Building Shoreline Resiliency in Marshfield & Duxbury through Beach and Dune Nourishment





Overview



CZM Coastal Resilience Grant Program

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Project Goals & Funding

Identify sites where beach & dune nourishment can be used to augment the Town's existing approaches for building shoreline resiliency and begin the permitting process for the selected sites.

Project Funding: CZM Coastal Resiliency Grant Project Cost: \$234,546 Grant Award: \$175,842 Town Match: \$58,704 (cash & in-kind services)

Grant Awarded: September 2019 Study Completion: September 30, 2020

Marshfield & Duxbury Today

- Vibrant coastal communities
- Year-round and seasonal residents





- Single-family homes
- Commercial development
- Barrier beaches & coastal headlands

Coastal Armoring





Coastal Armoring Impacts

- Benefits: last line of defense for erosion
- Disadvantage: adversely impacts fronting beaches



Coastal Armoring Impacts (cont.)

- Lower beach elevation beach elevation beach elevation
- Deeper water >> larger waves impacting the walls
- More overtopping increased damage



Current Management Approach

- Maintain/repair shore protection structures
- Elevate/buy out structures
- Regulate development in high hazard areas
- Planning studies MVP, CZM resiliency, etc.



Costs Associated with Status Quo

	Projected Costs Over Next 30 Years			
Town	FEMA Repetitive Loss Claims	Seawall Repairs	Storm Related Public Services	Total
Marshfield	\$15.1 million	\$49.5 million	\$7.3 million	\$71.9 million
Duxbury	\$5.0 million	\$15.9 million*	\$5.5 million	\$26.4 million
* doesn't include costs for annual maintenanc				ual maintenance

- Continued overtopping & damage to properties
- Continued risks to public safety
- Continued seawall damage
- Increased costs to repair/replace/maintain walls
- Potential loss of tax revenue
- Loss of beach for storm damage protection
- Loss of beach for recreation and wildlife habitat
- Decline in tourism

Need for Increased Resiliency

Goal: ID & permit resilient strategies that will:

- improve storm damage protection
- reduce damages caused by coastal flooding
- reduce wave-induced damages
- create resiliency to climate change
- augment current management approach



Shoreline Evaluation

- Natural beach & dune
 - Rexhame Public Beach
 - Winslow Ave
 - Green Harbor
- Seawalls
 - Fieldston & Sunrise
 - Hewitt's Point
 - Brant Rock
 - Bay Ave
 - Gurnet Rd
- Revetments
 - Ocean Bluff
 - Hewitt's Point
 - South Brant Rock



Resiliency Alternatives Considered

Traditional Nature Based Alternatives

- Buffer to storm waves
- Restore sediment to the system
- Combine with coastal armoring



• Require renourishment



Dune Nourishment



Resiliency Alternatives Considered

Hybrid Alternatives

- Reduce wave energy
- Layered or individual
- Flexible adaptation over time

Constructed Reefs

Source: Univ. of California, 2018

Reef Ball

Living Shoreline







Evaluation of Factors



Example Evaluation Process



Rexhame Beach Evaluation

Rexhame Beach	Action & Estimated Cost	Recommendation	
Status Quo	Maintain existing structures; estimated costs for FEMA claims & post storm clean up > \$2 M over next 30 years	Continued storm damage – not recommended	
Enhance/Enlarge Existing Structures	Increase height of existing walls to reduce overtopping; estimated cost of \$21.1 M	Costly solution with no benefits to beach – not recommended	
Beach Nourishment	NA - impacts to rocky intertidal resources	Not permittable – not considered	
Dune Nourishment	NA - impacts to rocky intertidal resources	Not permittable – not considered	
Intertidal Boulder Field	Install intertidal bounder field to reduce overtopping; estimated cost of \$8.1 M	Further evaluation & design warranted	
Elevate Structures	Elevate 1 st row homes; estimated cost of \$5.1 M for 41 homes	Phased implementation over next 30 years	
Managed Retreat	Managed retreat for 1 st row of homes; estimated cost of \$26.5 M for 41 homes	Phased implementation over next 30 years	

* Developed section of Rexhame Beach: Parker St to Porter St

Ocean Bluff Evaluation

Ocean Bluff	Action & Estimated Cost	Recommendation
Status Quo	Maintain existing structures; estimated costs for FEMA claims & post storm clean up \$9.3 M over next 30 years	Continued storm damage – not recommended
Enhance/Enlarge Existing Structures	Increase height of existing walls to reduce overtopping; estimated cost of > \$17 M	Costly solution with no benefits to beach – not recommended
Beach Nourishment	NA - impacts to rocky intertidal resources & need for frequent renourishment	Not permittable or cost effective- not considered
Dune Nourishment	NA - impacts to rocky intertidal resources & need for frequent renourishment	Not permittable or cost effective- not considered
Intertidal Boulder Field	Install intertidal bounder field to reduce overtopping; estimated cost of \$5 M	Further evaluation & design warranted
Managed Retreat	Managed retreat for at risk homes; estimated cost of \$7.6 M for ~12 to 15 homes	Phased implementation over next 30 years

* Ocean Bluff Beach: South end Foster Ave. to Samoset Ave.

Gurnet Rd. Beach Evaluation

Gurnet Rd.	Action & Estimated Cost	Recommendation
Status Quo	Maintain existing structures; estimated costs for FEMA claims & post storm clean up \$27 M over next 30 years	Continued storm damage – not recommended
Enhance/Enlarge Existing Structures	Increase height of existing walls to reduce overtopping; estimated cost of \$28.4 M	Costly solution with no benefits to beach – not recommended
Beach Nourishment	Large-scale beach nourishment with renourishment every 3-5 years; estimated cost of \$5.0 M for Duxbury	Improved storm damage protection, recreation, habitat – proceed with permitting
Dune Nourishment	Dune nourishment in combination with beach nourishment	Proceed with permitting for combined dune & beach nourishment
Intertidal Boulder Field	NA – impacts to intertidal beach; conversion of resource area	Not considered
Elevate Structures	Elevate 1 st row homes; estimated cost of \$7.1 M for 57 homes	Phased implementation over next 30 years
Managed Retreat	Managed retreat for 1 st row of homes; estimated cost of \$47.3 M	Phased implementation over next 30 years

Sites Selected for "Soft" Solutions

- Dune nourishment

 Rexhame Public Beach
 Winslow Ave. Beach

 Beach & dune

 nourishment
 - Fieldston & Sunrise Beaches
 - Bay Ave & Gurnet Rd Beaches



Sites Selected for Other Solutions

- Hybrid alternatives with co-benefits, elevate homes and/or managed retreat
 - Rexhame Beach
 - Ocean Bluff
 - Hewitt's Point
 - Brant Rock
 - South Brant Rock
 - Blue Fish Cove
- Status quo
 - Blakeman's Point
 - Green Harbor Beach



Rexhame Public Beach

Alt 1

- Dune nourishment Alt 2
- Dune + beach nourishment Alt 3
- Dune + beach nourishment





Rexhame Public Beach

Alternative	Volume (cy)/ Footprint Area (acres)	Level of Storm Damage Protection	Service Live (yrs)	Cost (\$)
Rexhame Public – Alt 1	47,240 cy/ 5.3 acres	50-yr storm	10	\$1.6 M
Rexhame Public – Alt 2	82,580 cy/ 14.9 acres	50-yr storm	6	\$2.7 M
Rexhame Public – Alt 3	129,000 cy 14.1 acres	50-yr storm	8	\$3.9 M

Preferred Alternative: Rexhame Public – Alt 1

fine- to medium-grained sand

Benefits: storm damage protection, habitat, recreation

Winslow Ave. Beach

Alt 1

- Dune nourishment Alt 2
- Dune nourishment





Winslow Ave. Beach (cont.)

Alternative	Volume (cy)/ Footprint Area (acres)	Level of Storm Damage Protection	Cost (\$)
Winslow – Alt 1	11,200 cy/ 3.7 acres	~ 10-yr storm	\$336 K
Winslow – Alt 2	17,850 cy/ 4.5 acres	> 10-yr storm < 50-yr storm	\$535 K

Preferred Alternative: Winslow – Alt 2 - cobble sized sediment to match existing dune Benefits: storm damage protection

Fieldston & Sunrise Beaches

Alt 1

- Dune + beach nourishment Alt 2
- Dune + beach nourishment

Alt 3

- Beach nourishment



Fieldston & Sunrise Alternatives

- Fieldson/Sunrise— Alt 1
 20 ft wide dune crest at elevation 13 ft; 55 ft wide berm at elevation
 8.0 ft; 1:20 slope to natural grade
- Fieldston/Sunrise Alt 2
 - 30 ft wide dune crest at elevation 13 ft; 90 ft wide berm at elevation 9.0 ft; 1:12 slope to natural grade
- Fieldston/Sunrise Alt 3

100 ft wide berm at elevation 11 ft; 1:15 slope to natural grade



Transect 12 - Sunrise Beach (11th St)

Fieldston & Sunrise Beaches (cont.)

Alternative	Volume (cy)/ Footprint Area (acres)	Overtopping Protection	Service Live (yrs)	Cost (\$)
Fieldston/ Sunrise – Alt 1	339,350 cy/ 37.0 acres	10-yr storm	3	\$10.1 M
Fieldston/ Sunrise – Alt 2	389,770 cy/ 30.5 acres	10-yr storm	4	\$11.6 M
Fieldston/ Sunrise – Alt 3	409,100 cy/ 34.0 acres	10-yr storm	3.5	\$12.2 M

Preferred Alternative: Fieldston/Sunrise– Alt 2 - medium-grained sand mixed with gravel & cobble Benefits: reduced overtopping, habitat & recreation

Bay Ave/Gurnet Rd Beaches

Alt 1

- Dune + beach nourishment
- Alt 2
- Dune + beach nourishment
- Alt 3
- Beach nourishment



Bay Ave/Gurnet Rd Alternatives

- Bay Ave/Gurnet Rd Alt 1
 20 ft wide dune crest at elevation 11 ft; 85 ft wide berm at elevation
 8.0 ft; 1:20 slope to natural grade
- Bay Ave/Gurnet Rd Alt 2 30 ft wide dune crest at elevation 13 ft; 90 ft wide berm at elevation 9.5 ft; 1:12 slope to natural grade
- Bay Ave/Gurnet Rd Alt 3

100 ft wide berm at elevation 11 ft; 1:15 slope to natural grade



Bay Ave/Gurnet Rd Beaches (cont.)

Alternative	Footprint Area (acres)	Overtopping Protection	Service Live (yrs)	Cost M/D (\$)
Bay Ave/ Gurnet Rd – Alt 1	313,160 cy/ 50.3 acres	10-yr storm	4.5	\$4.4 M/ \$5.0 M
Bay Ave/ Gurnet Rd – Alt 2	511,030 cy/ 36.4 acres	10-yr storm	5	\$7.2 M/ \$8.1 M
Bay Ave/ Gurnet Rd – Alt 3	527,740 cy/ 41.5 acres	10-yr storm	5.5	\$7.4 M/ \$8.4 M

Preferred Alternative: Bay Ave/Gurnet Rd– Alt 1

- medium-grained sand mixed with gravel & cobble Benefits: reduced overtopping, habitat, recreation

Bay Ave/Gurnet Rd Performance



Property Ownership

- Nourishment proposed on private properties
 - northern end of Rexhame Public Beach
 - Fieldston & Sunrise Beaches
 - Bay Ave & Gurnet Rd Beaches
- Requires public access easements
 - allows public use of beaches nourished using public \$
 - letters to property owners going out in Sept.
 - requires all property owners to sign easements







Sources of Nourishment Material

- Sources compatible with existing beaches
- Option 1 upland source trucked to the sites
- Option 2 beneficial reuse from dredging projects Green Harbor dredging (~ 30,000 cy/yr) South River dredging Federal dredging projects
 - offshore borrow site(s)





Permitting

- MEPA Expanded Environmental Notification Form Sept. 15, 2020
- MEPA Environmental Impact Report (EIR) 4th quarter 2020 (if required)
- Marshfield & Duxbury Conservation Commissions
- Mass DEP Waterways
- Mass Coastal Zone Management
- US Army Corps of Engineers Feb. 2021 through Feb. 2022
- Towns identify and secure sources of funding
- *Earliest possible construction winter 2023*

Questions & Comments

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Answers to Frequently Asked Questions: <u>www.Marshfield-ma.gov/planning-department</u>

www.town.Duxbury.ma.us/planning-department