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North Shore Dredge Purchase Feasibility Study

Wrap-Up Meeting
Town Hall, Essex, Massachusetts
July 12, 2019

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Merrimack Valley Planning Commission
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Presentation Outline

- Project Goals and Objectives
- Project Partners
- Review Project Tasks
- Preliminary Results
- Questions / Next Steps

Project Goals and Objectives

- Project partners on the upper North Shore understand the importance of maintaining safe and navigable entrance and internal navigation channels to support a vibrant commercial fishing fleet, recreational boating community, and to ensure first-responders are able to respond to on-water incidents quickly and safely.

This project aims to address whether a regionally owned, operated, and managed dredge is a cost effective and efficient alternative for meeting the upper North Shore's dredging needs or, whether more cost effective and/or efficient alternatives exist.

Project Partners

- Merrimack Valley Planning Commission
- State Officials
  - Senator Bruce Tarr
  - Representatives Mirra, Hill, and colleagues
- Municipal Stakeholders
  - Salisbury, Amesbury, Newburyport, Newbury, Rowley, Ipswich, Essex, Rockport, Gloucester, Manchester-by-the-Sea
- Woods Hole Group

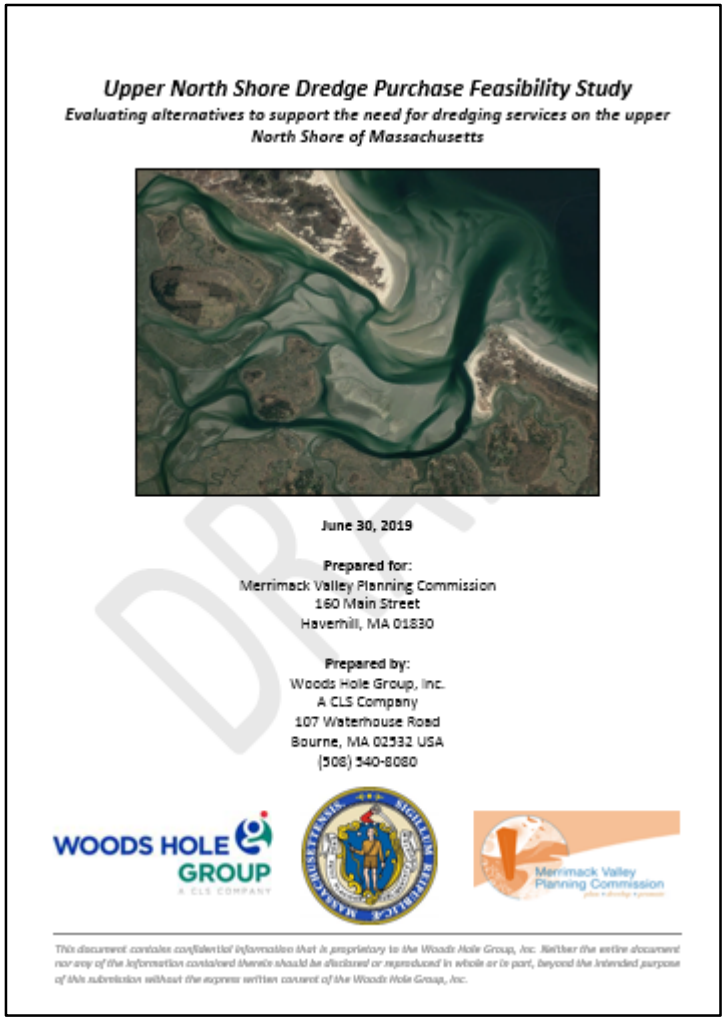
Acknowledgement of Funds

State Budget line item funds for the dredging assessment study were allocated to Executive Office of Energy and Environmental Affairs and administered by the Merrimack Valley Planning Commission (MVPC).

Final Report Outline and Overview

Attempting to Simplify a Complex, Multi-Faceted Issue

- 1.0 Introduction and Scope of Work
- 2.0 Municipal Outreach Campaign
- 3.0 Data Collection
- 4.0 Dredging 101
- 5.0 Regional Case Study
- 6.0 Dredge Volume Estimates
- 7.0 Feasibility Assessment
- 8.0 Findings and Recommendations



Upper North Shore Dredge Purchase Feasibility Study

Evaluating alternatives to support the need for dredging services on the upper North Shore of Massachusetts

June 30, 2019

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Merrimack Valley Planning Commission

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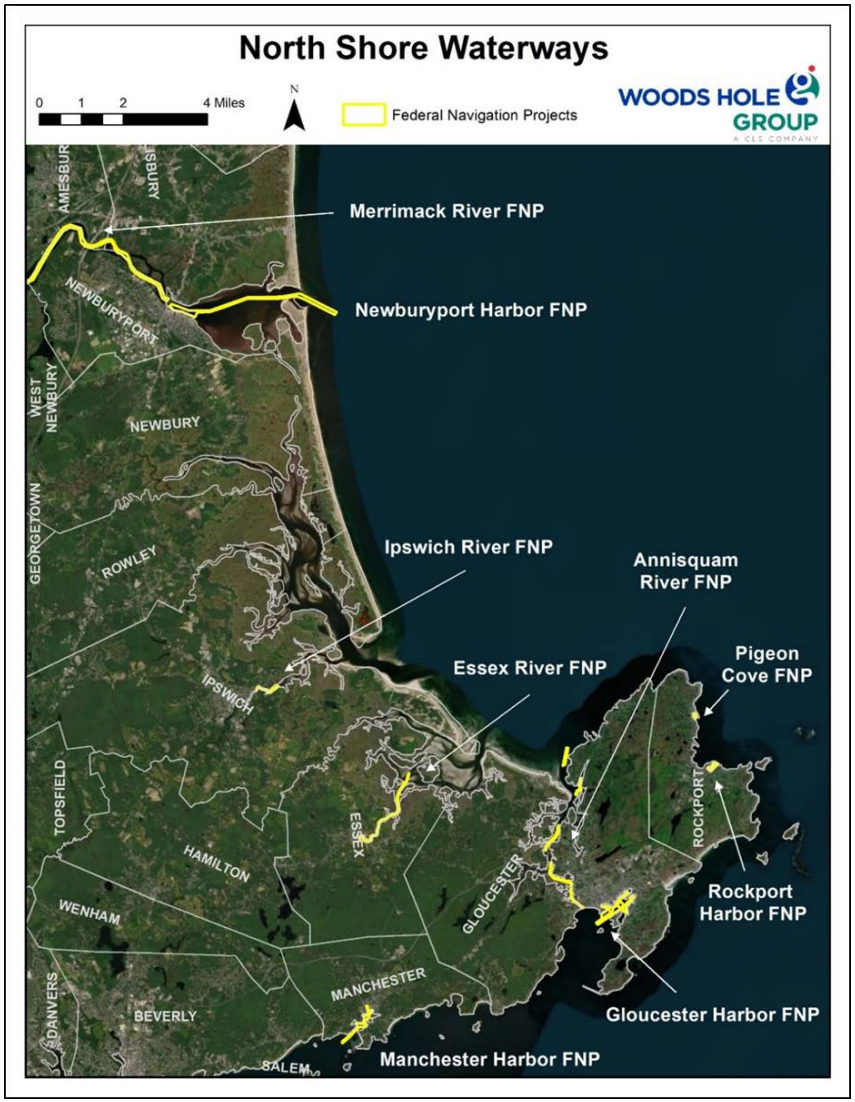
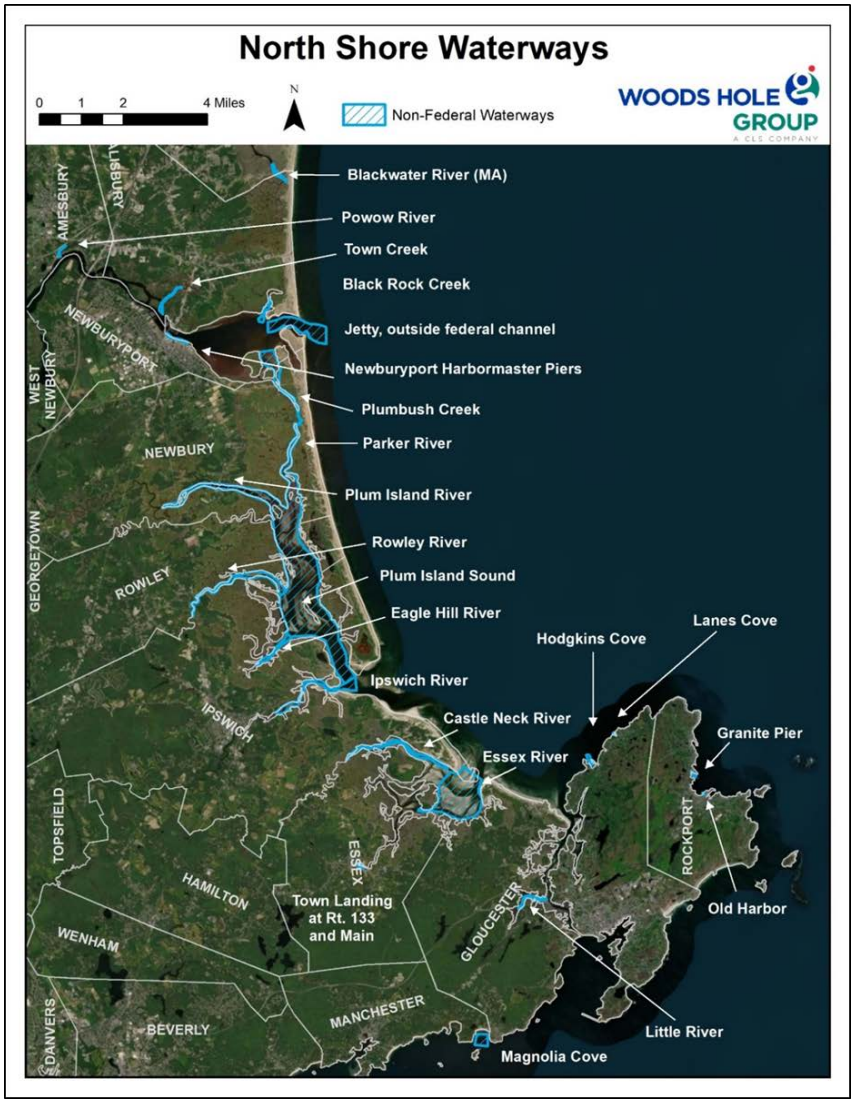
Geographic Scope

10 Upper North Shore Municipalities: 9 FNPs, 21 non-Federal waterways





Municipal Outreach Campaign
Preliminary Data Collection Survey

7 of 10 Municipalities Reporting on: Current Navigability; Specific Dredging Needs; Public Safety Concerns; Historic Dredging Events; Future Dredging Plans; Existing Permits; Preferred Alternatives for Beneficial Reuse of Dredged Material; Moorings and Marinas; Commercial and Recreational Boat Traffic

General Trends and Findings

- All 7 municipalities reported an immediate need for dredging in one or more Federal and/or non-Federal waterways.
- All FNPs located within the 7 municipalities have been previously dredged.
- Period since the last dredging event varied from a single year (2018) in Manchester Harbor to 125 years (1894) in the Ipswich River.
- Five out of the 7 municipalities reported that previous dredging events have not kept Federal and/or non-Federal waterways safe and navigable.
- Reported sediment type and preferred alternative for beneficial reuse and/or disposal varied considerably across waterways on the upper North Shore.
- At a minimum, 1,939 public and private moorings, 599 boat slips, 23 marinas, 556 Commercial Fishing Vessels, 105 Charter Fishing Vessels, and 5,455 Recreational Vessels (peak season) are reliant on safe and navigable waterways.

Data Collection

Extensive data collection effort to generate database of historic dredging events

Primary datasets included:

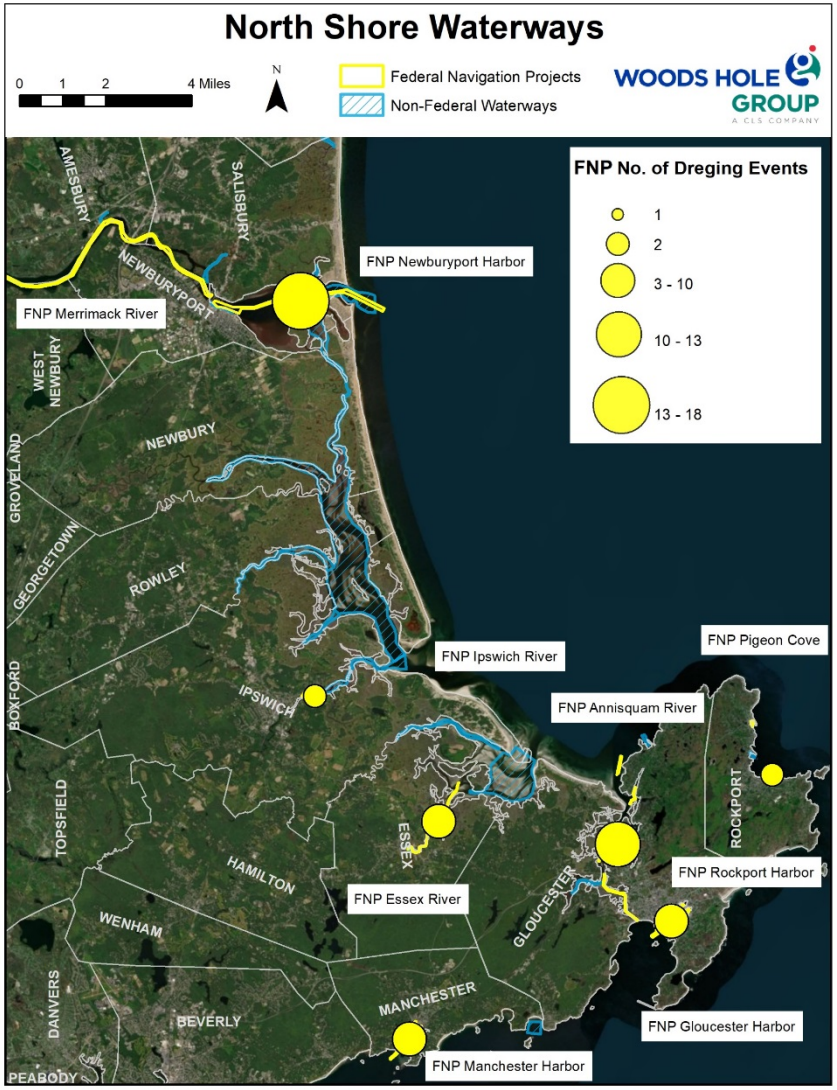
- The United States Army Corps of Engineers Annual Dredge Statistics
- The United States Army Corps of Engineers Ocean Dredged Material Disposal Site Database
- The United States Army Corps of Engineers Annual Waterways Reports
- The United States Army Corps of Engineers Hydrographic Surveys
- Urban Harbors Institute, State of Our Harbors Report
- The United States Geological Survey East Coast Sediment Texture Database

Allowing Woods Hole Group to identify:

- Project Proponents
- Type of Dredging Event (initial improvement, improvement, maintenance)
- Volume of Material Dredged (in cubic yards, cy)
- Dredged Channel Depth (feet relative to Mean Lower Low Water tidal datum, ft, MLLW)
- Characteristics of the Material Dredged
- Protocol for the Disposal of Dredged Material

Special thanks to the USACE New England Region for supporting data collection efforts

Data Collection Summary



- 3.31 million cy of material removed
- Events span 132 years
- 65 total historic dredging events
  - Nearly all in FNPs
  - Difficult to confirm non-federal events (disposal methods may not have required public record)
- Disposal alternatives included offshore, nearshore, and beach nourishment

Waterway	No. of Dredging Events	Volume (cy)	Sediment Quality
Newburyport Harbor (Merrimack River)	18	2,096,431	Gravel and Sand
Merrimack River (Upstream Reaches)	1	4,000	Sand / Mud
Ipswich River	2	11,931	Sand / Mud (Upstream)
Essex River	10	193,102	Sand / Mud (Upstream)
Annisquam River	13	596,904	Sand
Gloucester Harbor	9	254,204	Silt / Contamination
Rockport Harbor	2	50,800	Sand / Gravel / Mud
Manchester Harbor	8	105,869	Sand / Mud / Silt (Variable)
TOTAL	**65**	**3,313,241**	-

Data Collection Summary

Considering Disposal Alternatives

- Tremendous variability in sediment quality data
- Tremendous variability in preferred alternative(s) for beneficial reuse
- Conceptual Alternatives Considered:
  - Beach nourishment; Dune Enhancement; Nearshore; Offshore; Marsh Enhancement; Thin Layer Deposition (TLD)
- Summarized possible alternatives for each municipality based on:
  - Sediment quality data
  - Proximity to possible dewatering / reuse sites
  - Experience working with private dredge contractors and municipal dredge programs

Municipality	Navigation Channel	Sediment Quality	Possible Alternatives for Future Beneficial Reuse
Salisbury	Newburyport Harbor	Sand, Gravel	• Beach Nourishment and Dune Enhancement (25% Salisbury Beach, 75% Plum Island Beach)
	Black Rock Creek/ Town Creek	Mud, Sand	• Beach Nourishment and Dune Enhancement (Black Rock Creek, pump to Salisbury Beach) • Salt Marsh Enhancement • TLD (Town Creek, Black Rock Creek)
	Blackwater River	Mud, Sand	• Beach Nourishment and Dune Enhancement (Pump to Salisbury Beach) • Salt Marsh Enhancement • TLD
Amesbury	Merrimack River (upstream)	Sand, Mud	• Near-Shore Placement • Upland Disposal • Offshore Disposal
	Powwow River	Mud, Silt, Sand	• Upland Disposal • Offshore Disposal

Dredging 101

Anatomy of a Complex Industry

- Type of Dredging Event (improvement v. maintenance)
- Project Development (engineering plans, surveys, sediment sampling)
- Permitting (local, State, and Federal considerations)
- Required Equipment (types of dredging equipment, land and sea-based support)

Regional Case Study

Barnstable County Dredge: An important Case Study for the upper North Shore

- The BCD is governed by the BCD Advisory Committee, which monitors dredging operations, establishes the dredge schedule, and sets the dredge rate.
- Since the year 2000 the BCD has completed 175 projects and pumped 1,574,759 cy of sandy, beach compatible material, an average of 92,633 cy annually.
- The Barnstable County Dredge Program has consistently dredged sandy, beach compatible material at 38-68% below the market rate.
- The quick establishment of a reserve fund allowed the Barnstable County Dredge program to invest in replacement dredging equipment in 2017, 25 years after the initial dredge purchase.

Dredge Volume Estimates

Volume Estimate 1: Historic dredging records allowed Woods Hole Group to estimate the average volume of material dredged on an annual basis from waterways on the upper North Shore since the first documented dredging event.

Federal Navigation Project	No. Historic Dredging Events	Total Volume Dredged (cy)	Annual Rate* (cy/year)	Sediment Quality	Estimated % Suitable for Reuse**	Adjusted Total for Reuse (cy)
Newburyport Harbor	18	2,096,431	36,145	Sand / Gravel	100	36,145
Merrimack River (Upstream)	1	4,000	54	Sand / Mud	0	0
Ipswich River	2	11,931	90	Sand / Mud	75	68
Essex River	10	193,102	1,557	Sand / Mud	75	1,168
Annisquam River	13	596,904	4,557	Sand	100	4,557
Gloucester Harbor	9	254,204	4,707	Silt / Possible Contamination	0	0
Rockport Harbor	2	50,800	1,539	Sand / Gravel / Mud	50	770
Manchester Harbor	8	105,869	913	Sand / Mud / Silt	75	684
TOTAL	**65**	**3,313,241**	**49,562**	-	-	**43,391**

*Since first documented dredging event in the waterway

**As beach nourishment and dune enhancement

Dredge Volume Estimates

Volume Estimate 2: Recent bathymetric survey data available from the USACE allowed Woods Hole Group to estimate the volume of material immediately available to be dredged from waterways on the upper North Shore.

Federal Navigation Project	Estimated Total Volume (cy)	Expected Annual Total*	Sediment Quality	Estimated % for Beneficial Reuse	Adjusted Total for Reuse (cy)	Estimated Dredge Frequency
Newburyport Harbor & Merrimack River	139,898	27,980	Sand	100	27,980	5-year
Ipswich River	31,302	3,130	Sand / Mud (Upstream)	75	2,348	10-year
Essex River	53,108	5,311	Sand / Mud	75	3,983	10-year
Annisquam River & Gloucester Harbor	126,422	6,321	Silt / Contamination	60	3,793	20-year
Rockport Harbor	257	13	Sand / Gravel / Mud	50	7	20-year
Manchester Harbor**	-	-	Sand / Mud / Silt	-	-	20-year
TOTAL	**350,987**	**42,755**	**-**	**-**	**38,109**	**-**

*Since first documented dredging event in the waterway
**As beach nourishment and dune enhancement

Feasibility Assessment

Dredging Alternatives

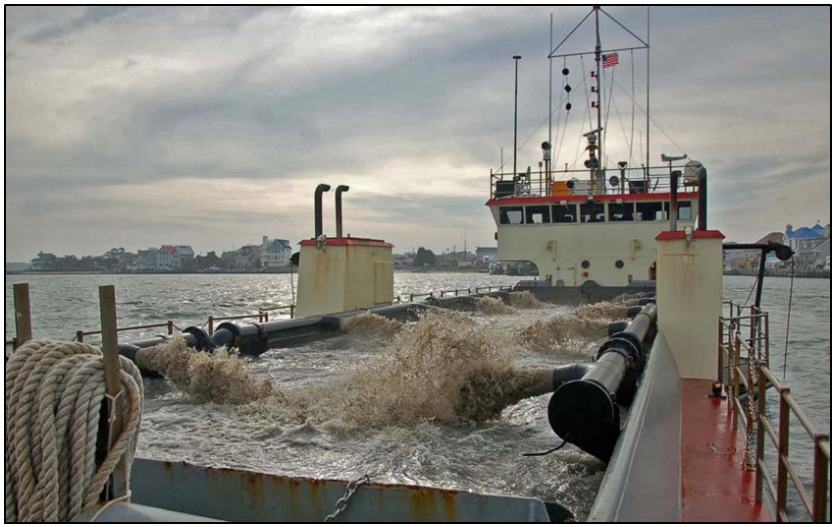
Alternative 1 – Purchase and Operation of Hydraulic Cutter Suction Pump Dredge

Alternative 2 – Purchase and Operation of Hopper Dredging Equipment

Alternative 3 – Retention of a Private Dredge Contractor – high and low bounds

Alternative 3 (low cost scenario at $10/cy)

Alternative 3 (high cost scenario at $40/cy)



Feasibility Assessment

Alternative 1 – Purchase and Operation of Hydraulic Cutter Suction Pump Dredge

Total Equipment Costs

Dredge Superstructure	Estimated Cost
Ellicott 670 Dragon	$1,800,000
Total Superstructure Costs	**$1,800,000**

Marine-Based Support Craft	Estimated Cost
Primary Push Boat	$250,000
Support Boat (to haul pipe)	$75,000
Support Skiff (to haul personnel)	$20,000
Booster Pump	$350,000
Dredge Pipe (11,000 linear feet (12-14"))	$418,000
Total Equipment Costs	**$1,113,000**

Land-Based Vehicular Support	Estimated Cost
3x GMC Sierra 2500HD Duramax Pickups	$180,000
2x Heavy-Duty Equipment Trailers	$15,000
CAT 928 Wheeled Loader	$125,000
Loader Attachments	$10,000
Land-Based Support Costs	**$330,000**

Total Equipment Costs (One-Time)	**$3,243,000**

*Does not include assumed inclusive dredge rate of $15/cy

Total Personnel and Overhead Costs

Personnel	Estimated Cost
Dredge Superintendent	$100,000
Dredge Captain	$75,000
Dredge Leverman	$65,000
Dredge Deckhand	$65,000
Dredge Deckhand	$50,000
Dredge Deckhand	$50,000
Total Personnel Cost (Annual)	**$405,000**

Overhead Cost	Estimated Cost
Maintenance	$100,000
Insurance	$25,000
Diesel Fuel	$164,000
Total Overhead Cost (Annual)	**$289,000**

Total Ancillary Cost (Annual)	**$694,000**

- Estimated dredge volume required to cover Year-1 expenses: 57,286 cy

Feasibility Assessment

Alternative 2 – Purchase and Operation of Hopper Dredging Equipment

Total Equipment Costs

Dredge Superstructure	Estimated Cost
Custom Hopper (pump-out, side-cast, bottom-dump capable)	$10,000,000
Total Superstructure Costs	**$10,000,000**

Marine-Based Support Craft	Estimated Cost
Support Boat (to haul pipe)	$75,000
Support Skiff (to haul personnel)	$20,000
Dredge Pipe (5,500 linear feet (12-14"))	$209,000
Total Equipment Costs	**$304,000**

Land-Based Vehicular Support	Estimated Cost
3x GMC Sierra 2500HD Duramax Pickups	$180,000
2x Heavy-Duty Equipment Trailers	$15,000
CAT 928 Wheeled Loader	$125,000
Loader Attachments	$10,000
Land-Based Support Costs	**$330,000**

Total Equipment Costs (One-Time)	**$10,634,000**

*Does not include assumed inclusive dredge rate of $15/cy

Total Personnel and Overhead Costs

Personnel	Estimated Cost
Dredge Superintendent	$150,000
Dredge Captain	$95,000
Dredge Leverman	$75,000
Dredge Deckhand	$65,000
Dredge Deckhand	$50,000
Dredge Deckhand	$50,000
Total Personnel Cost (Annual)	**$485,000**

Overhead Cost	Estimated Cost
Maintenance	$250,000
Insurance	$100,000
Diesel Fuel	$273,000
Total Overhead Cost (Annual)	**$623,000**

Total Ancillary Cost (Annual)	**$ 1,108,000.00**

- Estimated dredge volume required to cover Year-1 expenses: 104,595 cy

Feasibility Assessment

Alternative 3 – Retention of a Private Dredge Contractor – high and low bounds

- Assuming 3-year-on, 7-year-off cycle

Mobilization, Demobilization, and Survey Costs

Mobilization, Demobilization, and Survey Costs	Estimated Cost
Initial Mobilization	$350,000
Subsequent Mobilizations (4x)	$200,000
Pre and Post-Dredge Surveys (5x)	$30,000
Total Costs (Annual)	**$580,000**

Range of Pumping Costs

Annual Dredging Costs*	Min. Cost/CY	Max. Cost/CY
Dredging Cost per CY	$10	$40
Total Cost (Annual)	**$1,169,960**	**$4,679,840**

*Assuming 116,996 CY dredged annually

Feasibility Assessment

30-year Lifecycle Cost Comparison

Costing Criteria	Alt. 1: Hydraulic	Alt. 2: Hopper	Alt. 3: Low	Alt. 3: High
Estimated Year-1 Costs	$859,287	$1,568,927	$1,749,960	$5,529,840
Estimated 3-Year Contract Costs	-	-	$5,249,880	$15,779,520
Estimated 30-Year Lifecycle Costs	$28,343,072	$48,999,518	$15,749,640	$47,338,560

Costing Criteria	Alt. 1: Hydraulic	Alt. 2: Hopper	Alt. 3: Low	Alt. 3: High
Estimated CY to Offset Expenses	57,286	104,595	116,996	116,996
Estimated Total CY Dredged	1,889,538	3,266,633	1,052,964	1,052,964
Estimated Net Cost per CY	$15.00	$15.00	$14.96	$44.95

Alternatives 1, 2:

- Assuming total cy dredged to offset expenses over 30-year time horizon.
- Includes personnel, ancillary/overhead, and depreciation expenses.
- Excludes pumping cost of $15/cy

Alternative 3 (low/high)

- Assuming 350,987 cy of material dredged during each 3-year contract period.
- Alternative 3 includes all estimated mobilization, survey, pumping, and dewatering/disposal costs

Feasibility Assessment

Preliminary Findings

- **Regarding Minimum Dredge Volumes:**
  - The volume required to cover expenses for Alternatives 1 and 2 exceeds the estimated annual volume available to be dredged from upper North Shore FNPs.
  - It is possible that sufficient volume exists in non-Federal waterways to maintain financial solvency under Alternative 1 and Alternative 2, however, dredge records and hydrographic survey data to support this claim do not currently exist.
  - Prior to pursuing Alternatives 1 or 2, additional data collection would be required to refine annual volume estimates.
- **Regarding the most Cost-Effective Alternative:**
  - The most cost-effective Alternative for dredging on the upper North Shore of Massachusetts is Alternative 3 (low) assuming a rate of $10 per cy inclusive of simple dewatering and disposal / beneficial reuse.
  - It is possible that the rate per cy could increase substantially with pumping / barging distance, if more elaborate dewatering structure were required or if a more elaborate alternative for beneficial reuse were selected.

Weighing Pros and Cons

Alternatives 1, 2

Pros

- Reduces uncertainty and prevents scheduled projects from being delayed.
- Allows individual municipalities to exercise a high degree of autonomy in managing waterways.
- Allows projects to be implemented at a inclusive rate generally below the market average.
- Potential reduction in beach management costs while increasing coastal resilience.

Cons

- Purchasing and operating dredging equipment is a significant long-term investment.
- Contingent on identifying, permitting, and dredging a sufficient volume of material annually for the lifetime of the dredging equipment.
- Projects with significant amounts of gravel or cobble could not be completed using a hydraulic or hopper dredging equipment.
- Purchasing and operating a regional dredge would expose the owners to liability and risk.
- Ensuring equitable access to dredging equipment and scheduling may prove challenging.
- Identifying and recruiting a qualified dredge superintendent and skilled laborers with industry experience into a municipal role may prove challenging.

Weighing Pros and Cons

Alternative 3 (low, high)

Pros

- Allows individual municipalities to exercise a high degree of autonomy in managing waterways and prioritizing projects outside FNP boundaries.
- Allow municipalities to utilize the best available dredging technology and equipment.
- Ability to manage variable sediments (sand, mud, cobble, etc.).
- Reduced liability and risk.
- Avoid the need to recruit, train, and retain a skilled dredge crew.
- Sufficient dredge volumes would only be required during 3-year contract period.
- Potential reduction in beach management costs while increasing coastal resilience.

Cons

- Would not allow municipalities to retain fully depreciated assets, which may retain value.
- Contingent on identifying, permitting, and dredging a sufficient volume of material annually to ensure a cost-effective dredge rate.
- Ensuring equitable access to private dredge contracting services may prove challenging.
- Contracted dredge rates are not subsidized or fixed, and may fluctuate considerably based on available volume of material to be dredged and preferred alternative(s) for beneficial reuse.

Recommended Next Steps

- **Administrative:**
  - Establish Regional Dredge Steering Committee to evaluate Alternatives and collaborate with local, State, and Federal stakeholders to identify appropriate pathway towards improved management of upper North Shore waterways.
  - Develop a conceptual design for any future Regional Dredge Advisory Committee and administrative structure that would ensure equitable access to dredging resources.
- **Data Collection:**
  - Sediment Coring
  - Geochemical Testing
  - Hydrographic Surveying
  - Identifying Rates of Sediment Transport
  - Feasibility of alternatives for the beneficial reuse
- **Permitting:**
  - For each waterway, identify specific permitting requirements
  - Work to secure consolidated, comprehensive dredging and disposal permits for each municipality to allow for better adaptive management of waterways from year to year, based on need.

Questions, Comments, Initial Feedback?