



Benefit Cost Analysis Technical Memo

Portland Harbor Working Waterfront Rehabilitation Project

Contents

Project Description	3
Benefit Cost Analysis.....	3
Design Life.....	3
Baseline Scenario	4
Cost of Inaction.....	4
Summary of Benefits.....	4
Confidence in Individual Benefits	4
Individual Benefit Methodology	9
Entertainment Value of Cruise Access.....	9
Economic Benefit to the City of Portland and the City of South Portland – Sales Tax	9
Economic Benefit to the City of Portland and the City of South Portland – Piloting Fees for Cruise Ship Landings	9
Value of Lobster Not Being Redirected	10
Value of Herring Not Being Redirected	10
Value of Ocean Access (Marina Slip and Commercial Berthing Fees).....	10
Ferry Delays	11
Commercial East End Boat Ramp Delays.....	11
Residual Value	11
Cost of Maintenance.....	12
Summary of Costs.....	12

Project Description

The Portland Harbor Working Waterfront Rehabilitation Project (the Project) is a fully permitted project and resulted from the collaboration of the Cities of Portland and South Portland, the Portland Harbor Commission, and Maine Department of Transportation working to remove contaminated sediments to improve berthing and improve water quality, and environmental conditions in Portland Harbor.

Portland Harbor is an important economic hub for the State of Maine, providing public and private infrastructure that supports many diverse industries. The economic growth of Portland Harbor has been negatively impacted by sedimentation between and around the piers and waterfront areas, decreasing water depth available for commercial and recreational vessels. Historic, extensive build-up of contaminated sediment has made portions of the immediate waterfront unusable and in some areas, bottom sediments are exposed at low tide where large ocean-going vessels were once able to dock.

The Project proposes to dredge the Portland Harbor, remove the contaminated sediment, and construct Maine's first Confined Aquatic Disposal (CAD) cell to permanently sequester this contaminated material. Dredging maintains a safe and functional water depth to support commercial and recreational vessel access, allowing loading and unloading, berthing, vessel service and repair, marine construction, and the transport of goods and people, ultimately securing Portland Harbor as a center for marine commerce.

Benefit Cost Analysis

The final BCA calculation provides a benefit cost ratio of 3.18. The BCA was calculated using the parameters described in this technical memo and should be reviewed with the corresponding spreadsheet.

Design Life

A design life of 50 years was assumed for the Project. Maintenance dredging will be needed to maintain the berthing depths, but the newly accumulated sediment is expected to meet environmental standards to be disposed of in more economically feasible manner. The individual pier and waterfront property owners will be responsible for future dredging costs. Today, existing property owners are not able to dredge the piers and waterfront properties to maintain the current condition due to the testing and disposal costs associated with contaminated sediment.

The removal of the contaminated sediment will provide generational access to the Harbor; therefore, the design life was assumed to be long. The CAD cell itself is a permanent facility.

Since the project type is unconventional and not covered in the USDOT Guidance, a sensitivity analysis was completed to determine how the design life length would impact the final BCA. Table 1 below shows the calculated BCA for a 20-year, 30-year, and 50-year design life assumption.

Table 1: Design Life Sensitivity Analysis

Design Life	BCA
50 Years	3.18
30 Years	3.13
20 Years	3.07

Baseline Scenario

If this Project is not completed, the Portland Harbor will continue to accumulate sediment and even more berthing will become less efficient or lost. All the areas that are being dredged are considered inefficient or at risk of becoming unusable, therefore, the Baseline scenario assumes that the areas being dredged will no longer be available for their current uses.

For the Casco Bay Lines Ferry and Commercial East End Boat Ramp, which provide access and services to outlying islands, access is at risk of becoming tidally restricted. The East End Ramp is already only accessible 16 hours of the day. This ramp provides access for trash collection, construction supplies, emergency vehicles, and personal vehicle transport to the surrounding island. The baseline scenario accounts for the lost efficiency associated with this tidal restriction.

The Project is proposing to dredge approximately 47% of all available commercial berthing and 32% of available recreational berthing. These percentages were applied to the current economic output to define what percent capacity the Portland Harbor will lose if the contaminated sediment is not dredged and disposed

Cost of Inaction

Not included in this analysis is the increasing cost of inaction. Newer, cleaner sediments continue to accumulate on older contaminated sediments. Separating the two grades of contamination is technically impractical and financially infeasible, resulting in an ever-expanding volume of material requiring expensive disposal methods needed for contamination. These avoided costs are significant, but not included in this analysis.

Summary of Benefits

Confidence in Individual Benefits

Since the Project is not a traditional roadway transportation project, additional economic benefits fostered by the Project cannot be captured in the travel time savings. Therefore, the best way to quantify the economic development benefit of the Project is to quantify metrics that are not typically permitted in the USDOT Benefit-Cost Guidance.

The confidence in these benefits may be lower than the more traditionally quantified benefits. Each benefit has been labeled either “High”, “Medium”, or “Low” based on the confidence in the approximation. Table 2 below shows the BCA when “Low” and/or “Medium” ranked benefits are removed. A 50-year design life was assumed for all calculations.

Table 2: Benefit Confidence Sensitivity Analysis

Design Life	BCA
High + Medium + Low	3.18
High + Medium	2.96
High	1.30



Table 3 below shows the benefits that were quantified to represent the societal value the Portland Harbor provides the surrounding communities. Each benefit is described in more detail in the subsections.

Table 3: Summary of Benefits

Benefit Description	Benefit Rationale	20 Year Analysis Period Benefit Total	Confidence Level
Entertainment Value of Cruise Access	<p>Access to the City of Portland and the City of South Portland via cruise is a benefit to the public. Unlike traditional roadway transportation projects, travel time savings for these patrons is not estimated. Therefore, <u>estimating the benefit on its own is estimating the societal benefit, not an economic transfer.</u></p> <p>To quantify the value of this benefit, the municipal fees that the City of Portland collects based on the number of cruise ship passengers was used as a stand-in. Currently, cruise ships port at Ocean Gateway and the Portland Ocean Terminal, both of which continue to lose berthing depth due to sedimentation.</p>	\$14,465,608	Medium
Economic Benefit to the City of Portland and the City of South Portland – Sales Tax	<p>Access to the City of Portland and the City of South Portland for cruise ship passenger will improve the local economies. Unlike traditional roadway transportation projects, travel time savings for these patrons is not estimated. Therefore, <u>estimating the benefit on its own is not double counting.</u></p>	\$2,438,027	Medium

	<p>The City of Portland and the City of South Portland generate sales tax through cruise ship passengers and crew that port in the harbor. Cruise ships port at Ocean Gateway and the Portland Ocean Terminal, both of which continue to lose berthing depth due to sedimentation.</p>		
<p>Economic Benefit to the City of Portland and the City of South Portland - Piloting Fees for Cruise Ship Landings</p>	<p>There is benefit to the cruising industry to have access to the City of Portland and the City of South Portland via cruise ship access. Unlike traditional roadway transportation projects, travel time savings for these users is not estimated. Therefore, <u>estimating the benefit on its own is estimating the societal benefit, not an economic transfer.</u></p> <p>Piloting fees are collected to bring cruise ships into the port. Cruise ships port at Ocean Gateway and the Portland Ocean Terminal, both of which continue to lose berthing depth due to sedimentation.</p>	<p>\$5,424,603</p>	<p>Low</p>
<p>Value of Lobster Not Being Redirected</p>	<p>Lobster is brought from the piers to packaging and processing plants in Portland, South Portland and elsewhere in New England. As available berthing continues to decline, lobster landings could be relocated to Harpswell, the nearest port. This will result in truck traffic moving the cargo and the associated travel times and expenses. Additionally, the vessels will accrue travel time delays to reach the further port.</p>	<p>\$1,886,614</p>	<p>High</p>

Value of Herring Not Being Redirected	Herring (used as lobster bait) is brought from the docks to bait distribution facilities in Portland and elsewhere along the Maine Coast. The only herring freezing operation is located in Portland. As available berthing continues to decline, herring and other bait species could be relocated to Rockland, or other New England ports. This will result in truck traffic moving the cargo and the associated travel times and expenses. Additionally, the vessels will accrue travel time delays to reach the further port.	\$6,200,200	High
Value of Ocean Access Marina Slip and Commercial Berthing Fees	<p>There is value to residents and businesses to be able to port their boats in the Portland Harbor in order to easily access the ocean. Unlike traditional roadway transportation projects, travel time savings for these users is not estimated. Therefore, <u>estimating the benefit on its own is estimating the societal benefit, not an economic transfer.</u></p> <p>The marinas and commercial piers that are being dredged are able to charge slip and berthing fees which represent the value of the access to the public and commercial users.</p>	\$23,136,764	Medium
Ferry Delays	Without dredging, the berthing associated with ferries that service the outlying islands will become tidally restricted. The dredging will eliminate potential delay associated with the tidal restriction.	\$19,830,261	High

East End Ramp Delays	The East End Ramp provides access to municipal services, private construction, and vehicle transport to the Casco Bay islands including trash collection construction supplies, emergency vehicles, and deliveries personal vehicle transport. The ramp is already tidally constrained resulting in lost travel time in the hours before and after low tide.	\$725,827	High
Residual Value	The residual value is the value of the asset at the end of the analysis period.	\$2,795,744	N/A
Ongoing Costs	A disbenefit of any transportation cost is the cost to maintain the asset.	-\$66,940	N/A
Total Benefits (Low + Medium + High)		\$76,836,708	
Total Benefits (Medium + High)		\$71,412,105	
Total Benefits (High)		\$31,371,706	

Individual Benefit Methodology

Entertainment Value of Cruise Access

Access to the City of Portland and the City of South Portland for cruise customers is a benefit to the public. Unlike traditional roadway transportation projects, travel time savings for these patrons is not estimated. Therefore, estimating the benefit on its own is not double counting.

As a way to approximate the value to individuals to be able to access the City of Portland and the City of South Portland via cruise ship, it was assumed that the municipal fee collected was equivalent (or less) to the individual's perceived value of the amenities.

For each cruise ship passenger, the municipalities collect a \$14.00 fee and an additional \$2.00 infrastructure fee. Approximately 175,000 cruise ship passengers port in Portland Harbor each year. The area where most cruise ships passengers, conservatively assumed to be 75%, port is continuing to lose berthing depth due to sedimentation. If the Harbor is not dredged with the contaminated sediment appropriately disposed, then this municipal revenue is at risk of being eliminated.

Economic Benefit to the City of Portland and the City of South Portland – Sales Tax

Access to the City of Portland and the City of South Portland for cruise ship passenger will improve the local economies. Unlike traditional roadway transportation projects, travel time savings for these patrons is not estimated. Therefore, estimating the benefit on its own is not double counting. To estimate the economic value that can be spurred by the project, sales tax collected from the cruise ship passengers was calculated to represent the economic development benefits for cruise access to Portland Harbor.

The Maine Office of Tourism, in association with CruiseMaine, commissioned a study of cruise ship visitors to Maine in 2019. When on land, the average passenger spends \$61.76. Additionally, 23% of the crew disembark at each port of which each spend an average of \$66.67 per day. This results in an average spend collection of \$2.55 in sales tax for each disembarked individual.

Approximately 175,000 cruise ship passengers and 10,063 crew members port in Portland Harbor each year. The area where most cruise ships passengers, conservatively assumed to be 75%, port is continuing to lose berthing depth due to sedimentation. If the Harbor is not dredged with the contaminated sediments appropriately disposed, then this municipal revenue is at risk of being greatly reduced or eliminated.

Economic Benefit to the City of Portland and the City of South Portland – Piloting Fees for Cruise Ship Landings

Access to the City of Portland and the City of South Portland for cruise lines will improve the cruise businesses. Unlike traditional roadway transportation projects, travel time savings for these businesses is not estimated. Therefore, estimating the benefit on its own is not double counting. To estimate the



economic value that can be spurred by the project, piloting fees collected from the cruise lines was calculated to represent the value to cruise lines to do business vis the Portland Harbor.

When a cruise ship is coming to dock at a port, a publicly licensed pilot goes to meet the vessel and bring it to the dock safely. Annually, pilot services in Portland Harbor charge \$1,050,000 in fees to provide safe transportation connection each year between cruise ship passengers and the Cities of Portland and South Portland.

The area where most cruise ships, conservatively assumed to be 75%, port is continuing to lose berthing depth due to sedimentation. If the Harbor is not dredged with the contaminated sediments appropriately disposed, then this benefit is at risk of being eliminated.

An additional benefit that was not included in this analysis are the piloting fees collected for safely piloting other large vessels. Any vessel of significant size will require a licensed pilot and berthing for these larger vessels is at risk.

Value of Lobster Not Being Redirected

Portland Harbor and the surrounding area process over 3 million pounds of lobster annually. Currently, these commercial fishing vessels use the Portland Harbor to transfer the lobster. If the commercial berthing continues to fill in, the lobster may be redirected to different ports adding travel time and miles to the supply chain. It was assumed that the rerouted lobster would use the nearest harbor – Harpswell. This harbor is 80 road miles and 2-hour roundtrip away. For the vessels, Harpswell is an additional 15 miles north resulting in additional 3 hours round trip for the crew. In the BCA, the ability to avoid the unnecessary trips was calculated using these assumptions.

Value of Herring Not Being Redirected

Portland Harbor and the surrounding area land over 34 million pounds of herring annually. Currently, these commercial fishing vessels use the Portland Harbor to transfer the herring to local processing locations. The only herring refrigeration and freezing operation in the State of Maine is located in Portland. If the commercial berthing continues to fill in, the herring may be redirected to different ports adding travel time and miles to the supply chain. It was assumed that the rerouted herring would use the Rockland Harbor. This harbor is 160 miles and 3.5-hour roundtrip away. In the BCA, the ability to avoid the unnecessary trips was calculated using these assumptions.

Value of Ocean Access (Marina Slip and Commercial Berthing Fees)

There is value to residents and businesses to be able to dock their boats in the Portland Harbor in order to easily access the ocean. Unlike traditional roadway transportation projects, travel time savings for these users is not estimated. Therefore, estimating the benefit on its own is not double counting. To estimate the value of ocean access, the value of marina slips was calculated. If boat owners are willing to pay the cost to

berth their boats, it is assumed that the individuals value the access to the ocean at the cost of the marina slip or greater.

The marinas in Portland Harbor charge seasonal berthing fees based on the linear length of the berthing. A conservative value of \$145 per linear foot and an average slip of 30 feet was assumed to determine how valuable the access to recreational boats is to the surrounding communities. For commercial berthing, a \$10 per linear foot per month was assumed for the leasing value. The leases continue throughout the whole year for an annual rate of \$120/linear foot

Ferry Delays

The Casco Bay Ferry has five vessels. The ferry service provides over 1.1 million rides per year. The berthing which serves the four smaller vessels is to be impacted by sedimentation and if the harbor is not dredged, these routes will become tidally restricted. These routes provide over 330,000 rides annually. The assumption is that the operations will lose the ability to board and alight for 6 hours of the day, three hours around each low tide. For calculation purposes, it is assumed that the average passenger during low tide will be delayed an hour per trip if the berthing becomes tidally restricted. Since tides change throughout the year, it was assumed that this will delay will impact 25% of trips based on the percentage of time the berthing is not available.

Commercial East End Boat Ramp Delays

The Commercial East End Boat Ramp provides access for municipal services to the surrounding islands, including trash, construction supplies, emergency vehicles, and deliveries personal vehicle transport. These commercial uses are already tidally constrained only being able to access the ramp for 16 hours of the day. On an average day, there are 9 vessels carrying multiple service vehicles using the ramp. This results in 9,855 commercial trips annually. For calculation purposes, it is assumed that the average trip during low tide will be delayed an hour per trip due to the tidally restricted berthing. Since tides change throughout the year, it was assumed that this will delay will impact 33% of trips based on the percentage of time the ramp is not available.

Residual Value

The residual value is the value of the asset at the end of the analysis period. It is calculated using the total construction capital costs multiplied by the percentage of the useful life remaining. Assuming a useful life of 50 years and an analysis period of 20 year after the end of construction, a discounted residual value of \$2,795,744 was calculated.

The CAD cell will never need to be rebuilt; therefore, its useful life is beyond the approximated 50 years and the residual value of the asset is higher than projected. The 50-year assumption is conservative.

Cost of Maintenance

A disbenefit of any transportation cost is the cost to maintain the asset. The CAD cell will not require any upkeep; however, the Harbor will need dredged in order to maintain the depth required to realize the calculated benefits. It was assumed that every ten years it will cost the economy \$150,000 (2021\$) to maintain the berthing depth required to continue to serve the intended uses. The discounted sum of dredging completed in 2039 and 2049 is \$66,940. This value is represented as a disbenefit in the numerator of the BCA equations.

Summary of Costs

The total project cost is \$33,149,401. These costs are distributed over the seven years, which discounted at 7% is calculated to be \$24,145,124. See Table 4 below for the annual expected expenditures.

Table 4: Summary of Costs Per Year

	Year	Cost	Discounted Cost (2021\$)
Year 1	2023	\$349,715	\$305,454
Year 2	2024	\$7,786,470	\$6,356,079
Year 3	2025	\$10,900,302	\$8,315,788
Year 4	2026	\$3,585,851	\$2,556,662
Year 5	2027	\$3,585,851	\$2,389,404
Year 6	2028	\$4,464,541	\$2,780,292
Year 7	2029	\$2,476,671	\$1,441,445
Total		\$33,149,401	\$24,145,124