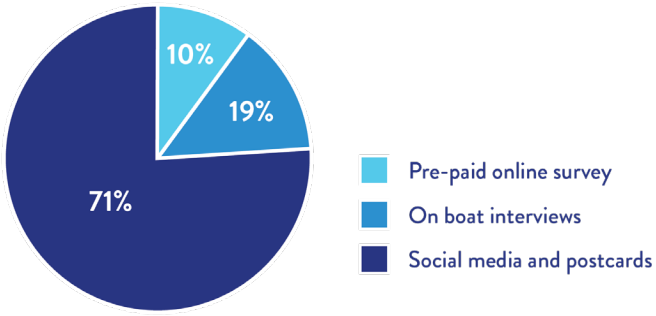
¨ Denotes existing piers where ferries could dock in April 2019

While the survey was being conducted, the team was also studying thirty dock sites that had been proposed during the stakeholder workshops. For each site, four types of data were collected:

- Geographic data about the area around the dock site and the multimodal options available to access it;
- Demographic data about the population around the dock site including the size of the population, the size of the labor force, where they work and how they get there, and other demographic traits including income that might affect people's decisions to take a ferry;
- Development data about recent and planned construction that would impact the growth in demand for a ferry over the next five years; and
- Physical site conditions relating to the existing pier, ramp, and floats as well as any proposed or funded designs.

These analyses made it clear that some sites were stronger candidates than others for new service in the near term.

Source of Stated Preference Survey Responses



Narrowing the Dock List

In November of 2017, the thirty dock profiles were presented at an eight-hour open house at Rowes Wharf on the Boston waterfront. The public was invited via email and social media to attend and provide feedback. Participants were invited to read and provide feedback on the dock profiles as well as the previously prepared reports on the stakeholder workshops, existing conditions, and best practices and some of the data from the stated preference survey. One hundred fifty people attended the day-long event and most people shared some form of feedback from report edits to route suggestions to comments on the choices of which dock locations would be studied further.

With the criteria that all dock locations that qualified for further study needed to have the potential to attract robust ridership and be implemented within the next one to five years, the following sites were selected for further analysis.

The sites that were not selected showed a lack of readiness to host a successful service in the immediate future. These sites

- lacked indicators of robust ridership demand,
- required significant capital investment in dock construction or dredging, which also requires significant federal and state permitting time,
- did not have local partners ready to advance needed projects, and/or
- have or will have privately operated ferry service that does not require a new business plan from this particular study.

Most of the dock sites do have the potential for new or expanded service over the longer term and could be the focus of future examination. The two ferry services from Boston and the one from Plymouth will continue to provide connections to Provincetown.

The results of the Open House and the narrowed list of dock sites were presented in December to the Water Transportation Advisory Council and to the Seaport Economic Council of the Executive Office of Housing and Economic Development.

150 people participated in the Water Transportation Open House at Rowes Wharf in December 2017.

Dock Sites Selected after Open House

Municipality	Proposed Dock Locations
Salem	Salem Ferry Terminal »
Lynn	Blossom Street Pier ¨
Winthrop	Winthrop Ferry Dock »
Boston	
- East Boston	Logan Airport Ferry Terminal » Lewis Mall
- Charlestown	Navy Yard/Pier 4 »
- North Station	Lovejoy Wharf ¨
- Downtown	Long Wharf North + South » Rowes Wharf »
- Seaport	Fan Pier (ICA) » World Trade Center East ¨
- Dorchester	Columbia Point at Fallon Pier
Quincy	Squantum Point/Marina Bay »
Hingham	Hewitt's Cove »
Hull	Pemberton Point »

» Denotes location with ferry service in the summer of 2018

¨ Denotes existing piers where ferries could dock in April 2019

Selecting Routes

As the study continued through the winter of 2018, the scope of work required that a limited number of routes be studied sufficiently to develop business plans. It became clear that some routes were too advanced to benefit from the creation of more detailed business plans while others had the potential to grow or evolve without a more detailed analysis. Salem has robust seasonal service and was awarded a Federal Transit Administration (FTA) Passenger Ferry Grant for $3,400,000 in the spring of 2018 to acquire a second vessel. Lynn has a business plan for ferry service that was completed by MassDOT in February 2017 that has yet to be implemented. Winthrop has a business plan, owns a vessel, and will launch its fourth year of service in April 2019. They continue to experiment with route configurations and pricing. The MBTA services to Hingham are growing ridership and there is potential to experiment with an additional stop in the Seaport in the future. The MBTA service to Hull is also growing and additional weekend service was added in the summer of 2018. A ferry service funded by Seaport employers connecting Lovejoy Wharf next to North Station

and Fan Pier launched in January 2019 after several years of careful planning.

Of the possible routes, there were two that seemed to be the most promising options for new service—a route that would connect a series of docks in the Inner Harbor and a route that would provide a direct connection between Squantum Point Park in Quincy and downtown Boston that could also serve Columbia Point. Each of these landings has seen new development and growth over the past decade that has increased the potential demand for ferry services. The findings of continued study of the docks, routes, vessels, and ridership for a potentially successful Inner Harbor Connector can be found on the following pages. A comprehensive business plan for a new southern route from Squantum Point/Marina Bay to Long Wharf with off-peak stops at Fallon Pier can be found in a separate report.

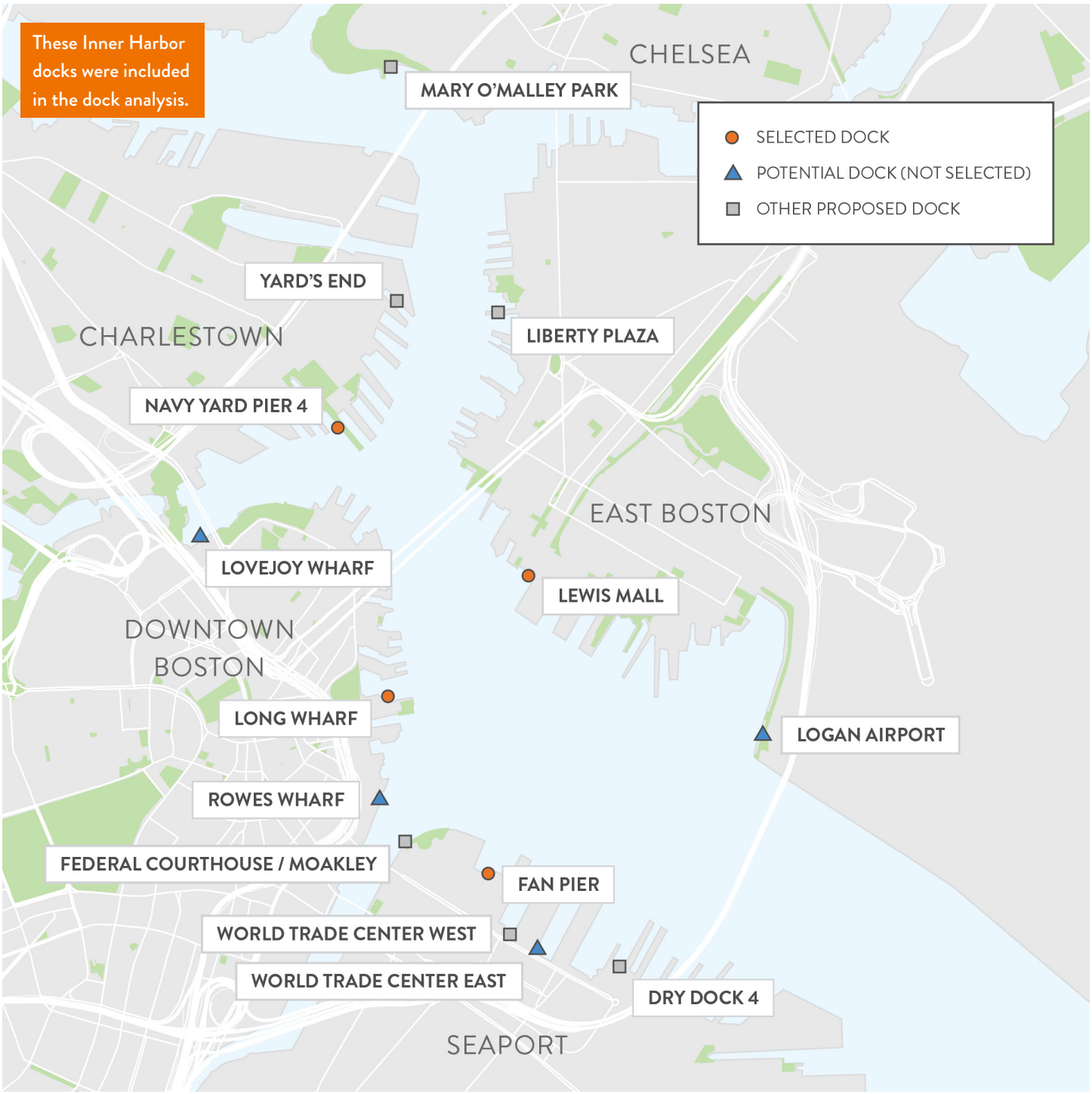
The initial ridership forecasting illustrated that most of the neighborhoods encircling the inner harbor need only one landing in the near term to adequately serve the ridership demand. With this in mind, a single site in each neighborhood was chosen to be part of the Inner Harbor Connector.

In Charlestown, Navy Yard Pier 4 was selected because it is being used for existing ferry service and would therefore have relatively few capital cost requirements. It also has strong community support given its adjacency to the residential development in the Navy Yard and supports high tourism ridership with its proximity to the National Park and Freedom Trail sites, including the USS Constitution.

In East Boston, three sites were considered: Lewis Mall, Liberty Plaza, and the existing Logan Airport Ferry Terminal. Ultimately, Lewis Mall was selected for its proximity to residential areas and its proximity to Long Wharf. While the Logan Airport ferry terminal is an existing facility with some MBTA service, the site requires shuttle buses to access it and this negates the potential travel time savings for passengers traveling to downtown Boston or the Seaport. It is also ill-equipped to serve most of the neighborhood residents.

In downtown Boston, Long Wharf North/Central was chosen because it is already the primary ferry terminal downtown, is centrally located, serves most North End residents, and is in close proximity to other transit connections including other ferry routes and the Blue Line. Additionally, Long Wharf requires very little initial capital investment since it is currently a functioning ferry terminal.

The Seaport had multiple possible sites including World Trade Center East and West, Fan Pier, and Federal Courthouse/Moakley. Fan Pier was selected because of its proximity to destinations in the Seaport and the site's ability to be used in the short term. World Trade Center East would be an ideal location in the long term if there is a future investment in the full buildout of the landings as this site is better positioned to serve more potential passengers who work in the district or who are visiting the Boston Convention and Exhibition Center.


These Inner Harbor docks were included in the dock analysis.
CHELSEA
MARY O'MALLEY PARK
SELECTED DOCK
POTENTIAL DOCK (NOT SELECTED)
OTHER PROPOSED DOCK
YARD'S END
CHARLESTOWN
LIBERTY PLAZA
NAVY YARD PIER 4
EAST BOSTON
LOVEJOY WHARF
LEWIS MALL
DOWNTOWN BOSTON
LONG WHARF
LOGAN AIRPORT
ROWES WHARF
FEDERAL COURTHOUSE / MOAKLEY
FAN PIER
WORLD TRADE CENTER WEST
WORLD TRADE CENTER EAST
DRY DOCK 4
SEAPORT

Dock Locations and Conditions

Boston Harbor has a variety of docking locations ranging from marinas to water taxi stops to potential ferry docks. Ten Inner Harbor dock locations were included in the initial dock survey, eight of them were part of the next phase of potential ridership analysis, and four locations are proposed for the Inner Harbor Connector.

Dock Locations Selected for the Inner Harbor Connector

These docks are proposed as part of the Inner Harbor Connector. More detailed information about the existing conditions of each of these dock locations is available in the sections that follow.

Dock	Location	Current Conditions
Long Wharf	Downtown Boston	Existing MBTA, Salem, and Harbor Island ferry service
Lewis Mall	East Boston	Needs dock improvements to accommodate ferries
Navy Yard Pier 4	Charlestown	Existing MBTA ferry service
Fan Pier	Seaport	Existing Winthrop/Quincy and Lovejoy/Seaport ferry service

Potential Dock Locations Not Selected for the Inner Harbor Connector

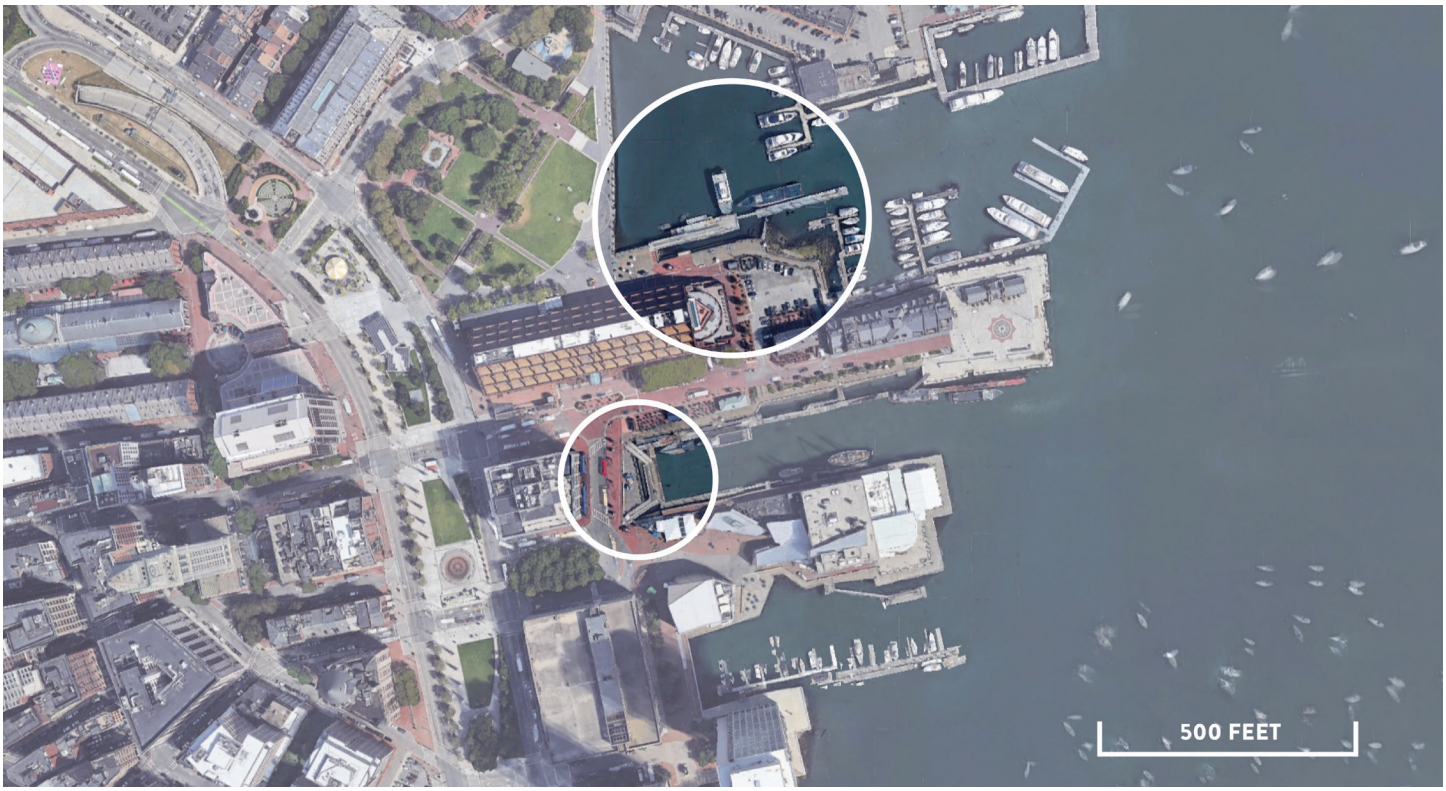
Each of these dock locations was considered for the Inner Harbor Connector. Each was determined to have potential for future routes in the inner harbor but had limitations for short term implementation within the parameters of the study.

Dock	Location	Limitations
Logan Airport Ferry Terminal	East Boston	Existing MBTA service connects Logan Airport with Hull and Hingham on a limited number of daily runs. This provides significant travel time savings for South Shore passengers; however, the bus from the airline terminals to the ferry terminal eliminates travel time savings for passengers heading to downtown Boston compared with other transit options.
Lovejoy Wharf	North Station	A ferry dock at this location was completed in January 2019. The height of the North Washington Street Bridge restricts the types of vessels that can access the dock, and bridge construction planned for the coming years may further complicate service. Additionally, forecasted demand is only to the Seaport and primarily during commuting hours.
Rowes Wharf	Downtown Boston	Existing MBTA service departs to Hingham from this dock; however the privately owned facility is already at capacity, needs ADA accessibility upgrades, and does not provide the proximity to transit to accommodate transfers to other ferry routes or the Blue Line.
World Trade Center East	Seaport	The existing facility does not accommodate regular ferry service and is not ADA accessible. Substantial investment is needed at this location before incorporating it into a ferry route. When the dock is reconstructed, it will be an ideal location for several potential route adjustments and improvements.

Other Proposed Dock Locations

These dock locations were part of the first phase of the study, but due to current levels of demand and dock conditions, they were not investigated in the design of the Inner Harbor Connector.

Dock	Location	Limitations
Liberty Plaza	East Boston	There is insufficient demand and no existing ferry dock.
Mary O'Malley Park	Chelsea	There is insufficient demand and existing pier in disrepair. Dredging is also needed.
Yard's End	Charlestown	There is insufficient demand, and existing pier cannot accommodate ferry.
Federal Courthouse/ Moakley	Seaport	Close proximity to Rowes Wharf and Fan Pier limits demand while closure of Northern Avenue Bridge limits easy pedestrian access.
World Trade Center West	Seaport	This private dock is fully leased.
Dry Dock 4	Seaport	There is insufficient demand and no existing ferry dock.



Long Wharf North and Central (Downtown/North End)

42.360904, -71.049512

Once stretching into Boston Harbor for more than a third of a mile, historic filling has brought the city out to Long Wharf. This downtown hub for water transportation is also the departure point for numerous boat tours including whale watches and Codzilla. It is home to the Marriott Long Wharf, the Chart House restaurant, and two outdoor bars. It's also next door to the New England Aquarium with 1.4 million visitors each year, five minutes from Faneuil Hall Marketplace with 18 million annual visitors, and adjacent to the North End neighborhood with more than 10,000 residents. Cut off from the downtown for decades by the elevated Central Artery, Long Wharf's western end now runs along the Rose Kennedy Greenway while half of its northern edge is bordered by Christopher Columbus Park. Both green spaces have substantial programming and provide a place for rest and relaxation.

Long Wharf North has two berthing locations that provide commuter and recreational ferry services. One berth offers year-round MBTA service to Hingham, Hull, and Logan Airport. The other berth offers seasonal ferry service to Salem and to six islands in the Boston Harbor Islands National and State Park. The docking locations are within a three-minute walk of the Blue Line at Aquarium Station. The MBTA service to Charlestown docks at a berth between Long Wharf South and the New England Aquarium, referred to here as "Long Wharf Central."

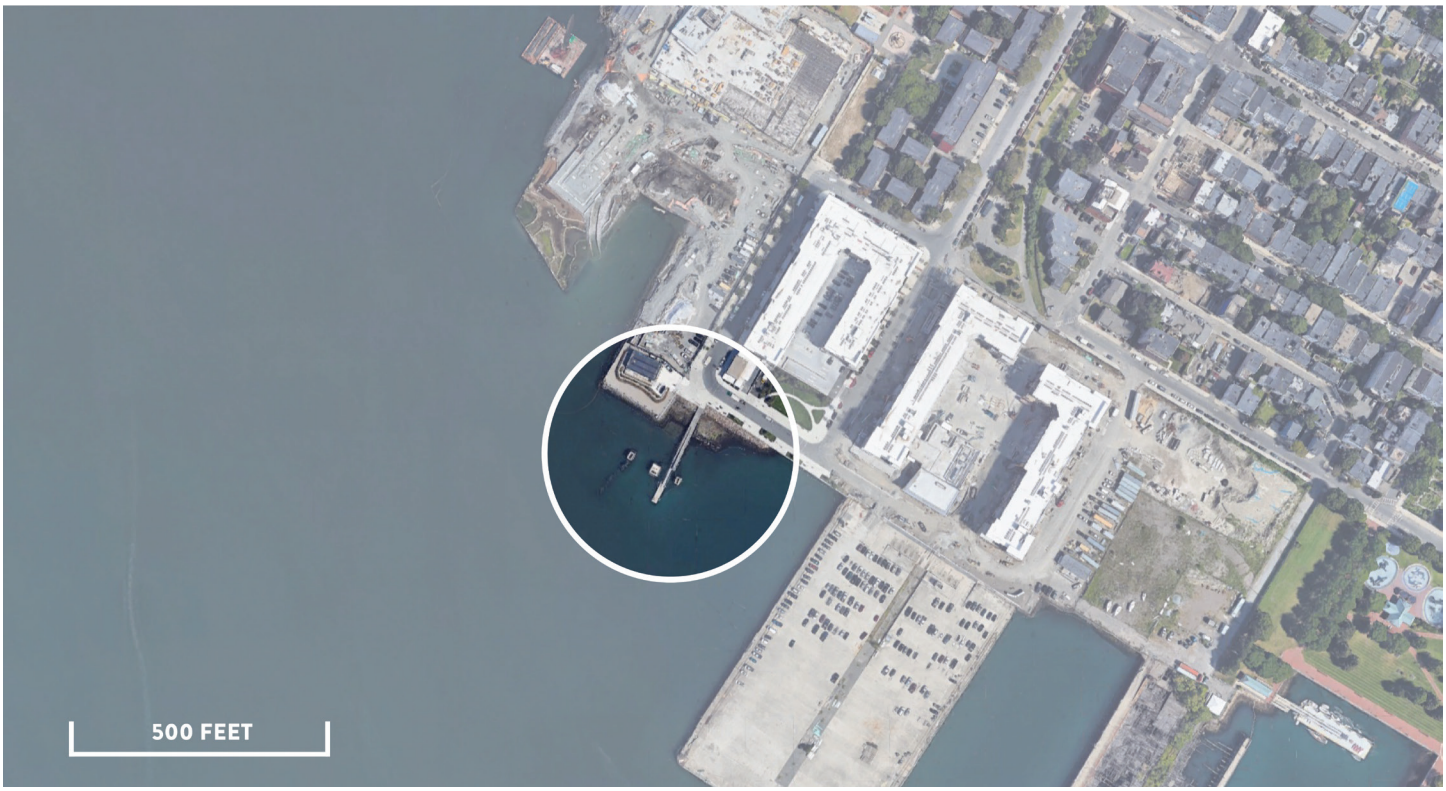
All of Long Wharf is owned by the Boston Planning and Development Agency (BPDA) who holds leases for each dock as well as the Water Boat Marina. The ownership documents are all held in the BPDA's legally registered name, the Boston Redevelopment Authority.

While berthing capacity is sufficient for the existing services, the narrow channel constrains vessel access during the peak of seasonal operations as the adjacent marinas fill up for the summer and a higher number of ferries arrive and depart with greater frequency.

Existing Infrastructure Conditions	
Landing site	Christopher Columbus Park and Harborwalk
Existing landing	Two berths
Docking conditions	All floats and piles are “mid-life” at 15 to 20 years old
ADA Access	Yes
Channel access / turning basin	Yes
Dredging required	Maintenance dredging in Columbus Park basin
Berthing capacity	West berth at 120 ft. accommodates side-loading and bow-loading; east berth at 180 ft. accommodates side-loading
Wave exposure	Minimal, Inner Harbor
Existing pier/bulkhead	Yes
Existing float	Yes, owned by the MBTA
Publicly owned property	Yes, owned by the BPDA
Rider amenities	Ticket booth and outdoor benches on the pier; covered waiting area on the MBTA float; waiting area, restrooms, and drinking fountains at Marriott Long Wharf; numerous restaurants around wharves

Multi-modal Access	
Pedestrian access	Yes, there are sidewalks around the site and connections from the Harborwalk
Bicycle access	Yes, bike lanes on Atlantic Avenue and other streets that run parallel to the Rose Kennedy Greenway and a cycle track along Atlantic and Commercial Streets in the North End
Bicycle parking	Yes, bike racks are along Atlantic Avenue in Christopher Columbus Park and next to the Aquarium T station. A Bluebikes bike share station is on the south side of the Marriott.
Transit access	Aquarium station on the Blue Line is less than 0.2 miles from the dock. State Street station on the Orange Line is 0.4 miles from the dock, and Haymarket station on the Green and Orange Lines is 0.5 miles from the dock. The 4, 352, and 354 bus routes all stop within 0.1 miles of the landing site; however, these buses do not provide frequent service. The 92 and 93 bus routes stop at State. The 15, 29, 57, 92, 93, 111, 117, 325, and 326 buses stop at Haymarket.
Parking	Yes, several private garages including paid parking at Harbor Garage

The berths are linked to Christopher Columbus Park and the Harborwalk, which can be prone to storm flooding and sea level rise. Depending on the type of storm, the ferry site is well protected and suitable to provide evacuation for local buildings in case of flooding due to storm events, but it may require higher Harborwalk access connections. There was significant flooding around this section of the waterfront during the nor’easters on January 4 and March 2, 2018.



Lewis Mall (East Boston)

42.365917, -71.041907

Nearly 7,000 people live within four blocks of East Boston's waterfront stretching from Logan Airport around to Chelsea Creek. The neighborhood is served by the Blue Line and several bus routes that converge at Maverick Square. New and expanded parks in the area also bring people down to the waterfront at LoPresti Park and Piers Park via the Harborwalk and the East Boston Greenway. The neighborhood, which had a long history of welcoming new immigrants even before it was home to an international airport, now has a substantial Latino population. Significant construction has taken place on the water's edge in recent years and the property developers have provided building residents and local neighborhood groups with vouchers for reduced-fares on the existing water taxis. This has been building momentum for and reliance on water transportation options.

Lewis Mall has an existing pier and an active water taxi dock, but no ferry berthing facilities. There is an existing float, but it is inadequate for accessible boarding at many tide levels and would not accommodate available vessels.

The site is owned by the City of Boston. The adjacent property owners are Massport and Lendlease. Portside at East Pier is mostly completed. Clippership Wharf, which is projected to add 478 residential units, is currently under construction. Major developments at The Eddy Apartments and Boston East have added another 400 residential units nearby. Other approved projects include 125 Sumner Street, 245 Sumner Street, 31 Orleans Street, 114 Orleans Street, 10-16 Everett Street, Maverick Shipyard, and 99 Sumner Street which will add a combined 284 residential units.

Historically, ferries departed from Lewis Mall to downtown Boston, but the completion of the Blue Line and the vehicular tunnels gradually led to decreased ridership until ferry

Existing Infrastructure Conditions	
Landing site	End of Lewis Street and Lewis Mall (park)
Existing landing	Yes
Docking conditions	Existing fixed pier is in fair condition; new float and ramps are required for passenger ferry service
ADA Access	No
Channel access / turning basin	Yes
Dredging required	No
Berthing capacity	One berth at 50 ft. accommodates side-loading
Wave exposure	Moderate, Inner Harbor
Existing pier/bulkhead	Yes
Existing float	Yes, but not sufficient for proposed ferry service
Publicly owned property	Yes, owned by the City of Boston
Rider amenities	Some benches

Multi-modal Access	
Pedestrian access	Yes, Harborwalk, Lewis Mall, and sidewalks. The start of the East Boston Greenway is 0.2 miles away and provides a car-free connection to the rest of the neighborhood.
Bicycle access	Yes, particularly via the East Boston Greenway
Bicycle parking	No, there are bike racks closer to the Maverick T-station headhouse 0.1 miles away. A Bluebikes bike share station is on Sumner Street in Maverick Square 0.2 miles away.
Transit access	Maverick station on the Blue Line is less than 0.2 miles from the dock . The 114,116, 117, 120, 121, and 129 bus routes all stop in Maverick Square within 0.2 miles of the landing site.
Parking	No, limited public parking

service was discontinued in 1952. The increase in waterfront residential units around the site coupled with the job growth in the Seaport and elsewhere around the Harbor's edge have once again attracted people to this location and primed it for future use as a water transportation hub.

As a result of residential development, the surrounding bulkheads are being reconfigured; however, the street level is subject to flooding from sea level rise and storm events. The ferry site is protected and suitable for the evacuation of local residential buildings in case of flooding due to storm events depending on whether there is access to the pier and float.

Navy Yard Pier 4 (Charlestown)

42.372825, -71.052582

Charlestown's Navy Yard is home to the USS Constitution —a part of the Boston National Historical Park along with other ships and facilities that capture the maritime and shipbuilding history of the area. This is a major site along the Freedom Trail, which more than three million people walk each year. The waterfront area is home to a residential population of more than 2,000 who live primarily in waterfront buildings and on boats, while the larger neighborhood is home to nearly 17,000. There are also several major health care employers in the area including Spaulding Rehabilitation Center and part of Mass General Hospital. The Harborwalk and Charlestown Naval Shipyard Park also attract walkers, runners, and dog owners to the area around the pier.

Navy Yard Pier 4 has one berthing area that provides commuter services to Long Wharf in Boston. This MBTA service runs year-round, seven days a week with frequent service during peak weekday hours. After the ferry docked for several years on Pier 3, ferry service returned to Pier 4 in 2016 as the result of advocacy by waterfront residents.

The Charlestown ferry is used during commuting hours by the neighborhood's residents and during the day and on weekends by tourists who are visiting the Navy Yard and walking the Freedom Trail. Both Pier 3 and Pier 4 are owned by the BPDA though other maritime uses lease waterfront access, including Courageous Sailing.

There is also an ADA accessible dock at Pier 1 that is owned by the National Park Service and has some seasonal recreational service as part of a "USS Constitution Cruise" with a narrated tour.

Existing Infrastructure Conditions	
Landing site	Flagship Way Avenue
Existing landing	One berth
Docking conditions	Existing floats are in fair to poor condition and accommodate side-loading passenger ferries only
ADA Access	Yes
Channel access / turning basin	Yes
Dredging required	No
Berthing capacity	Berth at 120 ft. accommodates side-loading
Wave exposure	Moderate, head of harbor surge potential
Existing pier/bulkhead	Yes
Existing float	Yes
Publicly owned property	Yes, pier owned by the BPDA, docking facilities owned by the MBTA
Rider amenities	There is a covered bus stop waiting area, in addition to outdoor seating. A ticket kiosk is set up in the summer. There are a limited number of restaurants and cafes in the Navy Yard.

Multi-modal Access	
Pedestrian access	Yes, Harborwalk, multiple sidewalks, and crossings from the neighborhood
Bicycle access	Yes, bike route through the Navy Yard and cycle track on Constitution Road
Bicycle parking	Yes, bike racks are adjacent to the dock; a Bluebikes bike share station is near the intersection of 1st Ave and 5th Street 0.2 miles away.
Transit access	Limited. The 93 bus stops 0.2 miles away on some versions of the route. Community College station on the Orange Line is 1.2 miles from the landing site. North Station —with Orange Line, Green Line, Commuter Rail, and Amtrak service—is also 1.2 miles from the landing site.
Parking	Yes, structured parking in Flagship Wharf is one block away.

The pier has a freeboard; however, the site experiences wave action and storm surge during extreme weather events. Depending on the type of storm, the ferry site may be suitable for evacuation of low-lying parts of the Navy Yard and nearby residential areas in extreme weather events depending on the environmental conditions.

Construction activity on the North Washington Street Bridge may increase demand at this ferry site as residents seek more alternatives to their usual travel routes over the bridge.

Fan Pier (Seaport)

42.353368, -71.043438

The Seaport district, more formally known as the South Boston Waterfront, has transformed over the past two decades from a series of surface parking lot and piers that once fueled the shipping industry to a sparkling new neighborhood with a mix of retail and restaurants, offices, hotels, and residences in twelve- to twenty-story buildings arranged around plazas and pedestrian areas. Since 2000, almost 12.2 million square feet of new commercial development and 4,562 residential units have been constructed or permitted. Another 10.4 million square feet and 2,643 units are planned.

On Fan Pier the condominium buildings at 22 Liberty and 50 Liberty have approximately 120 units each. Within Seaport Square, the Yotel opened in 2017 with 326 'cabins' in the hotel, 121 Seaport Blvd opened in 2018 with 450,000 square feet, 88 Seaport Boulevard is a planned 18-story building with 490,000 square feet of mixed-use, and two more retail and residential buildings are planned. The three-building complex at Echelon Seaport will have 717 apartments and condos, along with 125,000 square feet of retail. The Pier 4 development includes a 372,372 square foot office building that opened in 2018 and 106-unit condo building that should open in 2019 along with 20,000 square feet of retail. In October 2018, the 150 Seaport development broke ground on a 114-unit condo building. Most of these projects include ground floor retail or restaurant space and some public space in addition to the Harborwalk. Behind the development, the Boston Convention and Exhibition Center sits on Summer Street.

The ferry terminal at Fan Pier is owned and managed by the Fallon Company. The facility has ample berthing capacity. It is currently served by seasonal ferry service from Winthrop and Quincy, the Seaport employee commuter ferry from Lovejoy Wharf, and a private water shuttle that provides scheduled connections between the Institute for Contemporary Art (ICA) and its seasonal Watershed space in East Boston.

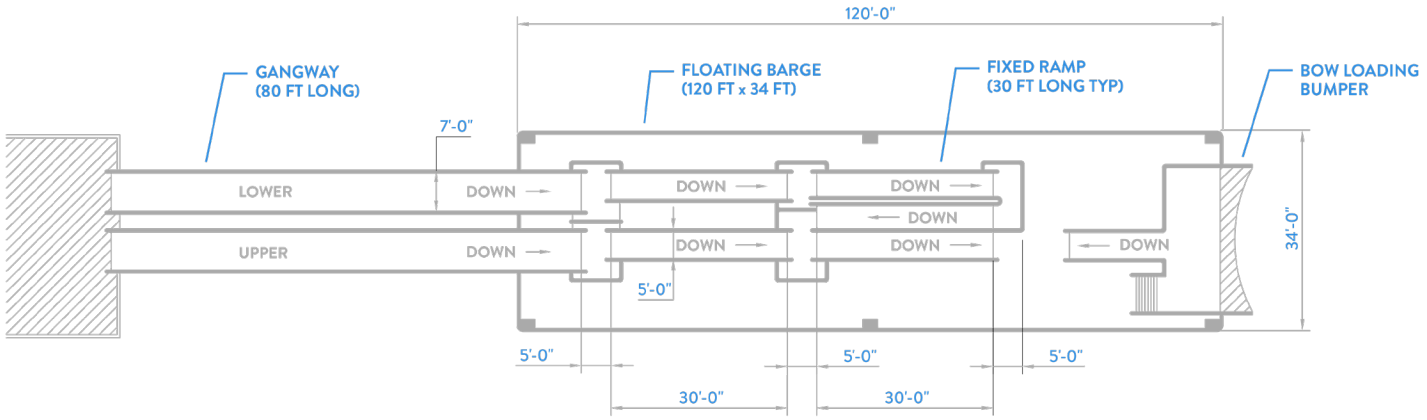
Existing Infrastructure Conditions	
Landing site	Harbor Shore Drive
Existing landing	Yes
Docking conditions	Good, completed in the past 10 years
ADA Access	Yes
Channel access / turning basin	Yes
Dredging required	No
Berthing capacity	One berth at 160 ft. accommodates side-loading
Wave exposure	Minimal, Inner Harbor with breakwater
Existing pier/bulkhead	Yes
Existing float	Yes
Publicly owned property	No, owned by Fan Pier Development LLC (part of the Fallon Company)
Rider amenities	There is a covered waiting area but no seating on the float; limited indoor waiting space in the ICA lobby, a 1 to 2-minute walk from the ferry landing; and benches along the Harborwalk. Public restrooms and additional amenities are available nearby at District Hall and the Lookout Pavilion. There are numerous restaurants nearby.

Multi-modal Access	
Pedestrian access	Yes, the Harborwalk and sidewalks provide access to the site
Bicycle access	Yes, protected bike lanes on Seaport Boulevard
Bicycle parking	Yes, bike racks and a Bluebikes bike share station are within 0.1 mile of the site.
Transit access	Courthouse station on the Silver Line is 0.2 miles from the dock. The 4, 741, 742, and 746 bus routes all stop within 0.2 miles of the landing site. Some private shuttle bus services also provide employees with access to the area.
Parking	Yes, some on-street metered parking and several private garages

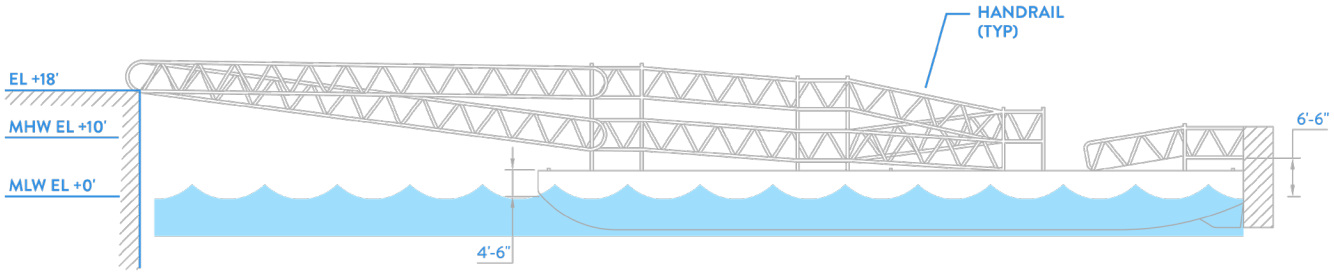
A "cultural connector" once offered service between the ICA, the Boston Children's Museum, and the New England Aquarium, but it was discontinued after several seasons of very low ridership. There are also water taxi services and some private marinas in the district. The Fallon Company manages the marina adjacent to the ferry landing.

The berth is at the level of the Fan Pier streets and the Harborwalk, which can be prone to storm flooding and future sea level rise. The floating breakwater reduces, but does not eliminate, wave exposure to the northeast. The ferry site is protected and suitable for evacuation of local residents and office buildings in case of flooding due to storm events provided safe connections via the Harborwalk are available.

BOSTON HARBOR FERRY LANDING CONCEPT
TYPICAL BARGE & RAMP SYSTEM



PLAN



ELEVATION

Dock Improvement Recommendations

Each ferry dock has its own unique needs and challenges, but a few components are standard across the ferry dock sites for the Inner Harbor Connector:

- A fixed and immovable pier attached to the land,
- A float where the passengers board and disembark from the ferry that moves up and down with the tides, and
- An ADA accessible gangway from the pier to the float.

Conceptual site designs were developed for each ferry terminal site that include these elements. Some newer docks require few changes while others require substantial upgrades to effectively service a future system.

Each conceptual site design is a sketch plan in order to develop cost estimates. A more substantial design process would be required to prepare shovel-ready final designs. The final dock designs may have different loading configurations, and additional modifications, such as float dimensions, fixed ramps, movable ramps, and other features, which are specified. Once vessels are selected, the float should be designed to accommodate the proper freeboard height for landing. Fendering should also be designed to meet the bow-loading or side-loading needs of the selected vessels.

The conceptual designs include both recommended and comprehensive configurations. In the short term, streamlined improvements to the existing infrastructure at some sites could support the initial pilot years of the ferry service. For permanent service, the recommended ferry terminals would have a set of barges, gangways, and ramps that could accommodate ADA compliant access with Boston Harbor's average daily tidal change of 10 feet and year-round weather conditions. The terminals would also include a protected waiting shelter, bow-loading fenders to accommodate vessels with more than side-loading capability, and a few custom site elements to improve access on land.

A set of additional features are included in the comprehensive design proposals. These features would be used to develop a consistent brand for the system and would include Intelligent Transportation Systems with digital arrival times and schedules, terminal identity signage including gate numbers landside and dockside, safety equipment like emergency call buttons and life ring ladders, ticket vending machines if needed, and covered bicycle storage. Further conditions surveys and site-specific elements may also be included with features like covered walkways or wave protection, where appropriate.

In the future, the ferry system has the potential to offer a uniform design feel and brand for all of Boston Harbor's ferries in order to emphasize that each terminal and vessel is part of a transit network. In establishing this comprehensive and coordinated design, even existing MBTA, Winthrop, and Salem services could be upgraded to include these features.

Key Dock Terminology

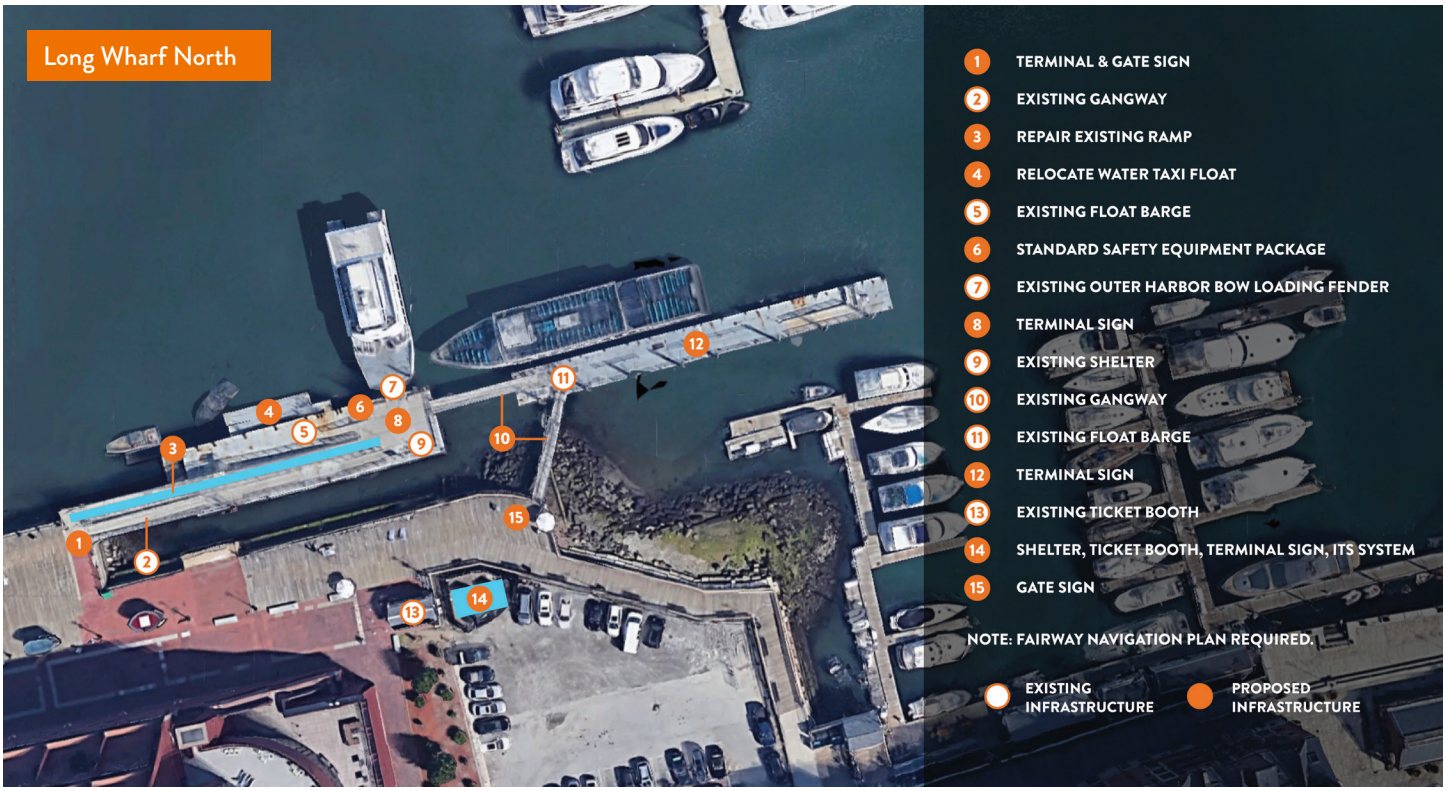
DRAFT - the vertical distance between the waterline and the bottom of the vessel's hull or keel. This distance plus an additional 1 to 2 feet is the benchmark for determining the minimum water depth where a vessel can navigate safely.

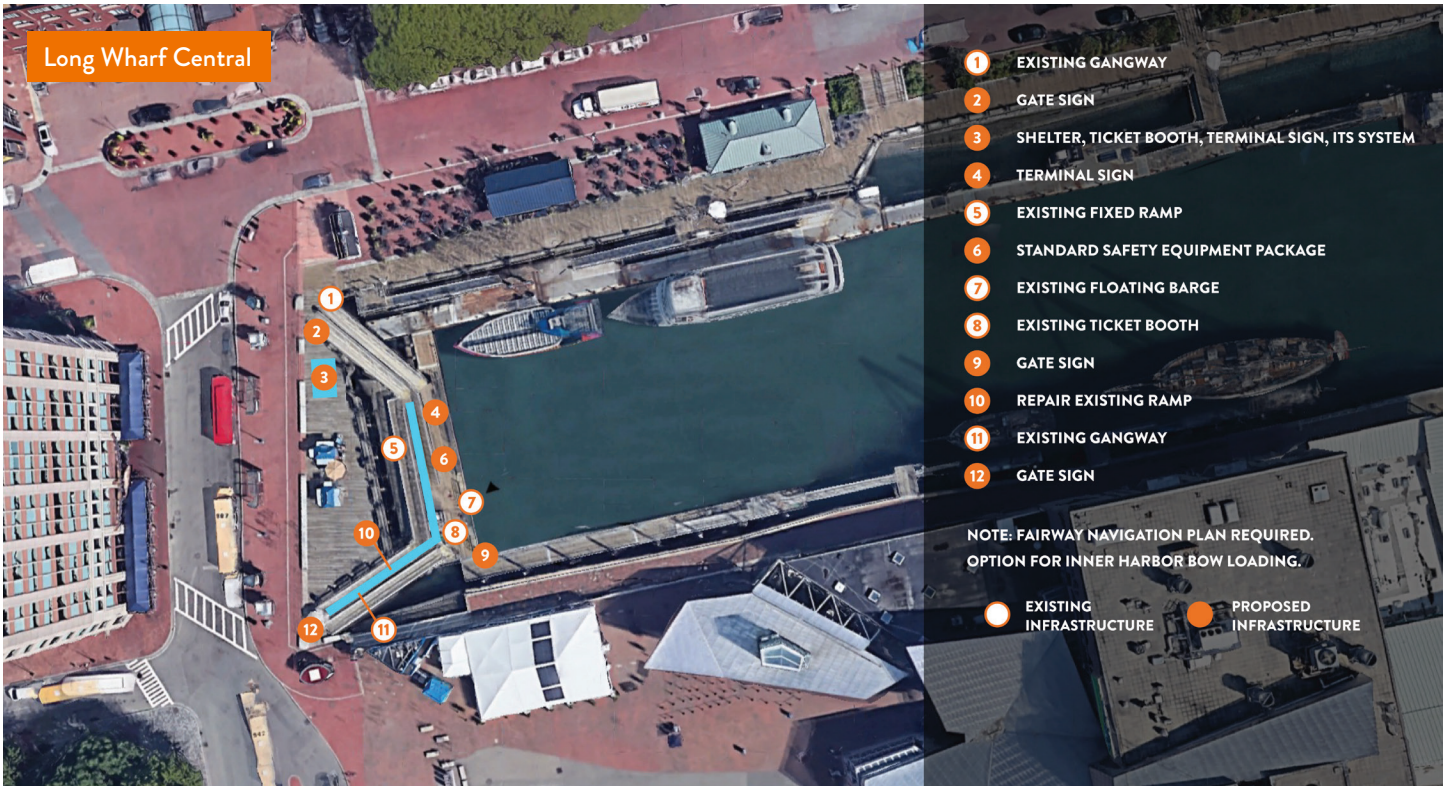
FENDERING - bumpers that provide a barrier between the edge of the dock and the vessel by absorbing kinetic energy.

FLOAT- the part of the dock that can move up and down with the tide where the vessel docks to load and unload passengers.

FREEBOARD HEIGHT - the vertical distance between the waterline and the deck of a float or the deck of a vessel.

PIER - the part of the dock that is a fixed structure. It provides access from land to the ramps and float.


Long Wharf North
1 TERMINAL & GATE SIGN
2 EXISTING GANGWAY
3 REPAIR EXISTING RAMP
4 RELOCATE WATER TAXI FLOAT
5 EXISTING FLOAT BARGE
6 STANDARD SAFETY EQUIPMENT PACKAGE
7 EXISTING OUTER HARBOR BOW LOADING FENDER
8 TERMINAL SIGN
9 EXISTING SHELTER
10 EXISTING GANGWAY
11 EXISTING FLOAT BARGE
12 TERMINAL SIGN
13 EXISTING TICKET BOOTH
14 SHELTER, TICKET BOOTH, TERMINAL SIGN, ITS SYSTEM
15 GATE SIGN
NOTE: FAIRWAY NAVIGATION PLAN REQUIRED.
EXISTING INFRASTRUCTURE
PROPOSED INFRASTRUCTURE


Long Wharf Central
1 EXISTING GANGWAY
2 GATE SIGN
3 SHELTER, TICKET BOOTH, TERMINAL SIGN, ITS SYSTEM
4 TERMINAL SIGN
5 EXISTING FIXED RAMP
6 STANDARD SAFETY EQUIPMENT PACKAGE
7 EXISTING FLOATING BARGE
8 EXISTING TICKET BOOTH
9 GATE SIGN
10 REPAIR EXISTING RAMP
11 EXISTING GANGWAY
12 GATE SIGN
NOTE: FAIRWAY NAVIGATION PLAN REQUIRED.
OPTION FOR INNER HARBOR BOW LOADING.
EXISTING INFRASTRUCTURE
PROPOSED INFRASTRUCTURE

Long Wharf North and Central (Downtown/North End)

On Long Wharf North, the facilities are all designed for year-round operations. The commuter ferry dock on the west float accommodates bow-loading and side-loading vessels. The facilities are ADA accessible and Massachusetts Architectural Access Board (MAAB) compliant from land to dock as well as from dock to vessel.

Though there is currently a staffed ticket booth for buying tickets to Salem and the Harbor Islands and a small covered shelter to wait on the float where the MBTA boat docks, better passenger amenities are recommended. A suggested $200,000 in upgrades would include an improved passenger waiting area on land. To expand capacity, a private water taxi float on the western edge should be relocated.

The installation of the comprehensive features would likely cost an additional $160,000. These features include Intelligent Transportation Systems along with terminal and gate signs; safety equipment including emergency call buttons, life rings, ladders and signage; and additional bike racks.

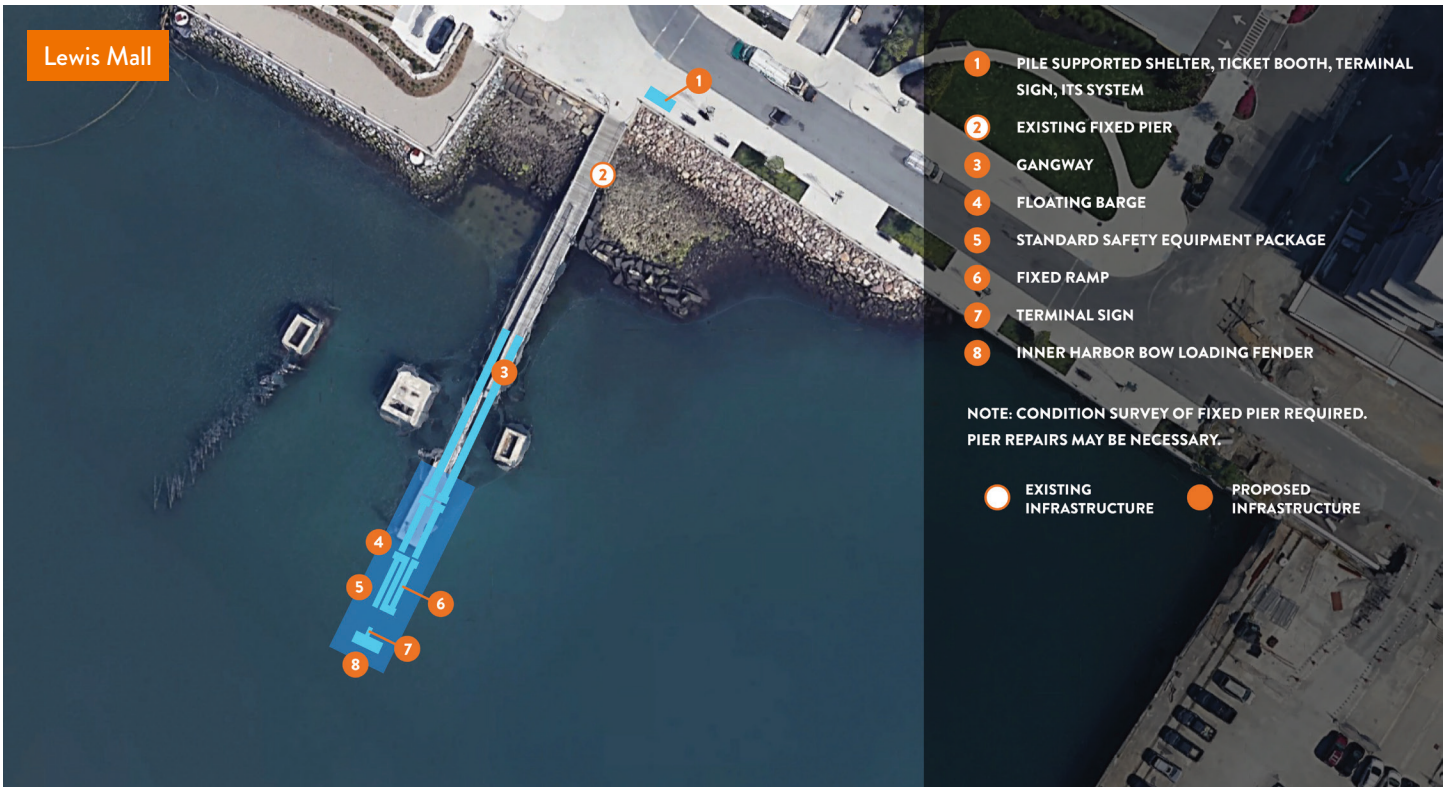
There is a broader vision for the Chart House parking lot on Long Wharf that is also owned by the BPDA. The Downtown Municipal Harbor Plan, released in the spring of 2018, outlines a basic vision for a waterfront park and a water transportation gateway on the site in the future.

On Central Wharf between Long Wharf and the Aquarium, the commuter ferry dock that serves the Charlestown MBTA service provides year-round operations with side-loading access only. The facility is ADA/MAAB compliant from land to dock but not from the dock to the vessel. Depending on the service changes or improvements, a bow-loading fender may be required.

There is an existing ticket booth that is open seasonally and a small shelter on the MBTA float, but a more substantial ferry passenger waiting area is recommended. The estimated cost for recommended site improvements is approximately $290,000.

The installation of the additional comprehensive features here would likely add $100,000 to the dock costs. These features include Intelligent Transportation Systems along with terminal and gate signs; safety equipment (including emergency call buttons, life rings, ladders, and signage); and additional bike racks.

Estimated Dock Improvement Costs	
Long Wharf North	
Recommended improvements	$200,000
Comprehensive improvements	$160,000
	$360,000
Long Wharf Central	
Recommended improvements	$290,000
Comprehensive improvements	$100,000
	$390,000
TOTAL	**$750,000**



Lewis Mall (East Boston)

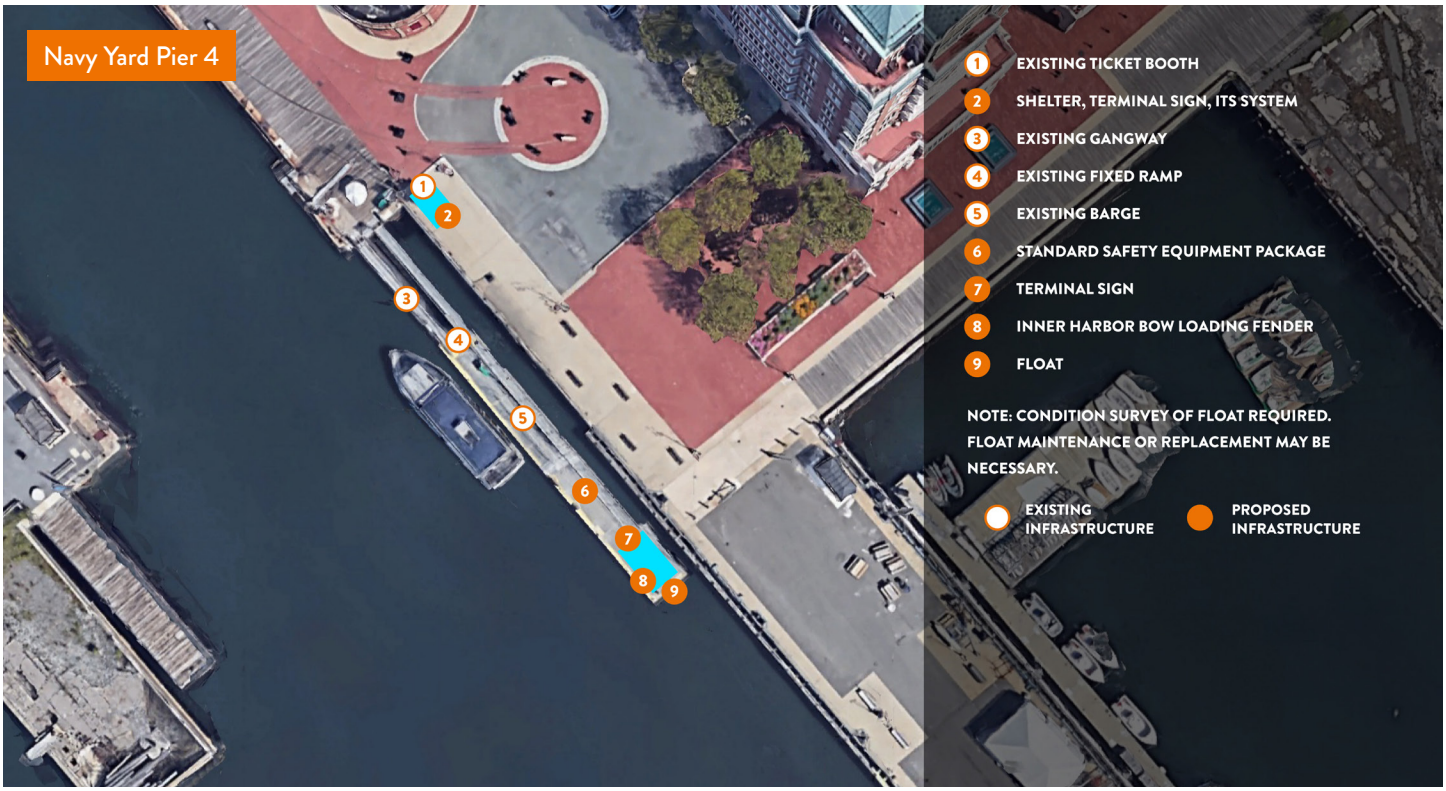
There is a fixed pier at the end of Lewis Mall that has a private water taxi float attached to it. Today, water taxis regularly serve this stop and neighborhood residents have access to vouchers for discounted rides through the Chapter 91 commitments of some of the waterfront developments. However, water taxi service is unscheduled, remains financially out of reach for many residents, and is not ADA accessible.

In order to operate ferry service at this site, a gangway, floating barge, and ramps are needed. The water taxi float would also need to be relocated. Ticketing and a sheltered waiting area are recommended. This substantial improvement on the site is estimated to cost $3,250,000. No potential maintenance repairs for the fixed pier are included in this amount.

The installation of the comprehensive features could cost an additional $180,000. These features include Intelligent Transportation Systems along with terminal and gate signs; safety equipment (including emergency call buttons, life rings, ladders, and signage); additional bike racks; and benches.

Beyond the scope of the site, the conditions on Lewis Mall between Maverick Square and the pier will be improved significantly as the Clippership Wharf development is completed and as new public art and other amenities are installed.

Estimated Dock Improvement Costs	
Recommended improvements	$3,250,000
Comprehensive improvements	$180,000
TOTAL	**$3,430,000**



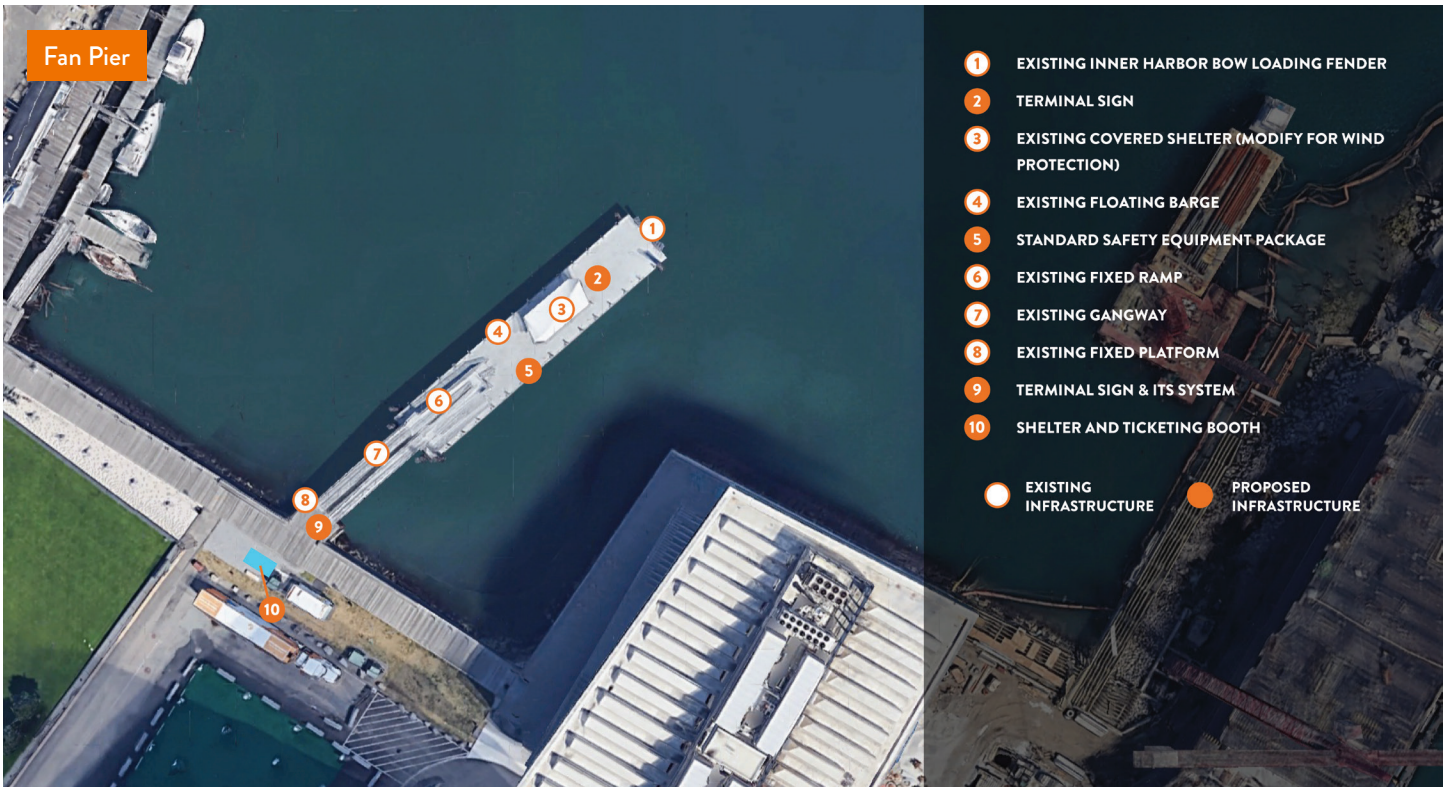
Navy Yard Pier 4 (Charlestown)

At Pier 4 in the Navy Yard, the facilities are designed for year-round operations. The commuter ferry dock there accommodates side-loading vessels only. The facilities are ADA/MAAB compliant from land to dock but not from dock to vessel, where a non-compliant transfer ramp connects with the ferry. The 30-year-old floating barge is in fair condition, and no additional maintenance costs are included in this estimate. The installation of a 40-by-16-foot barge would allow for the addition of a bow-loading fender.

During the peak summer season, when many of the passengers are visitors to the neighborhood who have walked the Freedom Trail, visited Bunker Hill, or toured the USS Constitution, there is a recognized need to sell individual tickets from a staffed booth. In order to better accommodate passengers year-round and at all times of day, a ticket vending machine is strongly recommended. There is a small glass waiting area at present, though an improved shelter is also recommended. The extended barge and these improvements are among the upgrades proposed for approximately $870,000.

The installation of the comprehensive features could cost an additional $290,000. These features include Intelligent Transportation Systems along with terminal and gate signs; safety equipment (including emergency call buttons, life rings, ladders, and signage); additional bike racks; and benches. There are some existing bike racks on the site, and there is a bike share station about four minutes away.

Estimated Dock Improvement Costs	
Recommended improvements	$870,000
Comprehensive improvements	$290,000
TOTAL	**$1,160,000**



Fan Pier (Seaport)

The relatively new ferry terminal at Fan Pier is in excellent condition and requires only minor upgrades. The floating barge can accommodate bow-loading and side-loading vessels appropriately sized for the Inner Harbor Connector. There is also water taxi access here and a special docking location accommodates the water shuttle that connects the Institute of Contemporary Art (ICA) with its East Boston outpost, the Watershed. For bow-loading vessels with low drafts, the facility is fully ADA compliant.

A wave screen effectively calms the waters around the dock, and though there is only seasonal ferry service today, the terminal can accommodate year-round operations. Without any physical structures to provide shelter or a ferry dock identity, the facility does not yet have the feel of a transit hub nor does it accommodate waiting passengers well, though people can wait nearby in the publicly accessible ICA lobby. Adding a shelter is estimated to cost $110,000.

On the barge itself, an existing shade structure protects waiting passengers from the sun and rain. Adding wind protection would make it more appealing to wait for the ferry in colder months. These improvements along with additional comprehensive features are estimated to cost $170,000. The other comprehensive features include Intelligent Transportation Systems along with terminal and gate signs; safety equipment (including emergency call buttons, life rings, ladders, and signage); a ticketing machine; and bike racks. There is a bike share station close to the ferry terminal, but the existing bike racks are further away and less visible.

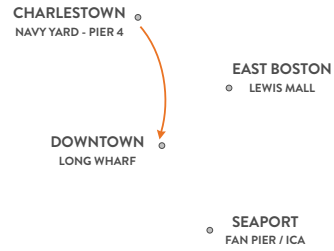
Estimated Dock Improvement Costs	
Recommended improvements	$110,000
Comprehensive improvements	$170,000
TOTAL	**$280,000**

7:30AM

Ferry departs Navy Yard

7:45AM

Ferry departs Navy Yard



7:45AM

Ferry meets two other vessels at Long Wharf and continues to Fan Pier

8:00AM

Ferry meets two other vessels at Long Wharf and continues to Lewis Mall

8:00AM

Ferry departs Fan Pier

8:15AM

Ferry departs East Boston

8:15AM

Ferry meets two other vessels at Long Wharf and continues to Lewis Mall

8:30AM

Ferry meets two other vessels at Long Wharf and continues to Fan Pier

8:30AM

Ferry departs Lewis Mall

8:45AM

Ferry departs Fan Pier

8:45AM

Ferry meets two other vessels at Long Wharf and continues to Navy Yard

9:00AM

Ferry meets two other vessels at Long Wharf and continues to Navy Yard

Route Configuration and Schedule

Throughout the study process, it was clear that an inner harbor ferry would be a likely recommendation; however, the design of the route—the sequence of stops, the frequency of service, and the number of vessels needed—continued to evolve with each phase of analysis. When members of the public were asked about the routes they wanted, they drew a circle connecting all the dots between all of the docks that they thought should have service. Yet the appeal of water transportation is the ability to connect directly between places that may normally require circuitous routes, toll bridges or tunnels, or traffic congestion delays. The more times a ferry stops the fewer passengers it attracts.

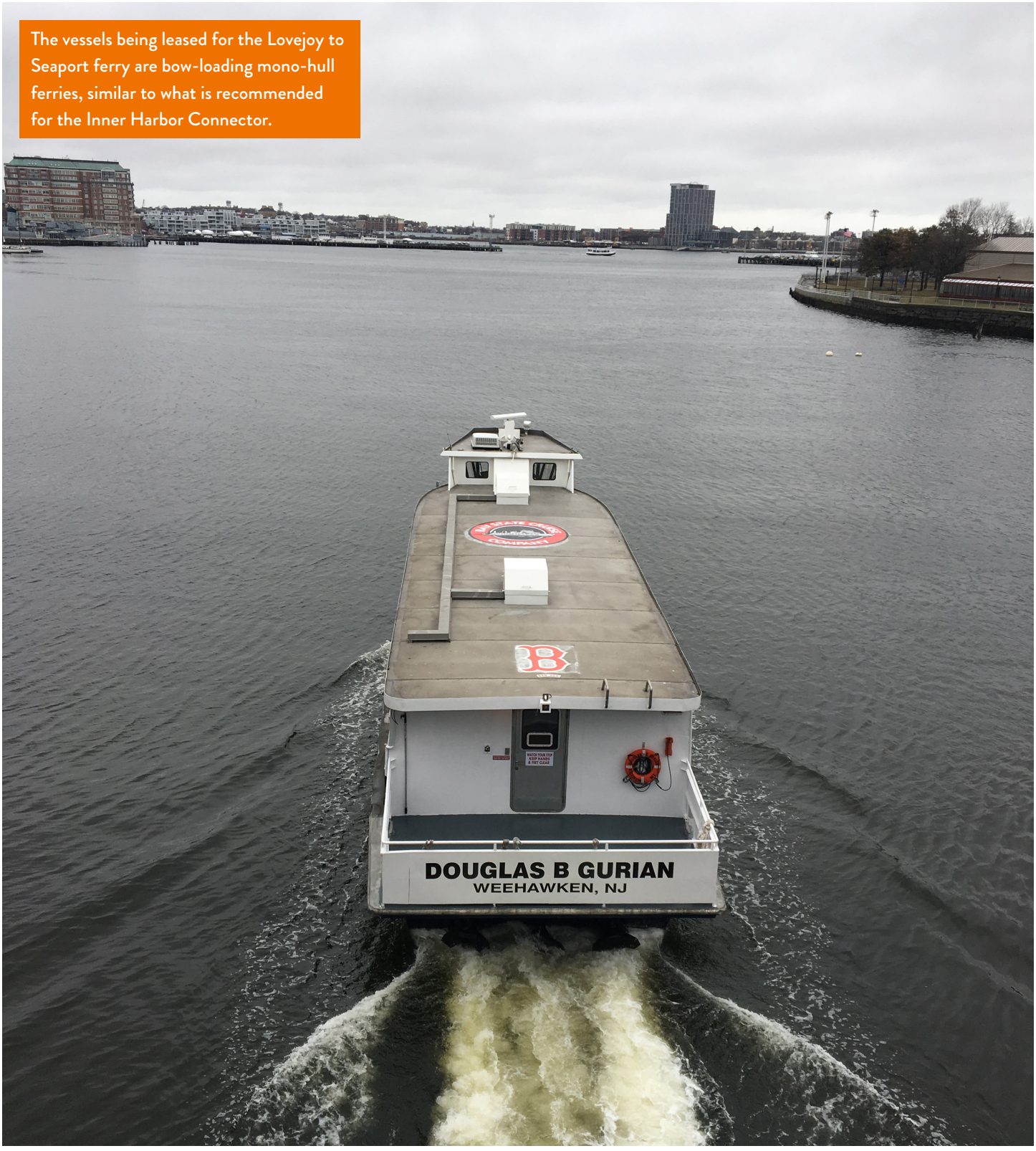
Once the four stops with the greatest ridership potential were selected, the question of route design focused on demand between the ferry terminals. Circular routes running counter clockwise and clockwise, a figure eight route, and U-shaped routes that went back and forth were all studied. Ultimately, it became clear that the segments with the highest ridership demand were for trips from Navy Yard Pier 4, Lewis Mall, and Fan Pier to Long Wharf and back. With this in mind, a "hub and spoke" route was designed to provide service that converges on Long Wharf. The added benefit of this configuration is that it maintains the same level of frequency from Navy Yard Pier 4 to Long Wharf as the existing MBTA service.

Operating this route with a schedule that enables ferries to depart from each terminal with this pattern and consistent timing would require six vessels. Initially, with "vessels of opportunity" at peak hours, there would be three vessels heading to Long Wharf and one vessel heading to each of the other docks at 15 minute intervals. The vessels at Long Wharf would converge and allow for transfers so passengers could continue on to other stops within the Inner Harbor Connector system or, for an additional fare, connect with other ferry services that depart from Long Wharf. During off-peak hours, the vessels would have 20-minute headways and either be in the process of converging at Long Wharf for transfers or returning to the three other docks.

Once six uniform ideal vessels are acquired, their interoperability will allow vessels that start in Charlestown to travel to Long Wharf, then continue on to the Seaport, then return to Long Wharf, then continue to East Boston. During peak hours, three vessels would travel clockwise and three vessels would travel counterclockwise and provide service every 15 minutes. During off-peak hours, three vessels would depart each dock at 20-minute intervals and travel in only one direction while the other vessels are cleaned, restocked, and refueled. A sample of a morning vessel pattern at peak times is diagrammed at left, showing the path of one vessel in each column.

Sample Route Configuration

The schedule and diagram on the facing page show the path of one counterclockwise vessel (left) and one clockwise vessel (right). A full schedule would include six ferries with three following each of these route patterns during peak hours.



The vessels being leased for the Lovejoy to Seaport ferry are bow-loading mono-hull ferries, similar to what is recommended for the Inner Harbor Connector.

Vessel Recommendations

The projected ridership, fare structure, capital costs, operating costs, and recommendations were developed using two distinct types of vessels:

- Vessels of opportunity, which assumes that six diesel vessels are leased from operators to get the service up and running. These vessels may include the two that currently serve the Charlestown to Long Wharf MBTA route as well as others currently available in Boston Harbor or it may rely entirely on leased vessels from elsewhere.
- New hybrid/electric vessels, which would be designed and built specially to serve this route with its short trips, speed restrictions, and projected ridership. These vessels would require capital investment up-front, but there would be long-term operating cost savings with substantially lower fuel costs and improved flexibility from having a fleet of identical ferries.

The business plan is designed with the assumption that either all six vessels are leased or all six vessels are new and meet the specified criteria. A lead time of at least three years is needed to design and build the ideal fleet. More time may be needed to apply for grants and secure the necessary funding for the procurement process before constructing the new vessels.

There may be a period when a combination of leased and new vessels are operating. In particular, it may be challenging to secure funding for an entirely new fleet in a single round of federal or state grants. However, the cost savings from reduced fuel consumption and interoperable ferries is significant enough that once the new vessels are under construction, every effort should be made to build the entire six-vessel fleet.

Estimated Vessel Costs (2019 dollars)	
Six vessels of opportunity	$1,063,000/annual lease
Six new hybrid/electric vessels	$11,600,000 purchase cost

The routes and schedules took into account both travel time, the length of time the vessel is in motion, and headway, the time between departures that allows for travel time, unloading, and loading. With six vessels, a 10-minute headway is possible, but it allows limited time for loading and restricts passengers' ability to transfer between vessels at Long Wharf. With 15-minute headways and six ferries, loading times are generous and passengers can make their connections to another ferry. During off-peak service, less loading time is needed and three ferries can maintain 20-minute headways.

Vessel Design and Power

The custom-built ferries should be designed for short, frequent trips in an area with speed restrictions. Given the density of boat traffic in the inner harbor and the maximum allowed speed of 10 knots, the design of the boat should allow for quick trips as well as efficient loading and unloading. The vessels should be able to go 10 knots, but should not be designed for additional power. Vessels designed for faster speeds have additional power needs but with Inner Harbor speed restrictions, they will never be able to travel faster and will burn fuel inefficiently as a result. Small ferries have shorter loading and unloading times, which improves their ability to remain on schedule. Larger ferries have the opposite effect. Similarly, single deck ferries also allow for faster loading.

Based on the power and maneuverability needs of this route, hybrid diesel-electric propulsion is recommended. With additional capital investment, zero-emission options are also attractive and feasible. A hybrid of battery energy storage along with a diesel generator enables power flexibility and reduces emissions. The engine runs at its most efficient point, and the emissions profile and fuel consumption rate are optimized with hybrid power. This would reduce the

carbon dioxide production and there would be no smoke or particulate discharge at the docks while passengers are unloading and loading. With traditional diesel engines, emissions could be reduced by shutting down the engine at the pier, which eliminates smoke or particulate discharge while passengers are unloading and loading

The MBTA and Winthrop have recently purchased bow-loading catamarans for services beyond the Inner Harbor. For this Inner Harbor service, the recommended vessels are long, thin, double-ended monohulls. These streamlined vessels would reduce resistance, offer the most maneuverability, and reduce interference with other ferry operations, particularly if they are electric drive. Additional attributes of the ideal vessels are listed in "Recommended Vessel Design Specifications" at right.

Depending on the anticipated demand and the number of vessels being purchased, the vessels should be designed to accommodate peak demand from Seaport to Long Wharf of 84 passengers—a higher passenger capacity is needed if the ferries arrive less frequently. These estimates assume that there are 15-minute headways and demand is spread across a 120-minute peak period. With less frequent headways, some demand would decline, especially from Charlestown, but the overall vessel size would need to go up to accommodate waiting passengers.

Cost Estimates

Construction of the ideal ferry fleet could be done one vessel at a time or as part of a three or six-vessel fleet order. Cost estimates are divided into shipyard costs and non-shipyard costs, which include contract design development, bid support and contracting, inspection and design review, contract management, training, spare parts and special tools, and post-delivery support. There can be as much as a million dollars in savings in shipyard costs and further savings in non-shipyard costs if the entire fleet is built as a single order.

Not including the time needed for soliciting and awarding a bid, the shipyard construction period for one ferry could take as little as nine months. The vessels are small enough that an entire fleet could be constructed two at a time and staggered at two-month intervals so that a six vessel fleet could be completed in a total period of 13 months.

Recommended Vessel Design Specifications	
Configuration	Monohull, single deck
Construction	Glass Reinforced Plastic (Fiberglass)
Certification	46 Code of Federal Regulations Subchapter T
Passenger Capacity	84 people
Crew	2 maximum
Design Speed	10 knots
Length Overall	85 feet
Length, Waterline	81 feet
Breadth	12 feet
Draft	3.5 feet
Deadweight	16,800 pounds
Displacement, Full Load	84,000 pounds, 1,313 ft^3 sea water
Prismatic Coefficient	0.54
Residuary Resistance	375 pounds
Wetted Surface	787 square feet
Friction Resistance	490 pounds
Propulsive Coefficient	0.5
Power Required	53 horsepower (39.6 kW)
Power Plant	Hybrid diesel-electric 2 x 40 horsepower electric motors 1 x 40 kW diesel generator - running steadily at 31 kW 1 x 40 kW-hr battery
Seating	Aluminum-framed fabric, one per passenger
Toilet Facilities	None
Food Service	None
Climate Control	Heat/vent
ADA compliance	Yes

There are many quantifiable benefits to investing in the fleet of ideal vessels. With new vessels, each of the routes to Long Wharf would continue to a different dock allowing passengers to remain on board without transferring. In addition to the improved experience of passengers who would no longer need to transfer, the uniform ideal vessels enable

Shipyard Costs	Total Cost	Cost per Vessel
Single ferry	$1,800,000	$1,800,000
Three ferry fleet	$5,000,000	$1,670,000
Six ferry fleet	$9,700,000	$1,620,000

Non-shipyard Costs	Total Cost	Cost per Vessel
Single ferry	$700,000	$700,000
Three ferry fleet	$800,000	$267,000
Six ferry fleet	$900,000	$150,000

trained crews to rotate between ferries with unique speed, maneuvering, docking, and maintenance characteristics. Terminal facilities can also be streamlined rather than trying to meet ADA requirements for each vessel, which can be physically and operationally complex. Most significantly, the hybrid diesel-electric engine would have substantially lower power requirements leading to lower fuel costs and reduced emissions.

Zero Emissions Alternative

It is also possible to operate the Inner Harbor Connector with vessels that have no combustion engines on board and hence no emissions. The two alternatives for zero emissions vessels are all-electric and fuel cell power systems.

For all-electric vessels, the on-board diesel generator described above would be replaced by additional battery capacity and all of the engine related machinery would be removed. Battery charging facilities would need to be installed at all of the terminals except Long Wharf. Though technically feasible, the logistics would be more complicated. The vessel speeds and battery capacities require further study to verify if the vessels could maintain the planned speeds or if they would need to be slowed due to limited energy storage capacity given their eventual hull design and passenger loading constraints. Generally, operating at higher speeds drains the batteries faster and affects charging requirements. A mitigating option is to have additional ferries charging at the route spokes and rotated into service.

Staging unused ferries at the spokes of the system would allow them to charge. The crew would change vessels each time they arrived at a neighborhood stop to take the fully charged vessel and leave the vessel with the drained battery behind. Due to the high density of ferries at Long Wharf, the installation of vessel charging infrastructure at the dock is not recommended. Additional procedures would also be put in place for charging during stops.

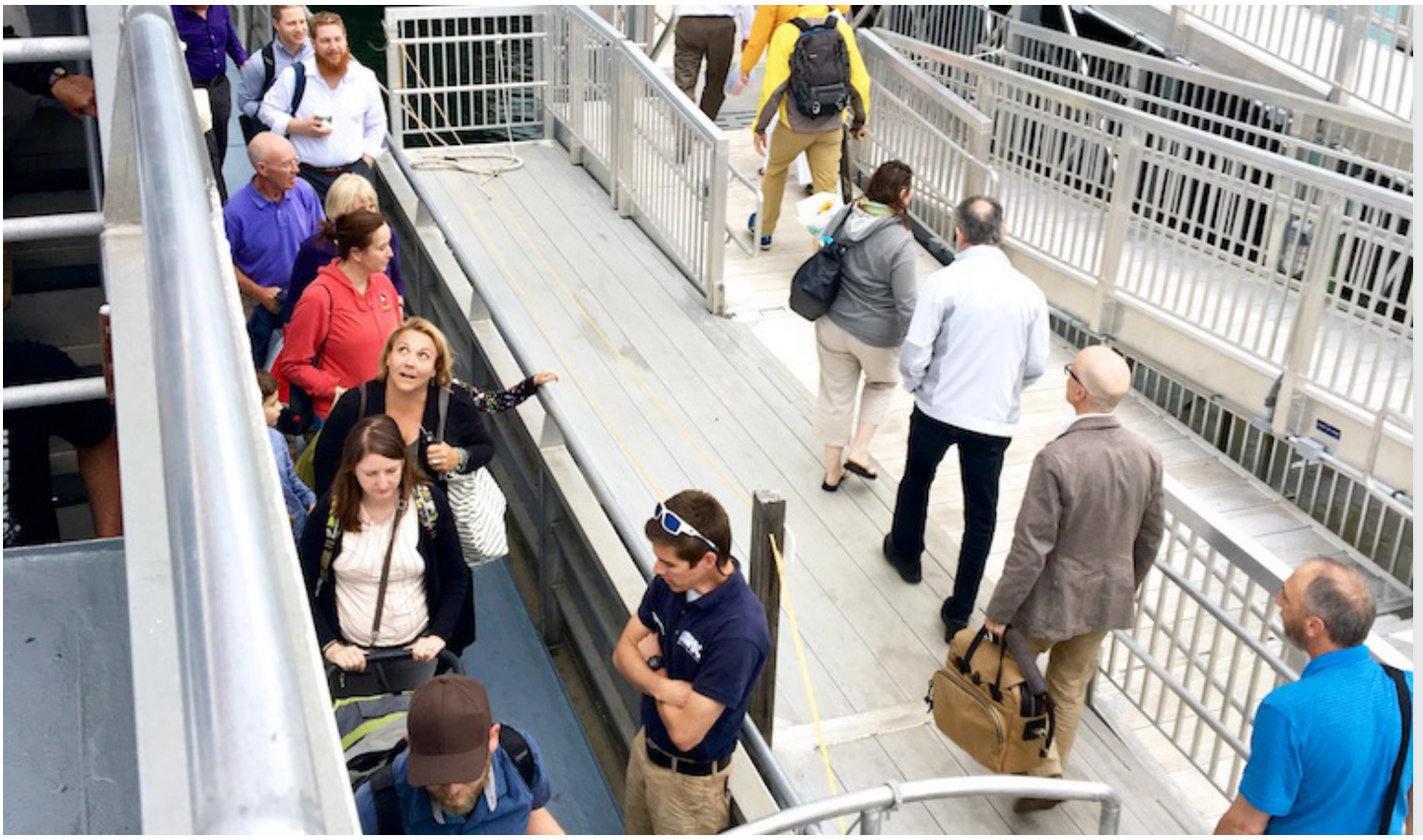
The second zero emissions option is the use of liquid hydrogen fuel cells in lieu of both engines and batteries. This option retains the electric motors for propulsion, but the energy is generated by fuel cells. This is a new technology in the marine environment, but there are significant development efforts to implement it. Vessels with these fuel cells require a consistent liquid hydrogen supply and particular attention in the design development to comply with the maturing regulatory environment.

Though technically feasible and environmentally friendly, the zero emissions vessels would be substantially more expensive to acquire and would need significantly more infrastructure at the docks and in the surrounding area to support the operations. There are a spectrum of options and considerations in developing the actual design for a particular service, but opting for zero emissions vessels could result in a 30% to 60% increase in capital costs compared with the hybrid vessels that are proposed.

Benefits of the Ideal Fleet

- Passengers can remain on-board for two legs of the trip
- Trained crew can flexibly rotate between vessels
- Terminal facilities can be streamlined
- Emissions and fuel costs reduced with hybrid power

Passengers disembark from existing ferries to the Harbor Islands and Salem.



Ridership and Fares

Although the Inner Harbor Connector business plan does not specify an operator of the service, and it may or may not be part of the MBTA system, the current fares and ridership provided a way to ground the projections and modeling of the future route with real data from an existing service. The existing MBTA ferry service connecting Long Wharf with Navy Yard Pier 4 in Charlestown costs $3.50 for a standard one-way ticket. In 2016, the service carried 317,355 passengers with an average weekday ridership of 840 passengers. Commuter demand drops off on weekends; however, due to significant ridership by visitors to the Navy Yard, an average of 740 passengers use the service on Saturdays and 600 passengers use the service on Sundays.

Ferry Fare Structure

As of April 2019, the MBTA F4 service has discounted fares for local seniors and students who are part of the CharlieCard system, and children under 12 travel for free with paying adults. Monthly ferry passes on the mTicket app ($74.50), monthly zone 1A commuter rail passes on CharlieCards ($84.50), unlimited daily CharlieTickets ($12.00), and unlimited weekly CharlieTickets ($21.25) all provide access to this ferry route at no additional charge.

On July 1, 2019, fares will increase, though reduced fares will not change. The standard fare for the MBTA F4 service will be $3.70, monthly CharlieCards will be $90.00, daily CharlieTickets will be $12.75, and weekly CharlieTickets will be $22.50.

Ideally, the future fare structure would be interoperable with the MBTA's fare system in order to enable passengers to connect between transit services efficiently and affordably and thereby attract more riders, but this has not been broken out in the analysis.

Two different fares were included in the study for the purpose of modeling ridership on the Inner Harbor Connector to test how much price impacts the number of passengers projected to use the service on each segment of the route. The stated preference survey provided data that could be used in a ridership model to determine the revenue-maximizing fare—the price per ticket at which the willingness to pay and the number of passengers willing to pay that fare combines to generate the largest possible value. For the Inner Harbor route, the revenue-maximizing fare was calculated at approximately $6.50. For comparison, a $3.50 fare, in line with the current price of a one-way ticket on the MBTA's Charlestown service, was also studied.

A total of four scenarios were evaluated using the ridership model developed for the Inner Harbor Connector. One assumes that the service has a $6.50 fare and uses vessels of opportunity which require passengers to transfer at Long Wharf. The second scenario has a $3.50 fare and uses vessels of opportunity. The third scenario has a $6.50 fare and uses ideal vessels that would allow passengers to stay on the same ferry and continue to another destination after stopping at Long Wharf. The final scenario has a $3.50 fare and uses ideal vessels. All of the projected ridership scenarios assume 15-minute headways during peak commuting hours.

While the ridership model outputs look like very precise data, they are meant to provide ballpark estimates of how each segment of the route would perform on an average day or year during the early years of the service's operation. They are best used as comparisons with other scenarios as the price and quality of service change. All of the scenarios below have modeled ridership volumes for 2019 in order to facilitate this comparison between possible fare and vessel combinations. Recognizing that the new vessel scenarios would have a later start year, the 20-year financial plans in the Appendix are based on each scenario's anticipated start year.

The ridership projections in the tables below do not include the connection between Charlestown and East Boston because the potential ridership between these two neighborhoods is not accurately captured in the ridership

model. The modeling is based on publicly available journey-to-work data between neighborhoods and known ratios of commuting trips to non-commuting trips. Since a very small number of commuters travel between Charlestown and East Boston today, the model did not show significant ferry ridership between the two neighborhoods. Within the catchment areas for the Navy Yard and Lewis Mall, there are fewer than 50 people who work in the other neighborhood resulting in the model predicting fewer than five trips per day for these connections. Recognizing that current connections between the two neighborhoods require one or more transfers on transit or likely rely on a bridge or tunnel with a toll, actual ridership may be higher. It is also worth noting that a free water shuttle operates seasonally between the Reel House in East Boston and Pier 6 in Charlestown. Between May 2018 and September 2018, it carried 35,000 passengers. This demonstrates that there is demand for recreation and leisure service, but with no cost and different hours than the modeled ferry service, it does not provide data that can be used in the model.

The tables below show the projected ridership volumes in 2019 that include weekday and weekend service.

Ridership Model with $6.50 fare and Six Vessels of Opportunity (2019)

Ridership	Annual	Daily	AM Peak	PM Peak	Other
East Boston - Charlestown	--	--	--	--	--
East Boston - Long Wharf	395,210	1,520	479	479	562
East Boston - Seaport	64,520	248	78	78	92
Charlestown - Long Wharf	228,370	878	219	219	440
Charlestown - Seaport	46,510	179	45	45	89
Seaport - Long Wharf	189,150	727	229	229	269
TOTAL	**923,760**	**3.553**	**1,050**	**1,050**	**1,452**

Ridership Model with $3.50 fare and Six Vessels of Opportunity (2019)

Ridership	Annual	Daily	AM Peak	PM Peak	Other
East Boston - Charlestown	--	--	--	--	--
East Boston - Long Wharf	647,200	2,489	784	784	921
East Boston - Seaport	106,520	410	141	141	151
Charlestown - Long Wharf	366,050	1,408	352	352	704
Charlestown - Seaport	78,610	302	75	75	151
Seaport - Long Wharf	355,550	1,368	430	430	505
TOTAL	**1,553,930**	**5,977**	**1,782**	**1,782**	**2,433**

Ridership Model with $6.50 fare and Six Ideal Vessels (2019)

Ridership	Annual	Daily	AM Peak	PM Peak	Other
East Boston - Charlestown	--	--	--	--	--
East Boston - Long Wharf	395,230	1,520	479	479	562
East Boston - Seaport	71,720	276	87	87	102
Charlestown - Long Wharf	228,380	878	219	219	440
Charlestown - Seaport	56,420	217	54	54	108
Seaport - Long Wharf	189,160	727	229	229	269
TOTAL	**940,910**	**3,619**	**1,068**	**1,068**	**1,481**

Ridership Model with $3.50 fare and Six Ideal Vessels (2019)

Ridership	Annual	Daily	AM Peak	PM Peak	Other
East Boston - Charlestown	--	--	--	--	--
East Boston - Long Wharf	647,220	2,489	784	784	921
East Boston - Seaport	118,220	455	143	143	168
Charlestown - Long Wharf	366,070	1,408	352	352	704
Charlestown - Seaport	106,820	411	103	103	205
Seaport - Long Wharf	355,570	1,368	430	430	505
TOTAL	**1,593,900**	**6,130**	**1,812**	**1,812**	**2,504**

Multi-modal Sensitivity

The proposed ferry service is part of a much larger transportation system that impacts how people make choices about how and when to travel based not only on the price and frequency of the ferry but also on the levels of congestion on roadways and the conditions on their other transit options. For the Inner Harbor Connector, roadway traffic in East Boston, Charlestown, downtown, and the Seaport can affect ridership as can changes in the reliability of transit service, particularly on the Blue Line and major bus routes.

Since many passengers can access the Inner Harbor Connector's ferry landings by foot or on a bike, roadway congestion has less of an impact on ridership than it might on other routes. With a 10% increase in travel times by private vehicle, ferry ridership and the corresponding revenue on the service increased by 3%. This represents a 2% increase in the farebox recovery ratio if leased vessels are being used and a 5% increase in the farebox recovery ratio if the new vessel fleet is installed. Though a 10% decrease in travel times for private vehicles is less likely, this improvement for drivers is projected to result in a 3% decline in ferry ridership and revenue and comparable declines in the farebox recovery of 2% and 5% for leased vessels and ideal vessels, respectively.

Projected Change in Ridership with Changes in Roadway Congestion

Ridership	Baseline daily ridership 2019	+10% roadway travel time	-10% roadway travel time
$6.50 fare + Six Vessels of Opportunity	3,553	3,670 (+3%)	3,442 (-3%)
$3.50 fare + Six Vessels of Opportunity	5,977	6,162 (+3%)	5,803 (-3%)
$6.50 fare + Six Ideal Vessels	3,619	3,742 (+3%)	3,505 (-3%)
$3.50 fare + Six Ideal Vessels	6,130	6,326 (+3%)	5,949 (-3%)

Though Inner Harbor Connector passengers are unlikely to drive to ferry terminals, they are likely to use the ferry as part of the larger transit system. Without specifically testing for a particular route, improved transit performance is projected to contribute to higher ridership on this route while a general decline in transit performance is projected to reduce ridership.

There may be specific changes in the performance of the Blue Line, Silver Line, or 93 bus that would have the most dramatic impact on ridership, but these have not been modeled. Significant improvements to the Orange Line are anticipated once the new train cars arrive and other signal upgrades have been completed. In each case, a decline in service may limit people's ability to access the ferry using these transit lines while simultaneously encouraging more people living or working near the terminal to use the service in lieu of other transit options.

For this model, a 20% increase in transit travel time (worse service) is projected to result in a 12% decline in ridership across all of the fare levels and vessel configurations. This translates into a 12 to 14% decrease in the farebox recovery ratio with leased vessels or a 27 to 30% decrease with the new vessel fleet. With a 20% decrease in transit travel time (improved service), the model projects a 6% increase in ridership. This would result in a 4 to 5% increase in the farebox recovery ratio with leased vessels or a 9 to 10% increase with the new vessel fleet.

Projected Change in Ridership with Changes in Transit Service

Ridership	Baseline daily ridership 2019	+20% transit time	-20% transit time
$6.50 fare + Six Vessels of Opportunity	3,553	3,142 (-12%)	3,772 (+6%)
$3.50 fare + Six Vessels of Opportunity	5,977	5,286 (-12%)	6,347 (+6%)
$6.50 fare + Six Ideal Vessels	3,619	3,202 (-12%)	3,850 (+6%)
$3.50 fare + Six Ideal Vessels	6,130	5,425 (-12%)	6,520 (+6%)

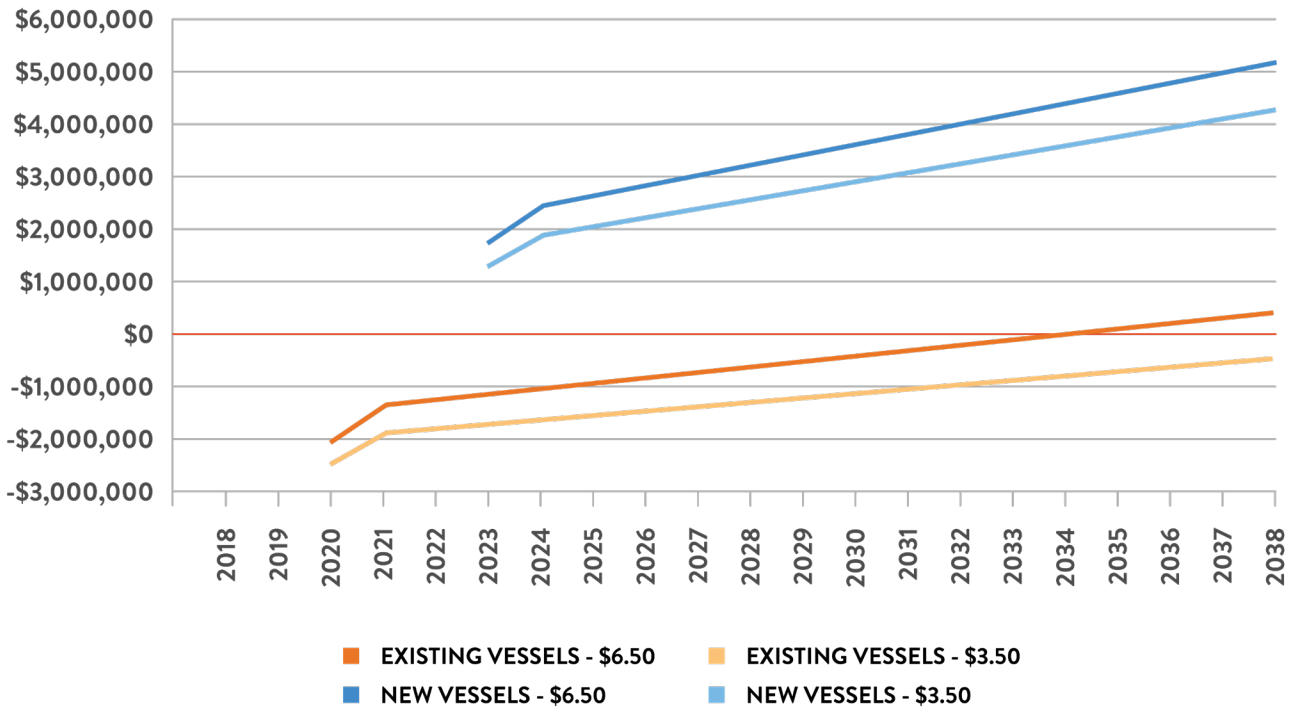
The relationship between the Orange Line's performance and the ferry's ability to attract riders is complicated. Significant improvements are in the works for the Orange Line, including a new fleet of trains and substantive signal upgrades. This is likely to improve the travel time for those who rely on the Orange Line and reduce the demand for this ferry service. Continued economic development and housing production that is exceeding projections by the Metropolitan Area Planning Council is likely to support ridership growth for both the train and the ferry, but relative to the baseline service, the Orange Line improvements lead to a decline in ridership in this model.

If the combination of Orange Line improvements results in travel time reductions of 25%, this is projected to lead to a 5% decline in ridership and revenue for scenarios using six vessels of opportunity. For scenarios using six ideal vessels, this decline in travel time for Orange Line passengers would decrease ridership and revenue on the ferry by 9%.

Projected Change in Ridership with Changes in Orange Line Service

Ridership	Baseline daily ridership 2019	-25% transit time
$6.50 fare + Six Vessels of Opportunity	3,553	3,371 (-5%)
$3.50 fare + Six Vessels of Opportunity	5,977	5,670 (-5%)
$6.50 fare + Six Ideal Vessels	3,619	3,306 (-9%)
$3.50 fare + Six Ideal Vessels	6,130	5,601 (-9%)

ANNUAL SYSTEM NET OPERATING REVENUE



Finances

The financial plan considers a wide range of transportation service costs, including the fixed costs of the capital investments, and the variable operating costs, which include fuel and labor. These variable costs depend on the type of vessels used in the fleet and the projected ridership demand, which is dependent on fare levels, service quality, time competitiveness of the route, and access to the ferry. This financial plan takes into account both vessel options and both fare levels and and uses 2019 dollar values as a baseline. In order to compare the possible options and the impact of different vessels and fares on the pro formas, there are four projected scenarios modeled here:

- Vessels of opportunity (existing vessels) with a $6.50 fare ,
- Vessels of opportunity (existing vessels) with a $3.50 fare,
- New hybrid/electric vessels (new vessels) with a $6.50 fare, and
- New hybrid/electric vessels (new vessels) with a $3.50 fare.

The scenarios compare different route characteristics to build a more complete and comprehensive financial picture. For the purpose of modeling for this report, service start-up was assumed to be in 2020 for the vessels of opportunity and in 2023 for the new vessels.

Overview

The Inner Harbor Connector has a projected annual operating revenue of $4.5 - 5.0 million depending on the scenario. The greatest difference between the four financial pro formas developed is the increased capital costs and the substantial operating cost savings in the new vessel scenarios. Both vessel options have similar maintenance costs. In the new vessel scenarios, there are no lease costs and substantially lower fuel costs, which are offset slightly by the annualized cost of major vessel overhauls in the future. The new vessels would also support a better service configuration and simplify staffing, which increases ridership and reduces operating costs slightly.

If only vessels of opportunity are used, the service would require an operating subsidy for fifteen years or more, depending on the fare levels. A significant capital investment in a new fleet of ideal vessels would result in a service that is projected to cover the operating costs with the fares paid by the passengers in the first year of service. However, it will take time to recoup the cost of the capital investment in the fleet. If this was done as a public system, or as a public-private partnership, where capital costs could be partially covered by federal grants, this would reduce the time required to recoup the initial investment. The combination of robust ridership, low fuel consumption, and lack of lease payments would make the system more affordable to operate than the same route with vessels of opportunity. Ultimately, the interest rates on any debt used to finance the capital cost of construction would determine the amount of time required for the service to be profitable.

The standard metric for the financial performance of transit routes is farebox recovery. In 2015, the farebox recovery for the three routes operated by the MBTA ranged between 58% and 74%. The projected 2019 farebox recovery for the Inner Harbor Connector with a $6.50 fare and the leased vessels described is 77.4%. With a $3.50 fare, the projected farebox recovery for the service is 70.1%.

Pro Forma

The financial pro forma that follows incorporates projected operating revenues and expenses in addition to the required capital investments for year-round service seven days a week. The 2019 pro forma laid out below provides a one-year snapshot that allows for a simplified comparison of the operational costs and revenues of the scenarios. A complete 20-year pro forma for each scenario can be found in the appendix. In each full pro forma, the first year of service is assumed to be 2020 for the existing vessels and 2023 for the new vessels. The capital investment needs in the last row are identified only for the first few years of service.

One Year Pro Forma (2019)

Operations	$6.50 fare Existing Vessels	$3.50 fare Existing Vessels	$6.50 fare New Vessels	$3.50 fare New Vessels
Operating Revenue				
Fare	4,898,000	4,436,000	4,990,000	4,551,000
Other Operating	49,000	44,000	50,000	46,000
Total Operating Revenue	4,947,000	4,480,000	5,040,000	4,597,000
Operating Expenses				
Vessel				
Crew Labor	1,058,000	1,058,000	1,058,000	1,058,000
Fuel	2,565,000	2,565,000	333,000	333,000
Maintenance	460,000	460,000	490,000	490,000
Insurance	394,000	394,000	394,000	394,000
Lease	1,114,000	1,114,000	n/a	n/a
Other	76,000	76,000	37,000	37,000
Subtotal	*5,667,000*	*5,667,000*	*2,312,000*	*2,312,000*
Shoreside				
Insurance	3,000	3,000	3,000	3,000
Miscellaneous Facility	177,000	177,000	177,000	177,000
Subtotal	*180,000*	*180,000*	*180,000*	*180,000*
Management and Support	*542,000*	*542,000*	*542,000*	*542,000*
Total Operating Expense	6,389,000	6,389,000	3,032,000	3,032,000
Net Operating Expense	**(-1,442,000)**	**(-1,909,000)**	**2,008,000**	**1,565,000**
Farebox Recovery	77.4%	70.1%	166.2%	151.6%
Total Capital Investment Required	**4,868,000**	**4,868,000**	**16,684,000**	**16,684,000**

Assumptions

Escalation Rates

The financial plan has a 20-year planning horizon and both revenue and expenses were assumed to escalate over time. The Consumer Price Index (CPI) was used to inflate all of the future operating costs except for fuel. The CPI was also used to adjust operating revenue to maintain 2018 constant dollar levels throughout the projections. Additionally, the US Energy Information Administration (EIA) annual energy outlook for the New England region was used to predict diesel fuel prices over time. It is notable that these fuel costs were projected to grow more slowly over time than the CPI. As a result, operating revenues for the routes are expected to increase over time, though the fuel needs are lower for the new hybrid/electric vessels so there is less of a benefit for those scenarios.

Operating Revenue

Initial fares were assumed to be at 2018 level dollars and were inflated in subsequent years to remain a constant dollar fare. The potential for fare increases to respond to inflation and growing demand was not taken into account. Based on previous experience, the fare actualization rate was assumed to be 80%—discounts for seniors, students, and others mean that not all of the riders will be paying full fare. It was also assumed that the first year's ridership is only about 88% of what is forecasted as awareness of the system builds and operational issues are hammered out. In later years, growth in ridership due to changing demographics is anticipated and incorporated into the revenue forecast.

Other operating revenue could come from off-board "galley" sales if a vending machine or kiosk sells coffee, soda, water, etc. to waiting passengers. These are estimated at 1.25% of the fare revenue. The relatively short duration of these routes limits the potential for on-board sales.

Operating Expenses

On each Inner Harbor Connector vessel, there is assumed to be a captain and one deckhand/purser in accordance with typical crewing requirements for vessels of this size and current US Coast Guard requirements. Wage rates were set to reflect current Boston-area wage levels for marine jobs. A weighted rate factor averages 37% and incorporates payroll taxes, industrial and health insurance, paid time off, and some level of premium pay for experienced staff. For the purposes of the pro forma, wages for captains were set at $19.00 per hour with a weighted rate of $27.32. Wages for deckhands/pursers were set at $13.00 per hour with a weighted rate of $20.20.

The initial price for fuel is based on the rate paid by the Commonwealth of Massachusetts in the summer of 2018 under its statewide contract fuel-purchasing program. The actual fuel prices are likely to be different depending on who ultimately operates the service. The US EIA fuel price index described above was used to adjust the price over time. Fuel consumption rates for the new hybrid electric vessels were established as part of a lifecycle costs analysis based on the specifications proposed for the ideal fleet. Fuel consumption rates for the vessels of opportunity were assumed based on the required power range. It is possible that some of the vessels leased for the service will not be designed for the route's speeds or passenger volumes, which would result in inefficient fuel consumption. The greatest operational cost savings comes from switching from diesel-powered vessels to hybrid diesel/electric.

For the fleet of new vessels, a lifecycle costs analysis determined the routine and annual maintenance expenses and calculated an additional allowance for engine rebuild/replacement for new vessels. In addition to fuel consumption rates and fuel prices, the lifecycle cost analysis considered the hours of service per vessel; lube oil consumption and costs; battery power consumption, storage, and discharge; battery replacement frequency and cost; dry-docking expenses; hull painting; and engine replacement. For the vessels of opportunity, industry algorithms were used to estimate the maintenance and rebuild/replacement expenses.

Insurance costs included the vessels' hulls and machinery as well as protection and indemnity. They are estimated based on

the cost of the vessels and the crew size.

Establishing an estimated cost for the vessel leases is difficult since the market is relatively small. There has not been an inventory completed specifically for potential vessels in the Boston area, though the two vessels serving Charlestown today as part of the MBTA service could potentially be part of the leased vessel fleet. A 2017 nationwide inquiry by a passenger ferry operator in another part of the country revealed that very few vessels were available for lease anywhere in the United States. Vessel lease costs were therefore estimated using a recent representative lease agreement adjusted for the size of the vessels required for the Inner Harbor route.

Other operating costs include consumables, communications, uniforms, etc. These were estimated using a percentage of the direct operating costs not including the cost of the vessel leases.

In addition to the vessel expenses, there are shoreside operating expenses. These include insurance, routine maintenance, cleaning, minor repairs, and utilities. They have been estimated based on other operators' experiences locally and in the Pacific Northwest.

Management and support costs came from a survey of other ferry operators. Based on their experience, and to normalize for fuel and vessel capital costs, management and support was estimate as 25% of the direct vessel operating cost not including the cost of fuel or vessel leases.

Capital Expenses

The capital expenses for this pro forma include the cost of the dock improvements and the cost of new vessels for the ideal fleet. Detailed descriptions of these cost estimates can be found in the preceding sections on dock improvement and vessel recommendations.

The capital costs used in the complete pro formas are based on the table below; however, the costs have been split over multiple years and incurred in years after 2019 when the costs are estimated to be incurred. To account for this, inflation was applied in line with the escalation rates noted earlier in this section.

Weekend Service

The MBTA weekend service between Long Wharf and Navy Yard Pier 4 currently generates 33% of the average weekday revenue. This ratio was used to project weekend ridership and revenue on this service. Relative to operating a weekday-only service, seven-day service is projected to increase the overall financial performance of the Inner Harbor Connector. In the initial years of the service, the existing vessel scenarios have a larger deficit as lease costs and additional fuel costs do not offset the availability of weekend service. However, with the $6.50 fare, the lease vessel scenario breaks even two years earlier with weekend service than without and all scenarios are expected to have 13% higher revenues as a result of weekend service.

Summary of Capital Expenses

Scenarios	Dock Costs	Vessel Costs	Total Cost
Recommended dock improvements	$4,430,000	n/a	$4,430,000
Comprehensive dock improvements	$5,230,000	n/a	5,230,000
Recommended dock improvements + New vessels	$4,430,000	$10,600,000	$15,030,000
Comprehensive dock improvements + New vessels	$5,230,000	$10,600,000	$15,830,000

Funding Opportunities

To close the gap between operating revenue and expenses and to fund the necessary capital investments, there are a range of funding sources that could be considered. These include public subsidies, private subsidies, public/private financing partnerships, grants, and additional revenue from concessions, advertising, and charters.

Across the country, public subsidies for ferry services take a variety of forms. There are four standard sources of public support:

- A local general fund allocation. This is used to subsidize the operating costs and cover capital investments for the new NYC Ferry system. Funds come from the City's operating budget and are dispensed through the Economic Development Corporation (NYC EDC).
- A sales or property tax. These are used to subsidize ferry service in Washington State. In Kitsap County, voters approved a 0.3% sales tax for passenger ferry purposes in November 2016. In King County the county-owned ferry service levies a $.0125 per $1,000 property tax.
- A portion of a bridge or road toll. The San Francisco Bay Ferry and the Philadelphia area's Delaware River Authority ferries are supported by tolls.
- A transportation district. This model is used by the Casco Bay Ferries that depart from Portland, Maine. Major capital investments rely on federal funding with the local matching funds coming from an allocation within a voter-approved statewide transportation bond package, revenue collected from parking garage fees, and Casco Bay Line's capital reserve account funded through non-farebox operating revenues, including group tours and charters.

Private subsidies provide another form of non-farebox revenue. They may take the form of sponsorships, which often fund pilots or the initial years of a new service. In San Francisco Bay and the Puget Sound in Washington State, private developers have enhanced the marketability of a property and large employers gave improved access and transportation options for their workforce by supporting ferry services. Sponsorships can also be provided along with water transportation service to a special event or to advertise for an upcoming event. No examples of long-term private support for a public ferry service were identified, but the corporate sponsorship of municipally owned bike share systems may provide a model.

Public/private partnerships (P3s) are an option for financing that may be used for securing capital for new vessel construction. Although this type of arrangement is not commonly used for the procurement of trains or buses, it may be a possibility for a ferry fleet of this size. With a P3, the private partner(s) can take on some of the risk and the debt does not contribute to the debt limit restrictions of the public partner. This type of arrangement is complex and typically comes at a higher cost than traditional bond financing. It would also require a concession term long enough to amortize the investment by the private entity. If the concession term is shorter than 10 years for example, a contractual arrangement would be required so that the private party would not be left owning vessels built for a service that they were not operating.

Federal, state, and local grants are typically focused on funding capital improvements and may be secured to maintain existing dock infrastructure, to build new dock infrastructure, or to procure vessels. Grant revenues can vary in availability, applicability, and funding allotment. Most grants are highly competitive, and they cannot be guaranteed as a source of funding in the early phases of a planning process. Securing grants typically requires a state agency or municipality to be the primary applicant. Finding and applying for relevant grants would require having the right staff expertise.

Federal Funding and Grants

The Federal Highway Administration (FHWA) uses the biennial National Census of Ferry Boat Operators to gather data on existing ferry services and then allocate funds across the country with the MAP-21 (now FAST ACT) Ferry Boat Formula Program (FBP). Each eligible state's Department of Transportation can use these funds for the construction or maintenance of vessels, docks, and waiting areas. The allocation of funds is based on the number of passengers carried by the system and the total route nautical miles serviced as well as the number of vessels carried, a category that does not apply to the ferries operating in Boston. These funds can be used to cover up to 80% of the costs of a capital project.

The Federal Transit Administration (FTA) uses the National Transit Database (NTD) to collect data on transit authorities and provide grants through the Urbanized Area Formula Program. Any ferry service that provides same-day commuter transportation is eligible for formula funding based on route miles and ridership. The FTA also disburses discretionary funding through the competitive Passenger Ferry Grant Program. Both programs provide capital funds to transit agencies and state departments of transportation to match up to 80% of project costs.

State Funding and Grants

Twice each year, the Seaport Economic Council (SEC) awards competitive grants of up to $1 million for capital expenses, though most grants are typically smaller. The flexible funding is designed to support cities, towns, and other state agencies with projects that stimulate the marine economy and expand jobs. Five types of grants are available, and three types may be applicable to the projects needed to implement new ferry services: Innovation Grants, Local Maritime Economic Development Planning Grants, and Supportive Coastal Infrastructure Project Grants.

Each SEC grant requires matching funds that cover 20 percent of the project funding request. These matching funds can come from "the municipality, federal grants, private funds, or contributions by partner organizations." Additional information on the application process and requirements can be found at www.mass.gov/seaport-economic-council-programs-and-grants.

The Massachusetts Department of Environmental Protection (DEP) has recently created an Expendable Trust to facilitate the disbursement of funds acquired through Chapter 91 Licenses for the purposes enhancing public access to the Boston Harbor waterfront and expanding water transportation to, from, or within Boston Harbor. DEP anticipates creating a process to direct funds to fulfill the purposes articulated in applicable Chapter 91 licenses. The process will include opportunities for interested parties to propose projects for potential capital and operating funding.

DEP intends to disseminate information on how this process will be structured in the spring of 2019. Various elements of this business plan may be eligible for funding including dock construction and maintenance, vessel acquisition, and potentially other costs involved in launching a new service.

Beyond the farebox, revenues can be generated with concessions, advertising, and charters. These can generate different levels of funding depending on how many passengers are served, whether those passengers are commuters or tourists, the length of the route, and the visibility of the vessels. The capital funding source of the vessels and dock facilities may limit which of these activities are allowable.

Concessions are the most common source of on-board non-farebox revenue. Also known as the "galley," ferries may sell food and beverages as well as newspapers and novelty items. For this route's financial plans, the trip times were deemed too short for effective on-board sales, so an off-board kiosk or vending machine was assumed to exist on the dock.

Advertising is a common form of revenue on many forms of transit, but it is often most effective on routes with particularly high ridership. Advertisers may be more interested in advertising on trains, or even buses, than on ferries, particularly in smaller markets. With increased ridership and a larger mix of tourists than many local routes, the Inner Harbor Connector may attract advertisers who want to promote events and attractions. If new vessels are constructed, an advertising strategist may be consulted during the design process to ensure that there is marketable space designed into the vessel. Larger advertising campaigns prefer to be the only sponsor at one time and to have a large area where an eye-catching ad can be displayed. Smaller, low-cost advertising for local realtors and organizations may want to have smaller spaces or areas for ads. A conscious policy decision should be made about how much space in the vessel should be dedicated to advertising.

Vessel wrapping is a specific form of advertising that requires the right type of service and advertiser. The Inner Harbor Connector's route will allow vessels to be visible from many areas around the harbor. Although this is a common practice on some other forms of transit, the high density of tourist activities and restaurants along the waterfront could offer a unique opportunity for an advertiser. However, in addition to the policy decisions that are made for the interior, the exterior is used primarily to brand the vessels and the service and serves as a way-finding mechanism for customers, which may complicate vessel wrapping options.

Charters are another way to utilize existing assets and earn revenue when the vessel is not needed for transit service. To succeed, there must be clear policies on when a charter can occur, and all contracts must ensure that regular ferry service takes priority over charter opportunities. It has been most successful in larger systems where a back-up vessel serves charter contracts and is available when the primary boats in the ferry system are out of service. The Town of Winthrop's ferry has been used for midday charters and for evening wine and sunset cruises after the commuter service finishes its route.

Not all ferry services have a back-up vessel or the kind of limited commuter service to make this viable. Additionally, vessels procured or maintained with FTA funding have to follow strict rules of use. The FTA outlines the regulations for operating chartered service in circular C 5010.1D, Chapter IV, Section 2, Subsection (i). They define incidental use as the "limited non-transit purposes due to transit operating circumstances" and describe when it is appropriate for a transit agency to raise additional revenues to support the system in this way. The guidelines further note that non-profit uses are permitted, if not encouraged, but none of the additional income can be used as a match for the original grant.

Emissions Impact

Like many forms of mass transit, ferries are assumed to reduce congestion and emissions. This study included an analysis of the extent to which the proposed route would be effective at meeting those goals. Using the data from the stated preference survey and the ridership models, the team projected the likely change in environmental impacts resulting from implementing each of the possible scenarios.

Since the Inner Harbor Connector provides an alternative to walking, biking, and other forms of transit in addition to driving and because the MBTA ferry already connects Charlestown to Long Wharf, less than half of potential passengers are anticipated to forgo car trips to take the ferry. The number of passengers projected to stop driving, the annual reduction in car trips, and the total reduction in vehicle miles traveled (VMT) is outlined below. The ratio of person trips to auto trips diverted is based on an average car occupancy factor of 1.67.

Daily and Annual Car Trip Diversion + Car Trip and VMT Reduction

Scenarios	Daily person trips diverted from cars	Annual person trips diverted from cars	Annual car trip reduction	Annual VMT reduction
$6.50 fare + Leased Vessels	1,126	292,760	175,305	569,743
$3.50 fare + Leased Vessels	1,998	519,480	311,066	1,010,964
$6.50 fare + Ideal Vessels	1,161	301,860	180,754	587,452
$3.50 fare + Ideal Vessels	2,064	536,640	321,341	1,044,359

Based on average passenger vehicle emissions rates outlined by the EPA in their 2008 document *Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks*, the annual volume of pollutants removed by diverted trips was calculated.

Annual Volume of Pollution Reduction (short tons)

Scenarios	NOx	THC	CO	PM 10	VOC (HC)	CO_2
$6.50 fare + Leased Vessels	0.44	0.68	5.90	0.00	0.65	231.37
$3.50 fare + Leased Vessels	0.77	1.20	10.48	0.00	1.15	410.54
$6.50 fare + Ideal Vessels	0.45	0.70	6.09	0.00	0.67	238.56
$3.50 fare + Ideal Vessels	0.80	1.24	10.82	0.01	1.19	424.11

There are many options for leased ferries that have a range of emissions. All marine diesel engines constructed after 2004 must meet EPA Tier III or Tier IV emissions requirements depending on the vessel classification. Projected emissions were calculated for fleet of hypothetical leased vessels with Tier III diesel engines and for a fleet of hybrid vessels like those described above. Both projections assume that there are three vessels operating throughout the day and an additional three vessels operating only during the peak commuting periods. Marine engines do not have required total hydrocarbon (THC) emissions standards while automobile engines do not have sulfur oxide (SOx) emissions requirements, so these cannot be directly compared.

Annual Volume of Pollution Emitted from Ferry Fleet (short tons)

Scenarios	NOx	CO	PM 10	VOC (HC)	SOx	CO_2
Leased Vessels	78.48	17.92	1.13	1.89	0.42	11,971
Ideal Vessels	4.70	0.93	0.05	0.13	0.09	2,597
Potential emissions reductions	94%	95%	96%	93%	78%	78%

Investing in the ideal vessels leads to a significant decrease in emissions relative to the leased vessels fleet. Nonetheless, the volume of nitrous oxide (NOx) and carbon dioxide (CO_2) emissions from the hybrid fleet outweighs the reduction of these emissions from diverting trips taken by other modes. There are not clear-cut environmental benefits to implementing ferries, particularly from a climate standpoint. Nevertheless, in the $3.50 fare scenarios the hybrid ferries do lead to a reduction in carbon monoxide (CO), and in all scenarios the hybrid ferry fleet has a reduction in volatile organic compounds (VOX)/ hydrocarbons (HC). Furthermore, although there will be some emissions of PM10, particulate matter 10 micrometers or less in diameter, in any ferry scenario, it is only significant in the leased vessel scenario. There may also be public health benefits when the emissions source from vehicles operating in a dense urban environment is moved to ferries operating over the water.

The emissions reductions gained from the ideal vessels goes beyond the type of engine. Leasing a vessel of opportunity in this scenario assumes that the vessel meets Tier III emissions standards but would likely be too large in terms of passenger capacity and has an engine with more power than is needed in the Inner Harbor. The ideal vessels in this model are not only hybrid diesel-electric but also have the right level of power for the speeds and distances in the Inner Harbor and are right-sized to accommodate passenger demand.

This pattern is consistent with the existing conditions on many passenger ferry fleets. It is typical for new ferry systems to result in a net increase in emissions, particularly when only some of the passengers are switching from auto trips while others are merely changing their preferred type of transit away from buses and trains.

Implementation

This plan has been compiled to serve as a roadmap for implementing a new Inner Harbor Connector service. With promising ridership projections and farebox recovery ratios that meet or exceed existing ferry service, this route has a high likelihood of being financially sustainable. Working in partnership, state and city agencies, private developers, non-profits, and others have the potential to effectively collaborate to ensure that this service is fully implemented within the next five years.

Though this plan focuses primarily on outlining an ideal service, there are many steps that must be taken to achieve this vision and many stakeholders must come together to realize it. Work must be done concurrently to design and build a new ferry docking facility at Lewis Mall and to develop phases of pilot service beginning with a Long Wharf to Seaport Connection. Once the Lewis Mall site is completed, a subsequent pilot service can be added to the route. To improve Lewis Mall, the federal and state grant programs, including Chapter 91 funds, may be used to secure the capital costs for designing and constructing a fully accessible dock site. As the system expands, docking at Long Wharf is likely to grow increasingly complex and additional planning will be needed to accommodate additional ferries.

At present, there is no state agency or operator designated for implementation of this route. Boston Harbor Now plans to remain involved in facilitating the implementation of this service. MassDOT and Massport are interested in partnering with other state agencies, municipalities, and the private sector to make this plan a reality. With the formation of an Inner Harbor Working Group to oversee the process of initiating and sustaining this service, the following issues need to be resolved in order to fully develop this new system:

- Establish pilot service with clear benchmarks for defining it as permanent service.
- Determine how existing service will be altered or affected as the larger system is developed.
- Ensure that the experience of a new or expanded route feels seamlessly integrated for passengers using the existing ferry system.
- Decide whether an expanded fleet of vessels is focused on vessels of opportunity or on investments in new vessels.
- Determine the level of improvements needed at each dock location to initiate the service and which features will be installed at a later time.
- Secure capital funding for dock improvements and vessel construction as needed.
- Address gaps in operating funding.
- Develop a governance structure for the new service.

It should also be noted that Long Wharf is currently a flood pathway during major storm events and will be increasingly vulnerable to sea level rise and other climate change impacts. The City of Boston's Climate Ready Downtown and North End planning process is underway. Boston Harbor Now will work with the Climate Ready team to convene stakeholders who can contribute to developing appropriate design concepts that address these environmental impacts with resilient solutions while also improving the functionality of Long Wharf's maritime features and preserving its history.

Appendix

The following pages provide detailed twenty-year pro formas for each of the scenarios.

All four of the pro formas have a 2019 base year for comparison, but service initiation varies by design. With vessels of opportunity, service to the Seaport could begin in 2020 (or sooner) and service to East Boston can begin as soon as the Lewis Mall dock facility is completed. Acquiring ideal vessels takes longer, and the pro formas reflect that with a service initiation date of 2023.

All of the pro formas include weekend service, because there was no scenario where weekday-only service had a higher farebox recovery rate.

Twenty Year Pro Forma : $6.50 Fare and Existing Vessels

Operations	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Revenue	Base Year	Service Initiation							
Fare	4,898,000	4,501,000	5,338,000	5,563,000	5,742,000	5,937,000	6,143,000	6,143,000	6,579,000
Other Operating	49,000	45,000	53,000	56,000	57,000	59,000	61,000	61,000	66,000
Total Operating Revenue	4,947,000	4,546,000	5,391,000	5,619,000	5,799,000	5,996,000	6,204,000	6,204,000	6,645,000
Operating Expenses									
Vessel									
Crew Labor	1,058,000	1,084,000	1,109,000	1,134,000	1,159,000	1,187,000	1,216,000	1,216,000	1,277,000
Fuel	2,565,000	2,692,000	2,736,000	2,779,000	2,817,000	2,846,000	2,856,000	2,856,000	2,923,000
Maintenance	460,000	471,000	482,000	492,000	503,000	515,000	528,000	528,000	555,000
Insurance	394,000	404,000	413,000	422,000	432,000	442,000	453,000	453,000	476,000
Lease	1,114,000	1,141,000	1,168,000	1,193,000	1,220,000	1,249,000	1,280,000	1,280,000	1,344,000
Other	76,000	78,000	80,000	82,000	84,000	86,000	88,000	88,000	92,000
Total Vessel Operating	*5,667,000*	*5,870,000*	*5,988,000*	*6,102,000*	*6,215,000*	*6,325,000*	*6,421,000*	*6,421,000*	*6,667,000*
Shoreside									
Insurance	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Miscellaneous Facility	177,000	181,000	185,000	189,000	193,000	198,000	203,000	203,000	213,000
Total Shoreside	*180,000*	*184,000*	*188,000*	*192,000*	*196,000*	*201,000*	*206,000*	*206,000*	*216,000*
Management and Support	542,000	555,000	568,000	580,000	593,000	608,000	623,000	623,000	654,000
Total Operating Expense	6,389,000	6,609,000	6,744,000	6,874,000	7,004,000	7,134,000	7,250,000	7,250,000	7,537,000
Net Operating Income	**-1,442,000**	**-2,063,000**	**-1,353,000**	**-1,255,000**	**-1,205,000**	**-1,138,000**	**-1,046,000**	**-1,046,000**	**-892,000**

Capital	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Funding									
Grants									
State & Local									
Total Capital Revenue	0	0	0	0	0	0	0	0	0
Capital Expenditures									
Vessel									
Construction									
Total Vessel Capital	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Shoreside									
Improvements	2,733,000	2,135,000							
Major Maintenance									
Total Shoreside Capital	*2,733,000*	*2,135,000*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total Capital Expenditures	2,733,000	2,135,000	0	0	0	0	0	0	0
Net Operating & Capital Funding	**-2,733,000**	**-4,198,000**	**-1,353,000**	**-1,255,000**	**-1,205,000**	**-1,138,000**	**-1,046,000**	**-970,000**	**-892,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
6,810,000	7,052,000	7,299,000	7,551,000	7,809,000	8,077,000	8,354,000	8,641,000	8,938,000	9,244,000	9,558,000
68,000	71,000	73,000	76,000	78,000	81,000	84,000	86,000	89,000	92,000	96,000
6,878,000	7,123,000	7,372,000	7,627,000	7,887,000	8,158,000	8,438,000	8,727,000	9,027,000	9,336,000	9,654,000
1,309,000	1,343,000	1,377,000	1,410,000	1,445,000	1,480,000	1,516,000	1,553,000	1,591,000	1,629,000	1,668,000
2,958,000	2,983,000	3,024,000	3,037,000	3,068,000	3,103,000	3,118,000	3,132,000	3,184,000	3,199,000	3,222,000
569,000	583,000	598,000	612,000	627,000	643,000	658,000	674,000	691,000	707,000	724,000
488,000	500,000	513,000	525,000	538,000	551,000	565,000	578,000	592,000	607,000	621,000
1,378,000	1,414,000	1,449,000	1,485,000	1,521,000	1,557,000	1,596,000	1,634,000	1,674,000	1,715,000	1,756,000
95,000	97,000	99,000	102,000	104,000	107,000	109,000	112,000	115,000	118,000	121,000
6,797,000	*6,920,000*	*7,060,000*	*7,171,000*	*7,303,000*	*7,441,000*	*7,562,000*	*7,683,000*	*7,847,000*	*7,975,000*	*8,112,000*
3,000	3,000	3,000	3,000	3,000	4,000	4,000	4,000	4,000	4,000	4,000
219,000	224,000	230,000	235,000	241,000	247,000	253,000	259,000	265,000	272,000	278,000
222,000	*227,000*	*233,000*	*238,000*	*244,000*	*251,000*	*257,000*	*263,000*	*269,000*	*276,000*	*282,000*
671,000	688,000	705,000	722,000	740,000	758,000	776,000	795,000	814,000	834,000	854,000
7,690,000	7,835,000	7,998,000	8,131,000	8,287,000	8,450,000	8,595,000	8,741,000	8,930,000	9,085,000	9,248,000
-812,000	**-712,000**	**-626,000**	**-504,000**	**-400,000**	**-292,000**	**-157,000**	**-14,000**	**97,000**	**251,000**	**406,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
0	0	0	0	0	0	0	0	0	0	0
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	0	0	0	0	0	0	0	0	0	0
-812,000	**-712,000**	**-626,000**	**-504,000**	**-400,000**	**-292,000**	**-157,000**	**-14,000**	**97,000**	**251,000**	**406,000**

Twenty Year Pro Forma : $3.50 Fare and Existing Vessels

Operations	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Revenue	Base Year	Service Initiation							
Fare	4,436,000	4,067,000	4,834,000	5,036,000	5,199,000	5,375,000	5,561,000	5,755,000	5,956,000
Other Operating	44,000	41,000	48,000	50,000	52,000	54,000	56,000	58,000	60,000
Total Operating Revenue	4,480,000	4,108,000	4,882,000	5,086,000	5,251,000	5,429,000	5,617,000	5,813,000	6,016,000
Operating Expenses									
Vessel									
Crew Labor	1,058,000	1,084,000	1,109,000	1,134,000	1,159,000	1,187,000	1,216,000	1,246,000	1,277,000
Fuel	2,565,000	2,692,000	2,736,000	2,779,000	2,817,000	2,846,000	2,856,000	2,889,000	2,923,000
Maintenance	460,000	471,000	482,000	492,000	503,000	515,000	528,000	541,000	555,000
Insurance	394,000	404,000	413,000	422,000	432,000	442,000	453,000	464,000	476,000
Lease	1,114,000	1,141,000	1,168,000	1,193,000	1,220,000	1,249,000	1,280,000	1,312,000	1,344,000
Other	76,000	78,000	80,000	82,000	84,000	86,000	88,000	90,000	92,000
Total Vessel Operating	*5,667,000*	*5,870,000*	*5,988,000*	*6,102,000*	*6,215,000*	*6,325,000*	*6,421,000*	*6,542,000*	*6,667,000*
Shoreside									
Insurance	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Miscellaneous Facility	177,000	181,000	185,000	189,000	193,000	198,000	203,000	208,000	213,000
Total Shoreside	*180,000*	*184,000*	*188,000*	*192,000*	*196,000*	*201,000*	*206,000*	*211,000*	*216,000*
Management and Support	542,000	555,000	568,000	580,000	593,000	608,000	623,000	638,000	654,000
Total Operating Expense	6,389,000	6,609,000	6,744,000	6,874,000	7,004,000	7,134,000	7,250,000	7,391,000	7,537,000
Net Operating Income	**-1,909,000**	**-2,501,000**	**-1,862,000**	**-1,788,000**	**-1,753,000**	**-1,705,000**	**-1,633,000**	**-1,578,000**	**-1,521,000**

Capital	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Funding									
Grants									
State & Local									
Total Capital Revenue	0	0	0	0	0	0	0	0	0
Capital Expenditures									
Vessel									
Construction									
Total Vessel Capital	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Shoreside									
Improvements	2,733,000	2,135,000							
Major Maintenance									
Total Shoreside Capital	*2,733,000*	*2,135,000*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total Capital Expenditures	2,733,000	2,135,000	0	0	0	0	0	0	0
Net Operating & Capital Funding	**-2,733,000**	**-4,636,000**	**-1,862,000**	**-1,788,000**	**-1,753,000**	**-1,705,000**	**-1,633,000**	**-1,578,000**	**-1,521,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
6,165,000	6,385,000	6,608,000	6,836,000	7,070,000	7,312,000	7,564,000	7,823,000	8,092,000	8,369,000	8,653,000
62,000	64,000	66,000	68,000	71,000	73,000	76,000	78,000	81,000	84,000	87,000
6,227,000	6,449,000	6,674,000	6,904,000	7,141,000	7,385,000	7,640,000	7,901,000	8,173,000	8,453,000	8,740,000
1,309,000	1,343,000	1,377,000	1,410,000	1,445,000	1,480,000	1,516,000	1,553,000	1,591,000	1,629,000	1,668,000
2,958,000	2,983,000	3,024,000	3,037,000	3,068,000	3,103,000	3,118,000	3,132,000	3,184,000	3,199,000	3,222,000
569,000	583,000	598,000	612,000	627,000	643,000	658,000	674,000	691,000	707,000	724,000
488,000	500,000	513,000	525,000	538,000	551,000	565,000	578,000	592,000	607,000	621,000
1,378,000	1,414,000	1,449,000	1,485,000	1,521,000	1,557,000	1,596,000	1,634,000	1,674,000	1,715,000	1,756,000
95,000	97,000	99,000	102,000	104,000	107,000	109,000	112,000	115,000	118,000	121,000
6,797,000	*6,920,000*	*7,060,000*	*7,171,000*	*7,303,000*	*7,441,000*	*7,562,000*	*7,683,000*	*7,847,000*	*7,975,000*	*8,112,000*
3,000	3,000	3,000	3,000	3,000	4,000	4,000	4,000	4,000	4,000	4,000
219,000	224,000	230,000	235,000	241,000	247,000	253,000	259,000	265,000	272,000	278,000
222,000	*227,000*	*233,000*	*238,000*	*244,000*	*251,000*	*257,000*	*263,000*	*269,000*	*276,000*	*282,000*
671,000	688,000	705,000	722,000	740,000	758,000	776,000	795,000	814,000	834,000	854,000
7,690,000	7,835,000	7,998,000	8,131,000	8,287,000	8,450,000	8,595,000	8,741,000	8,930,000	9,085,000	9,248,000
-1,463,000	**-1,386,000**	**-1,324,000**	**-1,227,000**	**-1,146,000**	**-1,065,000**	**-955,000**	**-840,000**	**-757,000**	**-632,000**	**-508,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
0	0	0	0	0	0	0	0	0	0	0
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	0	0	0	0	0	0	0	0	0	0
-1,463,000	**-1,386,000**	**-1,324,000**	**-1,227,000**	**-1,146,000**	**-1,065,000**	**-955,000**	**-840,000**	**-757,000**	**-632,000**	**-508,000**

Twenty Year Pro Forma : $6.50 Fare and New Vessels

Operations	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Revenue	Base Year				Service Initiation				
Fare	4,990,000				5,149,000	6,049,000	6,259,000	6,477,000	6,703,000
Other Operating	50,000				51,000	60,000	63,000	65,000	67,000
Total Operating Revenue	5,040,000				5,200,000	6,109,000	6,322,000	6,542,000	6,770,000
Operating Expenses									
Vessel									
Crew Labor	1,058,000				1,159,000	1,187,000	1,216,000	1,246,000	1,277,000
Fuel	333,000				366,000	370,000	371,000	375,000	380,000
Maintenance	490,000				536,000	549,000	563,000	577,000	591,000
Insurance	394,000				432,000	442,000	453,000	464,000	476,000
Lease	0				0	0	0	0	0
Other	37,000				40,000	41,000	42,000	44,000	45,000
Total Vessel Operating	*2,312,000*				*2,533,000*	*2,589,000*	*2,645,000*	*2,706,000*	*2,769,000*
Shoreside									
Insurance	3,000				3,000	3,000	3,000	3,000	3,000
Miscellaneous Facility	177,000				193,000	198,000	203,000	208,000	213,000
Total Shoreside	*180,000*				*196,000*	*201,000*	*206,000*	*211,000*	*216,000*
Management and Support	540,000				591,000	605,000	620,000	635,000	651,000
Total Operating Expense	3,032,000				3,320,000	3,395,000	3,471,000	3,552,000	3,636,000
Net Operating Income	**2,008,000**				**1,880,000**	**2,714,000**	**2,851,000**	**2,990,000**	**3,134,000**

Capital	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Funding									
Grants									
State & Local									
Total Capital Revenue									
Capital Expenditures									
Vessel									
Construction			9,664,000	1,933,000					
Total Vessel Capital	*0*	*0*	*9,664,000*	*1,933,000*	*0*	*0*	*0*	*0*	*0*
Shoreside									
Improvements		2,833,000	2,254,000						
Major Maintenance									
Total Shoreside Capital	*0*	*2,833,000*	*2,254,000*	*0*	*0*	*0*	*0*	*0*	*0*
Total Capital Expenditures	0	2,833,000	11,918,000	1,933,000	0	0	0	0	0
Net Operating & Capital Funding	**2,008,000**	**-2,833,000**	**-11,918,000**	**-1,933,000**	**1,880,000**	**2,714,000**	**2,851,000**	**2,990,000**	**3,134,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
6,939,000	7,186,000	7,437,000	7,693,000	7,957,000	8,229,000	8,512,000	8,805,000	9,107,000	9,419,000	9,739,000
69,000	72,000	74,000	77,000	80,000	82,000	85,000	88,000	91,000	94,000	97,000
7,008,000	7,258,000	7,511,000	7,770,000	8,037,000	8,311,000	8,597,000	8,893,000	9,198,000	9,513,000	9,836,000
1,309,000	1,343,000	1,377,000	1,410,000	1,445,000	1,480,000	1,516,000	1,553,000	1,591,000	1,629,000	1,668,000
384,000	388,000	393,000	395,000	399,000	403,000	405,000	407,000	414,000	416,000	419,000
606,000	621,000	637,000	653,000	668,000	685,000	701,000	718,000	736,000	754,000	772,000
488,000	500,000	513,000	525,000	538,000	551,000	565,000	578,000	592,000	607,000	621,000
0	0	0	0	0	0	0	0	0	0	0
46,000	47,000	48,000	49,000	50,000	52,000	53,000	54,000	56,000	57,000	58,000
2,833,000	*2,899,000*	*2,968,000*	*3,032,000*	*3,100,000*	*3,171,000*	*3,240,000*	*3,310,000*	*3,389,000*	*3,463,000*	*3,538,000*
3,000	3,000	3,000	3,000	3,000	4,000	4,000	4,000	4,000	4,000	4,000
219,000	224,000	230,000	235,000	241,000	247,000	253,000	259,000	265,000	272,000	278,000
222,000	*227,000*	*233,000*	*238,000*	*244,000*	*251,000*	*257,000*	*263,000*	*269,000*	*276,000*	*282,000*
668,000	685,000	702,000	719,000	736,000	754,000	773,000	792,000	811,000	831,000	851,000
3,723,000	3,811,000	3,903,000	3,989,000	4,080,000	4,176,000	4,270,000	4,365,000	4,469,000	4,570,000	4,671,000
3,285,000	**3,447,000**	**3,608,000**	**3,781,000**	**3,957,000**	**4,135,000**	**4,327,000**	**4,528,000**	**4,729,000**	**4,943,000**	**5,165,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	0	0	0	0	0	0	0	0	0	0
3,285,000	**3,447,000**	**3,608,000**	**3,781,000**	**3,957,000**	**4,135,000**	**4,327,000**	**4,528,000**	**4,729,000**	**4,943,000**	**5,165,000**

Twenty Year Pro Forma : $3.50 Fare and New Vessels

Operations	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Revenue	Base Year				Service Initiation				
Fare	4,551,000				4,647,000	5,514,000	5,705,000	5,904,000	6,110,000
Other Operating	46,000				46,000	55,000	57,000	59,000	61,000
Total Operating Revenue	4,597,000				4,693,000	5,569,000	5,762,000	5,963,000	6,171,000
Operating Expenses									
Vessel									
Crew Labor	1,058,000				1,159,000	1,187,000	1,216,000	1,246,000	1,277,000
Fuel	333,000				366,000	370,000	371,000	375,000	380,000
Maintenance	490,000				536,000	549,000	563,000	577,000	591,000
Insurance	394,000				432,000	442,000	453,000	464,000	476,000
Lease	0				0	0	0	0	0
Other	37,000				40,000	41,000	42,000	44,000	45,000
Total Vessel Operating	*2,312,000*				*2,533,000*	*2,589,000*	*2,645,000*	*2,706,000*	*2,769,000*
Shoreside									
Insurance	3,000				3,000	3,000	3,000	3,000	3,000
Miscellaneous Facility	177,000				193,000	198,000	203,000	208,000	213,000
Total Shoreside	*180,000*				*196,000*	*201,000*	*206,000*	*211,000*	*216,000*
Management and Support	540,000				591,000	605,000	620,000	635,000	651,000
Total Operating Expense	3,032,000				3,320,000	3,395,000	3,471,000	3,552,000	3,636,000
Net Operating Income	**1,565,000**				**1,373,000**	**2,174,000**	**2,291,000**	**2,411,000**	**2,535,000**

Capital	2019	2020	2021	2022	2023	2024	2025	2026	2027
Capital Funding									
Grants									
State & Local									
Total Capital Revenue									
Capital Expenditures									
Vessel									
Construction			9,664,000	1,933,000					
Total Vessel Capital	*0*	*0*	*9,664,000*	*1,933,000*	*0*	*0*	*0*	*0*	*0*
Shoreside									
Improvements		2,833,000	2,254,000						
Major Maintenance									
Total Shoreside Capital	*0*	*2,833,000*	*2,254,000*	*0*	*0*	*0*	*0*	*0*	*0*
Total Capital Expenditures	0	2,833,000	11,918,000	1,933,000	0	0	0	0	0
Net Operating & Capital Funding	**1,565,000**	**-2,833,000**	**-11,918,000**	**-1,933,000**	**1,373,000**	**2,174,000**	**2,291,000**	**2,411,000**	**2,535,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
6,325,000	6,550,000	6,779,000	7,013,000	7,253,000	7,501,000	7,759,000	8,025,000	8,301,000	8,585,000	8,877,000
63,000	65,000	68,000	70,000	73,000	75,000	78,000	80,000	83,000	86,000	89,000
6,388,000	6,615,000	6,847,000	7,083,000	7,326,000	7,576,000	7,837,000	8,105,000	8,384,000	8,671,000	8,966,000
1,309,000	1,343,000	1,377,000	1,410,000	1,445,000	1,480,000	1,516,000	1,553,000	1,591,000	1,629,000	1,668,000
384,000	388,000	393,000	395,000	399,000	403,000	405,000	407,000	414,000	416,000	419,000
606,000	621,000	637,000	653,000	668,000	685,000	701,000	718,000	736,000	754,000	772,000
488,000	500,000	513,000	525,000	538,000	551,000	565,000	578,000	592,000	607,000	621,000
0	0	0	0	0	0	0	0	0	0	0
46,000	47,000	48,000	49,000	50,000	52,000	53,000	54,000	56,000	57,000	58,000
2,833,000	*2,899,000*	*2,968,000*	*3,032,000*	*3,100,000*	*3,171,000*	*3,240,000*	*3,310,000*	*3,389,000*	*3,463,000*	*3,538,000*
3,000	3,000	3,000	3,000	3,000	4,000	4,000	4,000	4,000	4,000	4,000
219,000	224,000	230,000	235,000	241,000	247,000	253,000	259,000	265,000	272,000	278,000
222,000	*227,000*	*233,000*	*239,000*	*245,000*	*251,000*	*257,000*	*263,000*	*269,000*	*276,000*	*282,000*
668,000	685,000	702,000	719,000	736,000	754,000	773,000	792,000	811,000	831,000	851,000
3,723,000	3,811,000	3,903,000	3,990,000	4,081,000	4,176,000	4,270,000	4,365,000	4,469,000	4,570,000	4,671,000
2,665,000	**2,804,000**	**2,944,000**	**3,093,000**	**3,245,000**	**3,400,000**	**3,567,000**	**3,740,000**	**3,915,000**	**4,101,000**	**4,295,000**

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
0	0	0	0	0	0	0	0	0	0	0
2,665,000	**2,804,000**	**2,944,000**	**3,093,000**	**3,245,000**	**3,400,000**	**3,567,000**	**3,740,000**	**3,915,000**	**4,101,000**	**4,295,000**

Credits

Project Coordinator

Boston Harbor Now

Partners

MassDOT
Massport

Sponsors

The Barr Foundation
Cabot Family Charitable Trust
Clippership Wharf
Envoy Hotel
Massachusetts Convention Center Authority
MassDOT
Massport
National Park Service
Seaport Economic Council of the Executive Office of Housing and Economic Development

Consultant Team

Led by: Steer (formerly Steer Davies Gleave)
Elliott Bay Design Group
KPFF
Moffatt and Nichol
Norris and Norris
Progressions

Image Credits

NYC ferry photo and King County ferry photos on page 13 courtesy of KPFF Consulting Engineers
Georges Island passenger photo on page 46 by Galya Freierman
All aerial satellite views courtesy of Google Earth
All other images courtesy of Boston Harbor Now

BOSTON HARBOR NOW

PARTNERS

massDOT
Massachusetts Department of Transportation

massport

SPONSORS

The Barr Foundation, Cabot Family Charitable Trust, Clippership Wharf, Envoy Hotel, Massachusetts Convention Center Authority, MassDOT, Massport, National Park Service, Seaport Economic Council of the Executive Office of Housing and Economic Development