OGS Contract SC813, Project SD353

West Shinnecock Bay Water Quality Improvement Feasibility Study

Pre-Screening Study Summary

Study Overview

Water quality in western Shinnecock Bay has been deteriorating due to watershed pollutant loadings and lack of adequate tidal flushing with the Atlantic Ocean. This has resulted in harmful algal blooms, other environmental issues, and public health concerns. To address this, Dewberry, under contract to the New York State Office of General Services (OGS) and supporting the New York State Department of Environmental Conservation (DEC), performed this study to improve water quality in the Bay.

Flow exchange between the ocean and bay can be improved through **dredging**, water **exchange structures** (submerged pipe with pump), and **cuts in the barrier island** at selected locations along Dune Road. Applying these three broad strategies, Dewberry developed individual projects, referred to as **options**, for an interdisciplinary pre-screening effort.

The objective of this study was to help identify three **alternatives** for a more detailed feasibility study. A total of 16 options were developed for pre-screening, each of which were evaluated based on four broad criteria: water quality, constructability, environmental impact, and social acceptance.

Location map for the initial 16 options considered in the pre-screening process

Based on the pre-screening exercise, and in collaboration with OGS, DEC, Town of Southampton, Town of Southampton Trustees, Suffolk County, and USACE, Dewberry **shortlisted three options** for the development of alternatives. These alternatives will be based on options **E3B** (one-way pipe with pump at Triton Lane that pumps ocean water into the bay), **O1** (seasonal cuts at Road L and 0.3 miles east of Triton Lane), and **O2** (permanent water exchange structure 0.3 miles east of Triton Lane).

The Long Island Nitrogen Action Plan (LINAP), a multi-year initiative to reduce nitrogen in Long Island's surface and ground waters, will use information generated from the Shinnecock Bay project in any future considerations of using hydromodification practices to improve water quality. LINAP is a collaborative effort by DEC, the Long Island Regional Planning Council, Suffolk and Nassau counties, and multiple partners and stakeholders. Many nitrogen reducing strategies are being looked at, including hydromodification.

Dredging (D) Options

Dredging (D) options are defined as those that increase the flow between Shinnecock Inlet, western Shinnecock Bay, and Quantuck Bay. They include removing impediments to flow and increasing the volume of flow. There are a total of five options representing five locations.

D1 - Modification of Shinnecock Inlet

Dredging the existing Shinnecock Inlet to break through an existing shoal and connect the deep waters on each side to improve conveyance of ocean waters into Shinnecock Bay

D2 – Removal of Flow Impediments Under Ponquogue Bridge

Installing culverts under northern and southern causeways at Ponquogue Bridge and dredging under the bridge to improve hydrodynamic communication between eastern and western Shinnecock Bays

D3 - Improve Hydrodynamic Connection between Ponquogue Bridge and Shinnecock Inlet

Deepening and widening the Inner Channel, the area between Ponquogue Bridge and Shinnecock Inlet, to improve flow communication to and from the inlet and the Long Island Intracoastal Waterway (LIIW)

D4 – New Bay Side Channel Parallel to Dune Road

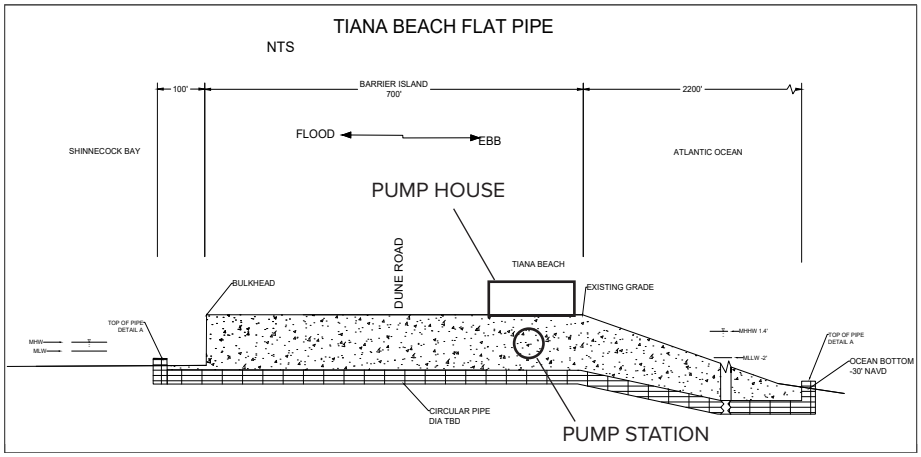
Dredging a channel in the center portion of the bay parallel to Dune Road and the horizontal alignment of the LIIW to provide a pathway for water to reach the inlet by augmenting conveyance and increasing flushing

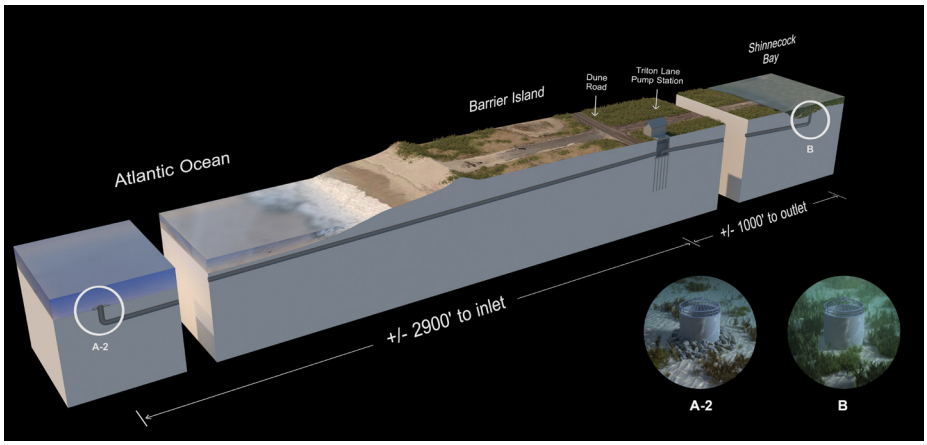
D5 – Improve Conveyance through Long Island Intracoastal Waterway

Maintaining the authorized width and deepening the Long Island Intracoastal Waterway, and removing shoaling/large sand ridge west of Ponquogue Bridge (includes options D1 and D3)

Water Exchange (E) Options

Exchange (E) options are defined as those that establish ocean and bay water exchange by creating pathways for ocean water into the bay, and vice versa, by utilizing pump-driven flow through a pipe at various locations and flow directions.





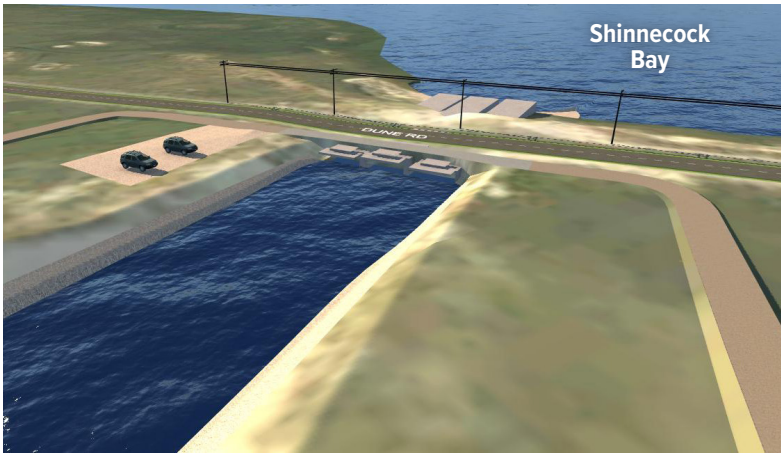
The pipe will transverse through and under the barrier island, under the dune and beach, and emerge from the ocean floor about 2,200 ft from the shore line. The bay side of the pipe will emerge from the bay bottom about 100 feet from the shoreline (except for option E3B-L). Pre-screening options considered circular, 7 ft diameter concrete pipes and one pump station.

Water Exchange Options Definitions

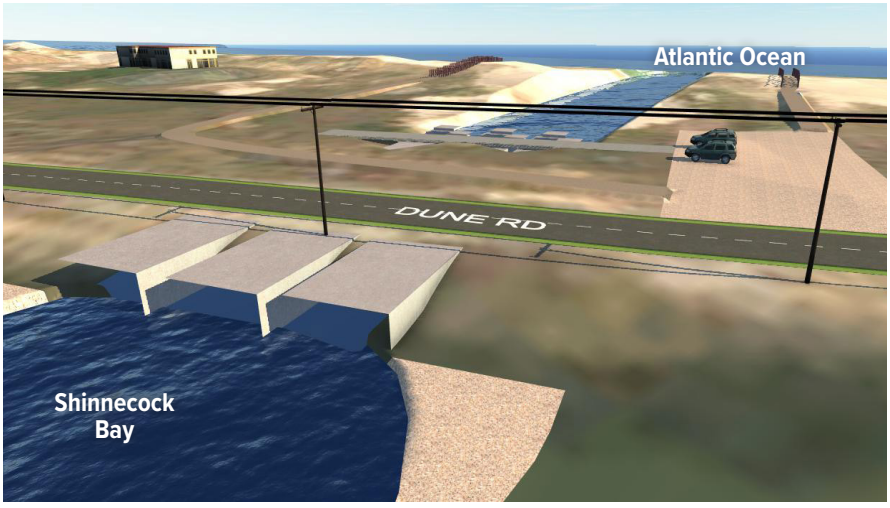
E1B	Buried pipe with pump under Dune Road at Tiana Beach, one-way flow from Atlantic Ocean into Shinnecock Bay
E2B	Buried pipe with pump under Dune Road at Sand Bar Beach, one-way flow from Atlantic Ocean into Shinnecock Bay
E3B	Buried pipe with pump under Dune Road at Triton Lane, one-way flow from Atlantic Ocean into Shinnecock Bay
E3O	Buried pipe with pump under Dune Road at Triton Lane, one-way flow from Shinnecock Bay into Atlantic Ocean
E3T	Buried pipe with pump under Dune Road at Triton Lane, two-way flow between Atlantic Ocean and Shinnecock Bay that reverses flow direction every 6 hours
E3B-L	Buried pipe with pump under Dune Road at Triton Lane, one-way flow from Atlantic Ocean into Shinnecock Bay, extending to the central portion of the bay (4,890 ft offshore)
E4B	Buried pipe with pump under Dune Road at Surf Club of Quogue, one-way flow from Atlantic Ocean into Shinnecock Bay (discharging from vertical Quogue Canal wall)
E5B	Buried pipe with pump under Dune Road at Quantuck Bay, one-way flow from Atlantic Ocean into Quantuck Bay
E5T	Buried pipe with pump under Dune Road at Quantuck Bay, two-way flow between Atlantic Ocean and Quantuck Bay

Other (O) Options

Other (O) options include ones that introduce water exchange between the ocean and bay through cuts in the barrier island. Locations and implementation options (seasonal vs permanent) were developed based on recommendations received from the Town of Southampton, NY Governor's office, and leveraging the previous study (SD142). The two options pre-screened were: (a) seasonal cuts at 0.3 miles east of Triton Lane (O1-1) and Road L (O1-2), and (b) a permanent water exchange structure located approximately 0.3 miles east of Triton Lane (O2).



Preliminary conceptual rendering of option O1, 0.3 miles east of Triton Lane (O1-1)



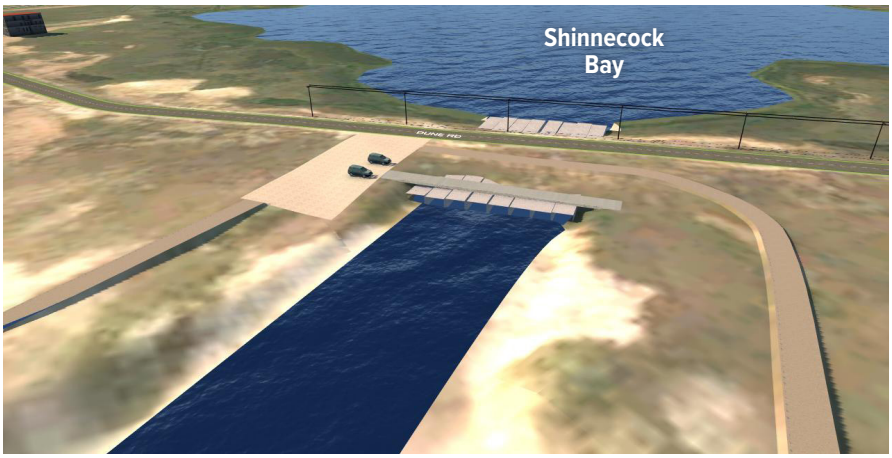
Preliminary conceptual rendering of option O1 at Road L (O1-2)

O1 – Seasonal Cuts at two locations along Dune Road

Two seasonal cuts in the barrier island at Road L and 0.3 miles east of Triton Lane will be installed using a 60' wide x 5' high x 70' long box culvert system under Dune Road. To ensure water exchange to improve water quality, the cuts will be open for three months during the year. During the reminder of the year and in the advent of a storm event, they will be closed manually using tide gates installed on the ocean side of the culverts under Dune Road.

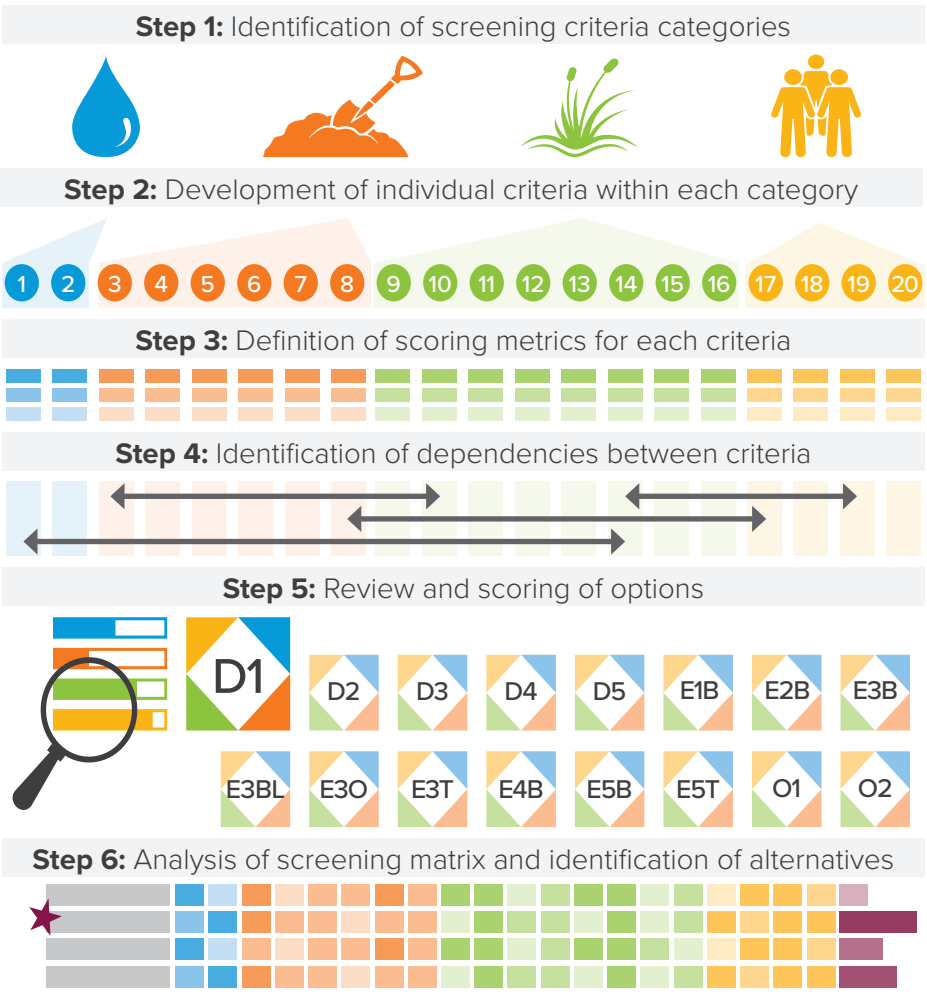
O2 – Permanent Water Exchange Structure

A new permanent water exchange structure will be installed 0.3 miles east of Triton Lane. This feature will be 100 ft wide x 5 ft high by 70 ft long, and will be implemented using eight box culverts that will each be 12 ft wide. The culverts will be under Dune Road with flood log structures for closure during the advent of storm events.



Preliminary conceptual rendering of option O2, 0.3 miles east of Triton Lane

Pre-Screening Process



Dewberry identified a total of seven different locations resulting in sixteen different options described in the Pre-Screening Report.

To implement the pre-screening process, a Pre-screening Criteria Matrix was developed by Dewberry as an interactive and adaptive decision support framework that incorporates defined criteria to assess and evaluate the sixteen options. Individual scoring metrics (quantitative and qualitative) were defined for each criterion to enable scoring of the sixteen options independently. The interdisciplinary pre-screening process facilitated the narrowing down of the sixteen options into three alternatives for a detailed feasibility assessment to identify the preferred alternative.

Pre-Screening Criteria

The sixteen options were pre-screened through a qualitative evaluation process using four broad criteria categories:

1. Water Quality,
2. Constructability,
3. Environmental Impact, and
4. Social Acceptance.

Under each category, detailed, interdisciplinary sub-criteria were developed to comprehensively address possible scientific, environmental, cost, real estate, legal, administrative, social and other concerns, as seen in the figure to the right.

Sub-Criteria Definitions

	CRITERIA	METRIC	DEFINITION
Water Quality	Residence Time	Excellent	Percent reduction in residence time that brings any waterbody's residence time within the County's "ideal" goal
		Improved	Percent reduction in residence time that brings any waterbody's residence time within the County's "improved" goal
		Marginal	No significant benifit to residence time (does not meet County's "ideal" or "improved" goals)
	Littoral Processes	Low	Insignificant or no impacts to littoral processes with no mitigation requirements
		Medium	May create impacts that are acceptable or mitigated with small costs
		High	Likely to create significant inlet shoaling and bay trapping without significant mitigation costs such as dredging and sediment by-passing
Constructability	Initial Cost	Low	Estimate does not exceed $15 million
		Medium	Estimate falls between $15 and $50 million
		High	Estimate exceeds $50 million
	Real Estate	Low	Public property with fewer properties impacted
		Medium	Few private properties or many public properties impacted
		High	Many private properties impacted
	O&M Cost	Low	Estimate does not exceed $200 thousand annually
		Medium	Estimate falls between $200 thousand and $500 thousand annually
		High	Estimate exceeds $500 thousand annually
	Construction Schedule	Short	Less than 1 year to substantially complete
		Moderate	Between 1 year to 3 years to substantially complete
		Long	Over 3 years to substantially complete
	CEHA	Absent	Project area not within a regulatory CEHAs
		Present	Project area within a regulatory CEHAs
	CBRS	Absent	Project area not within CBRS area
		Present	Project area within CBRS area
Environmental Impact	Wetlands	Absent	Unlikely existence of wetland habitat
		Present	Likely existence of wetland habitat
	SAV Habitat	Absent	Unlikely existence of SAV habitat
		Present	Likely existence of SAV habitat
	Shellfish Habitat	Absent	Unlikely existence of shellfish habitat
		Present	Likely existence of shellfish habitat
	T&E Species	Absent	Unlikely existence of T&E species
		Present	Likely existence of T&E species

Sub-Criteria Definitions

	CRITERIA	METRIC	DEFINITION
Environmental Impact	Historic Architecture / Districts	**Absent**	There are no historic properties or districts within or near the project area.
		Present	There are previously recorded historic properties or districts within or in proximity to the project area.
	Archaeological Sensitivity	**Low**	Potential exists for the alignment to encounter archaeology based upon lack of disturbance to the area and favorable environmental criteria, including within 400-500 feet from potable water.
		Moderate	An elevated potential to encounter archaeological sites, including within 300-400 feet from potable water, within an OPRHP Archaeological Sensitive Area or adjacent to a mapped NOAA submerged wreck or obstruction.
		High	Extremely likely for the alignment to encounter archaeology. Presence of an archaeological site at or nearby (up to 300 feet) from the project area.
	Permit Complexity	**Low**	Joint Nationwide USACE/NYSDEC General Permit
		Moderate	Joint Individual USACE/NYSDEC Permit or Nationwide USACE/NYSDEC Permits
		High	Joint Individual USACE/NYSDEC Permit with higher degree of regulatory scrutiny, potential Section 408 approvals, and/or Act of Congress
	Potential Environmental Documentation	**Low**	SEQRA Unlisted Action/Federal Categorical Exclusion (CE)
		Moderate	SEQRA Type 1/Federal EA
		High	SEQRA Type 1/Federal EIS
Social Acceptance	Visual/Noise Impacts	**Low**	All features (e.g., pump house, culverts) and accessories (e.g., gate operating structures, associated utility infrastructure) of the proposed option are “out of sight” and will not cause any noise impacts.
		Moderate	Features and accessories will have moderate visual signature. Noise impacts are expected, but will be minimally acceptable due to schedule and noise level.
		High	Features and accessories of proposed options will have a large visual signature and high noise levels that are likely not acceptable.
	Legal Actions Required	**Low**	None
		Moderate	One
		High	More than one
	Public Healty & Safety	**Low**	The potential for conflicts with public uses are non-existent or low.
		Moderate	The potential operational conflicts or safety concerns are moderate and acceptable, or can be mitigated at low cost.
		High	Likely to create significant operational conflicts as well as safety concerns.
	Resilience	**Meets**	The proposed option is self-resilient against natural hazards but do not offer any form of additional protection to the Town of Southampton. Examples: 1) gates on culverts can be closed to avoid floodwaters reaching the bay 2) proposed measures are stable under storm and seismic hazards and do not increase vulnerability to site and adjacent locations.
		Adverse	Proposed measures are not self-resilient against natural hazards or causes adverse impacts due to natural hazard events.

Water Quality Modeling

The Environmental Fluid Dynamics Code (EFDC) model serves as the tool to assess the water quality improvement goal solutions in SD353, which builds upon the previous phase (SD142) of this project. The domain of the EFDC model developed for the pre-screening study included the confluence of Moriches Bay & Quantuck Canal to the west through Quogue Canal and western Shinnecock Bay to eastern Shinnecock Bay to the east.

Reductions in residence times, which correspond to increased flushing in the embayments and water bodies, have been used as proxies, i.e. qualitative indicators, of possible improvements in water quality. Reductions in residence times predicted in this study should not be used to infer or interpret similar improvements in specific water quality parameters.

Dewberry collaborated with DEC and Suffolk County to identify the best approach for modeling residence time and evaluating residence time reductions. The approach used in the current study included only western water bodies (west of bridge to Quantuck Canal) tagged with initial tracer concentration of 1.0. Due to the disparity in SD353 and County residence times, percent reductions from existing to improved and ideal goals set by the County were used as metrics in the pre-screening phase to identify the efficacy of proposed options.

Note that relative changes in residence times as applied in this study may impose some uncertainty in the findings. Also, the system-wide approach applied in this study can mask localized residence time improvements in some cases.

Reductions in Residence Times

	Option Location	Reduction in Western Shinnecock Bay	Reduction in Quantuck Bay
D1	Shinnecock Inlet	0%	1%
D2	Ponquogue Bridge	0%	0%
D3	Shinnecock Inlet to Ponquogue Bridge	0%	0%
D4	New channel from Ponquogue Bridge to Quogue Canal	0%	1%
D5	Long Island Intracoastal Waterway (D1+D3+D5)	-16%*	21%
E1B	Tiana Beach Ocean-to-Bay	2%	0%
E2B	Sand Bar Beach Ocean-to-Bay	9%	0%
E3B	Triton Lane Ocean-to-Bay	16%	0%
E3B-L	Triton Lane - Ocean-to-Bay extended into middle of western Shinnecock Bay	16%	1%
E3O	Triton Lane Bay-to-Ocean	9%	1%
E3T	Triton Lane bidirectional flow	8%	0%
E4B	Surf Club of Quogue Ocean-to-Bay	17%	84%
E5B	Quantuck Beach Club Ocean-to-Bay	1%	94%
E5T	Quantuck Beach Club bidirectional flow	1%	85%
O1	Seasonal Open Cuts	17%	2%
O2	Permanent Water Exchange Structure	18%	1%

* Note that a negative percentage indicates an increase in Residence Time.

Pre-Screening Results Summary

	Water Quality		Constructability						Environmental Impact								Social Acceptance			
	Residence Time	Littoral Processes	Initial Cost	Real Estate/Permanent Easement Cost	O&M Cost	Construction Schedule	CEHA	CBRS	Wetlands	SAV Habitat	Shellfish Habitat	T&E Species	Historic Architecture/ Districts	Archaeological Sensitivity	Permit Complexity	Potential Environmental Documentation	Visual/ Noise Impacts	Legal Actions Required	Public Health & Safety	Resilience
D1	Marginal	Medium	Low	Low	Low	Short	Absent	Present	Absent	Absent	Absent	Present	Absent	Moderate	High	Medium	Low	Low	Low	Adverse
D2	Marginal	Low	Low	Low	Low	Moderate	Absent	Present	Absent	Present	Absent	Present	Absent	Moderate	Medium	Low	Medium	Low	Medium	Meets
D3	Marginal	Medium	Medium	Low	Medium	Moderate	Absent	Present	Present	Absent	Absent	Present	Absent	Moderate	Medium	Medium	Low	Low	Low	Meets
D4	Marginal	Medium	High	Low	High	Long	Absent	Present	Present	Present	Absent	Present	Absent	Moderate	High	High	Low	Low	Low	Meets
D5	Marginal	Medium	High	Low	High	Moderate	Absent	Present	Present	Present	Present	Present	1	Moderate	Medium	Medium	Low	Low	Low	Meets
E1B	Marginal	Low	High	Low	High	Moderate	Present	Present	Present	Present	Absent	Present	Absent	Low	Medium	Medium	Medium	Medium	Low	Meets
E2B	Improved	Low	High	Low	High	Moderate	Present	Present	Present	Present	Absent	Present	Absent	Low	Medium	Medium	Medium	Medium	Low	Meets
E3B	Improved	Low	High	Medium	High	Moderate	Present	Present	Present	Present	Absent	Present	Absent	Low	Medium	Medium	Medium	High	Low	Meets
E3BL	Improved	Low	High	Medium	High	Long	Present	Present	Present	Present	Absent	Present	Absent	Low	Medium	Medium	Medium	High	Medium	Meets
E3O	Improved	Low	High	Medium	High	Moderate	Present	Present	Present	Present	Absent	Present	Absent	Low	Medium	Medium	Medium	High	Low	Meets
E3T	Improved	Low	High	Medium	High	Moderate	Present	Present	Present	Present	Absent	Present	Absent	Low	Medium	Medium	Medium	High	Low	Meets
E4B	Improved	Low	High	High	High	Moderate	Present	Absent	Absent	Absent	Absent	Present	1	Low	Medium	Medium	Medium	Medium	Low	Meets
E5B	Excellent	Low	High	High	High	Moderate	Present	Absent	Absent	Absent	Absent	Present	Absent	Low	Medium	Medium	Medium	Medium	Low	Meets
E5T	Improved	Low	High	High	High	Moderate	Present	Absent	Absent	Absent	Absent	Present	Absent	Low	Medium	Medium	Medium	Medium	Low	Meets
O1	Improved	High	Low	Medium	High	Moderate	Present	Present	Present	Absent (O1-1) Present (O1-2)	Absent	Present	Absent	Low	High	High	High	High	Medium	Meets
O2	Improved	High	Low	Low	High	Moderate	Present	Present	Present	Present	Absent	Present	Absent	Low	High	High	High	Medium	Medium	Meets

Next Steps and Considerations Moving Forward

The three shortlisted options, E3B (one-way pipe with pump at Triton Lane that pumps ocean water into the bay), O1 (seasonal cuts at Road L and 0.3 miles east of Triton Lane), and O2 (permanent water exchange structure 0.3 miles east of Triton Lane) will be used for developing alternatives for the feasibility assessment phase of this study. That assessment will result in a preferred alternative.

General Considerations

The following key considerations were received, consolidated, and incorporated into identification of the alternatives to be selected for further evaluation:

- Due to the lack of appreciable effect on water quality, dredging options will not be considered for further analysis.
- Intangible benefits of the pipe and pump options are critical to consider. Relative to the other options, local reaction would likely be better and aesthetics would be more acceptable.
- Pipe/pump options cause the least permanent damage to the beach and have less performance risk, whereas O options have more performance risk.
- Recognizing costs in conjunction with relatively high water quality improvements, the O options warrant further consideration.

E Options Considerations

Further evaluation of **E3B** will include the following considerations:

- Pre-screening assumed a 7' diameter pipe, a 200 cfs pump running 24/7 for three months, and an ocean side pipe length of 2,200'. Optimizing length and diameter of pipe, and capacity and duration of pumping will be considered without compromising the "improved" water quality benefits.
- A reversible pump will be considered as a measure to flush out the pipe if it gets clogged, with due consideration to cost. Diffusers on each end of the buried pipe could help minimize velocity impacts.

O Options Considerations

Further evaluation of **O1** and **O2** will include the following considerations:

- Jetties and groins have created significant erosion and downdrift issues. The rip rap being placed as part of the project may end up becoming a jetty because of the movement of the beach.
- Mecox and Sagaponack Cuts, located to the east of Shinnecock Inlet are similar to O1, so lessons learned regarding escalating O&M costs and litigation would be informative.
- Impacts on littoral processes, the stability of the Shinnecock Inlet, and stability of the proposed seasonal cuts and permanent water exchange structure need to be considered.
- Based on the reductions in residence times predicted by the hydrodynamic modeling in this pre-screening study, a seasonal open cut at O1-1 location shows to be ineffective in flushing the western Shinnecock Bay and is not suitable for more detailed analysis. A seasonal open cut at O1-2 alone was found to provide the flushing mechanism necessary for residence time reductions due to the seasonal open cut concept.

The full Pre-Screening Report can be found at [LINK ON TOWN OF SOUTHAMPTON WEBSITE TO BE PROVIDED WEEK OF JULY 20], and any questions can be sent to WShinnecockWQ@dec.ny.gov.