



Economic Analysis of the Delaware Bay Shoreline: Delaware Bay Beach Work Group Briefing



Baker



Sept. 14, 2012



Summary – History of Presentations

Multiple Presentations to Date – Quarterly Since January 2011

- **Geographic Coverage**
- **Management Scenario Development**
- **Data Collection**
 - **Structure Inventory - Elevations**
 - **Structure Metrics**
 - **Modeling Flood/Erosion/SLR**
 - **Flood/Erosion Damages**
 - **Recreational Beach Widths**
- **Economic Studies – Approach**
 - **Flood/Erosion Damages Avoided**
 - **Recreation**
 - **Tax Revenues**
 - **Ecosystem Services**
- **Preliminary Findings on Recreation Benefits**

Study Area/Communities



***SHOW THE BOARD WITH SURVEY
AREA IN TAN***

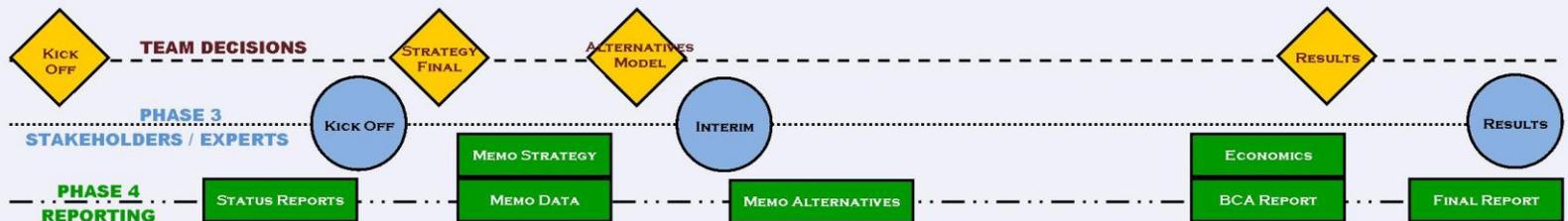
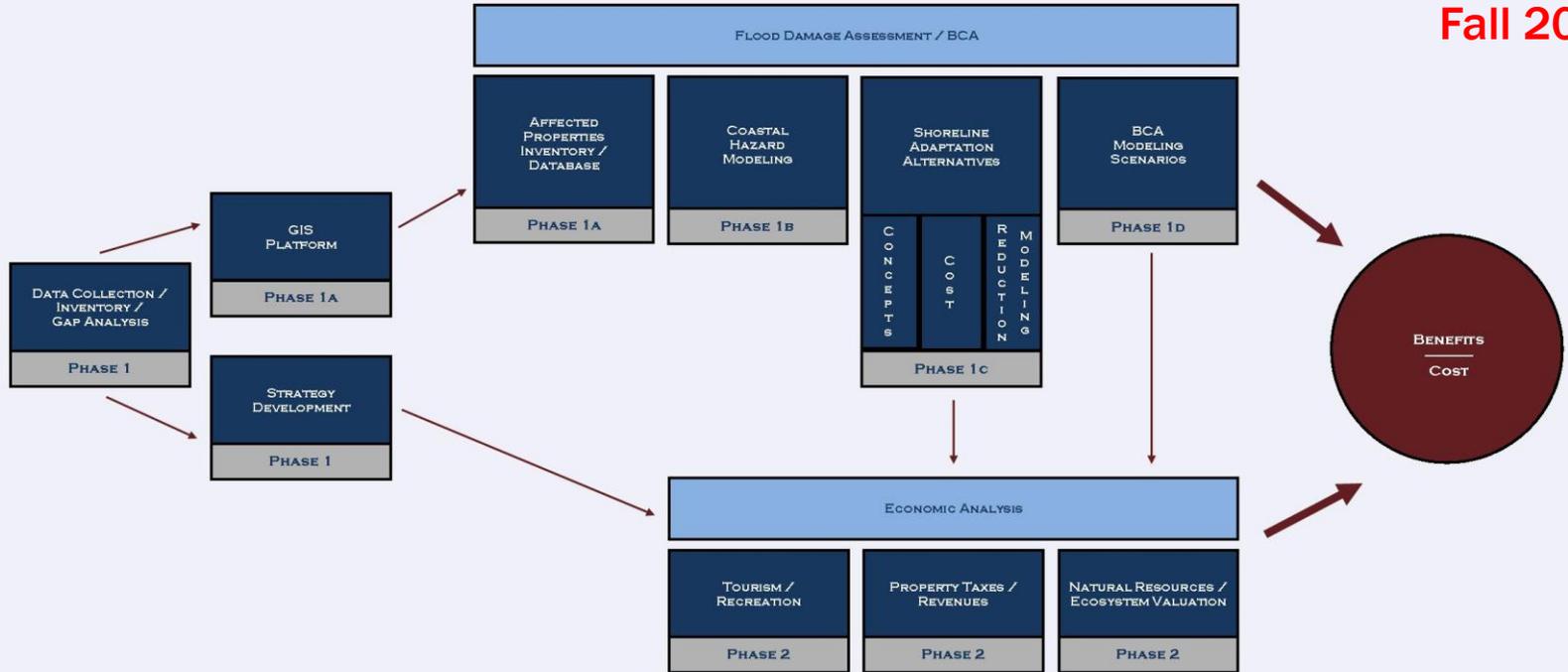
Approach

ECONOMIC ANALYSIS OF DELAWARE BAY SHORELINE ADAPTATION ALTERNATIVES

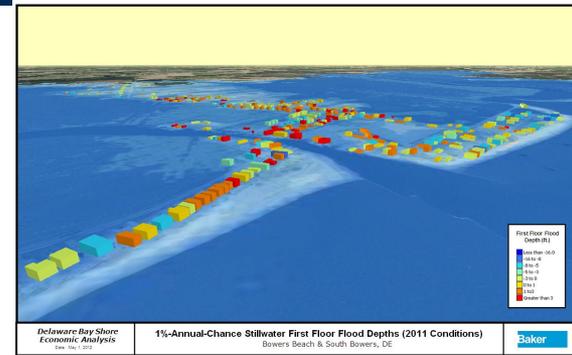
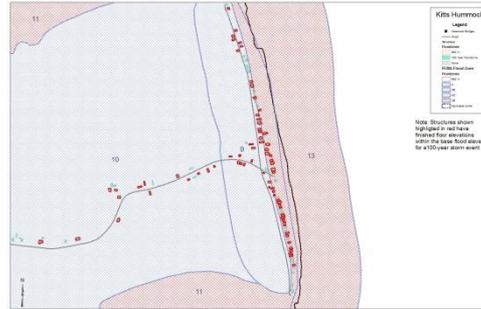
PROJECT APPROACH SUMMARY



Fall 2012



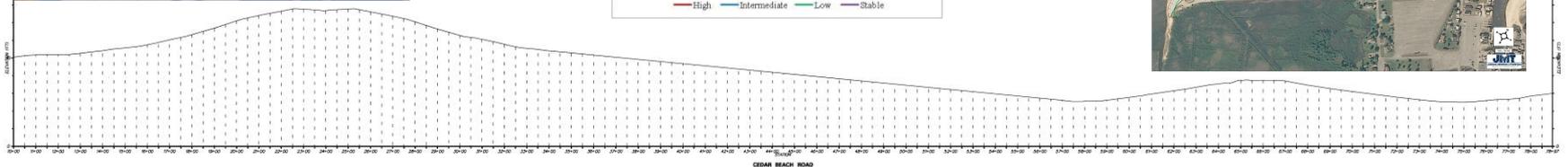
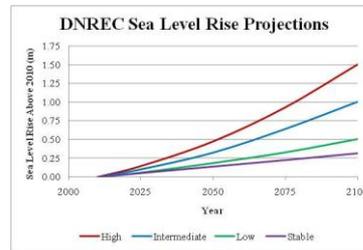
Data Collection



Attributes of DE_Bay_Bldgs

JMT_Classific	Res_Bldg_Type	ItRes_Bld	ItRes_Bldg_Name	Constr_Type	FoundationType	Kent Fo	FF_SQFT	Bldg_SQFT	Kent St
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1423.8307	2847.661479	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Slab	<Nul>	1131.6068	2263.213629	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Crawspace	<Nul>	2065.6480	2065.648072	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Crawspace	<Nul>	2347.8437	2347.843711	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Crawspace	<Nul>	2816.7296	2816.729659	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Crawspace	<Nul>	3036.8643	3036.864387	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1456.5210	1456.521015	<Nul>
<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	1462.8861	1462.886106	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1270.3472	1270.34724	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Crawspace	<Nul>	2405.1396	2405.13964	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1342.8284	2685.656954	<Nul>
Residential	Mobile Home	<Nul>	<Nul>	Pre-Engineered	Crawspace	<Nul>	1233.2701	1233.270104	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1664.0855	1664.085592	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1190.1438	2390.2876	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1791.8626	1791.862604	<Nul>
<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	1353.5004	1353.500491	<Nul>
<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	<Nul>	1177.3371	1177.337193	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1520.7658	3041.531633	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1425.4747	1425.474749	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1559.1659	3118.331933	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1170.1088	2340.216999	<Nul>
Residential	One-Story without Basement	<Nul>	<Nul>	Engineered	Crawspace	<Nul>	1038.6557	1038.655732	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	4426.8889	8853.777961	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	2711.4743	5422.948714	<Nul>
Residential	Two or More Stories without Basement	<Nul>	<Nul>	Engineered	Pile	<Nul>	1752.0462	3504.096548	<Nul>

Records: 0 (out of 1790 Selected) Options



Scenario 4 - Do Nothing : Baseline

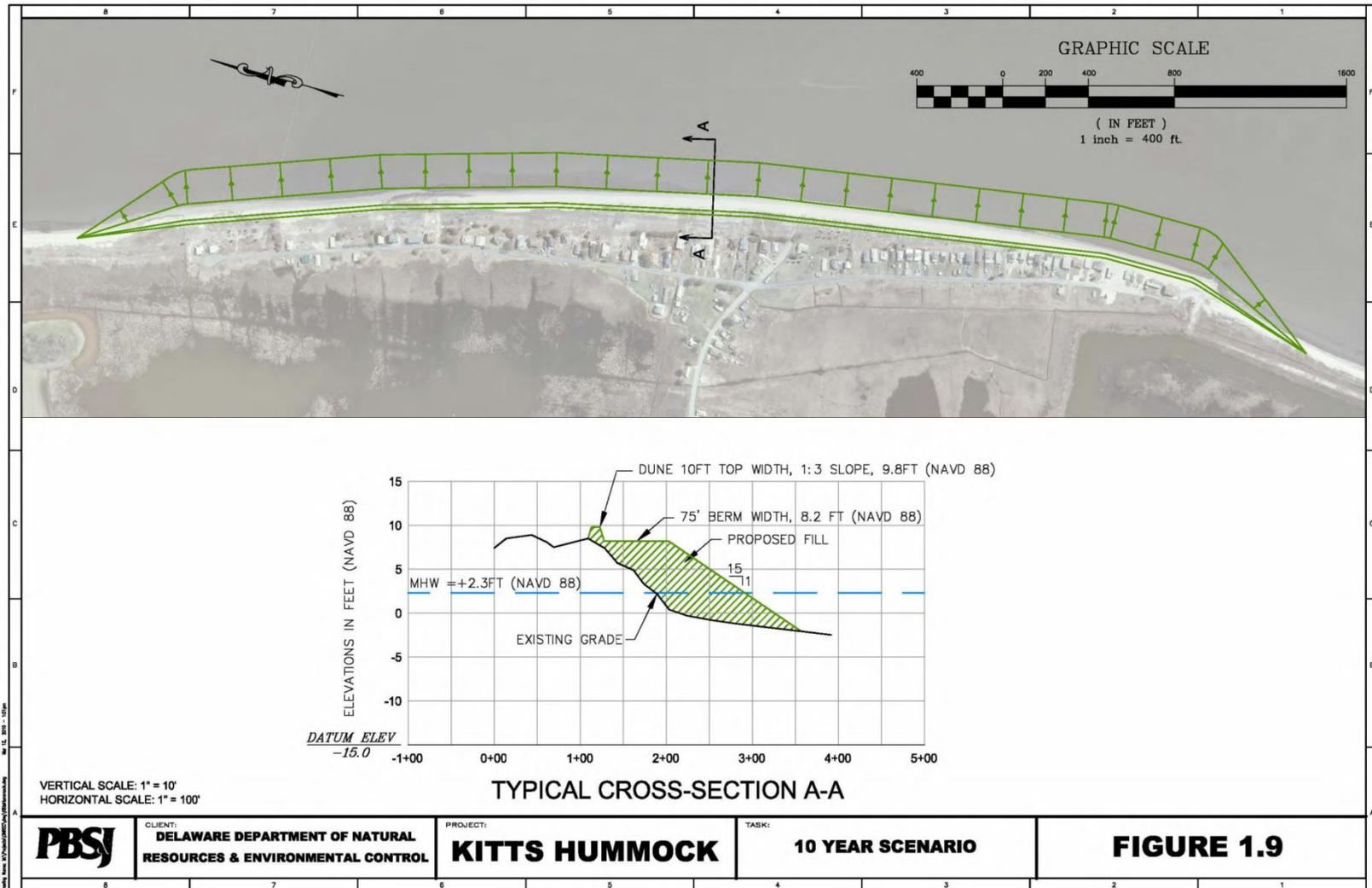
-No government intervention or management (*this is NOT Status Quo*).



Remnant foundations/debris of
structures removed after
abandoned

Scenario 1: Beach Nourishment - Defined

- construct and maintain 10-year storm beach/dune system in front of existing development



Scenario 3 - Basic Retreat - Defined

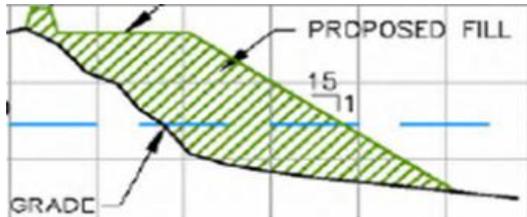
Initially remove structures to allow a beach/dune width equal to the current widths in each community.

Where existing structures occupy the beach, initial removal occurs .

As additional erosion/shoreline migration occurs, additional structures removed to maintain this beach width.



Scenario 2 - Enhanced Retreat - Defined



Initially remove structure to allow a beach/dune width equal to the recommended beach nourishment templates for each community.

As additional erosion/shoreline migration occurs, additional structures are removed to maintain this beach width



Scenario Highlights – Expected Outcomes

NO ACTION

- Houses are lost
- Some communities lose all houses others only a portion
- Limited costs to government (clean up only)
- Recreational benefits remain to visitors

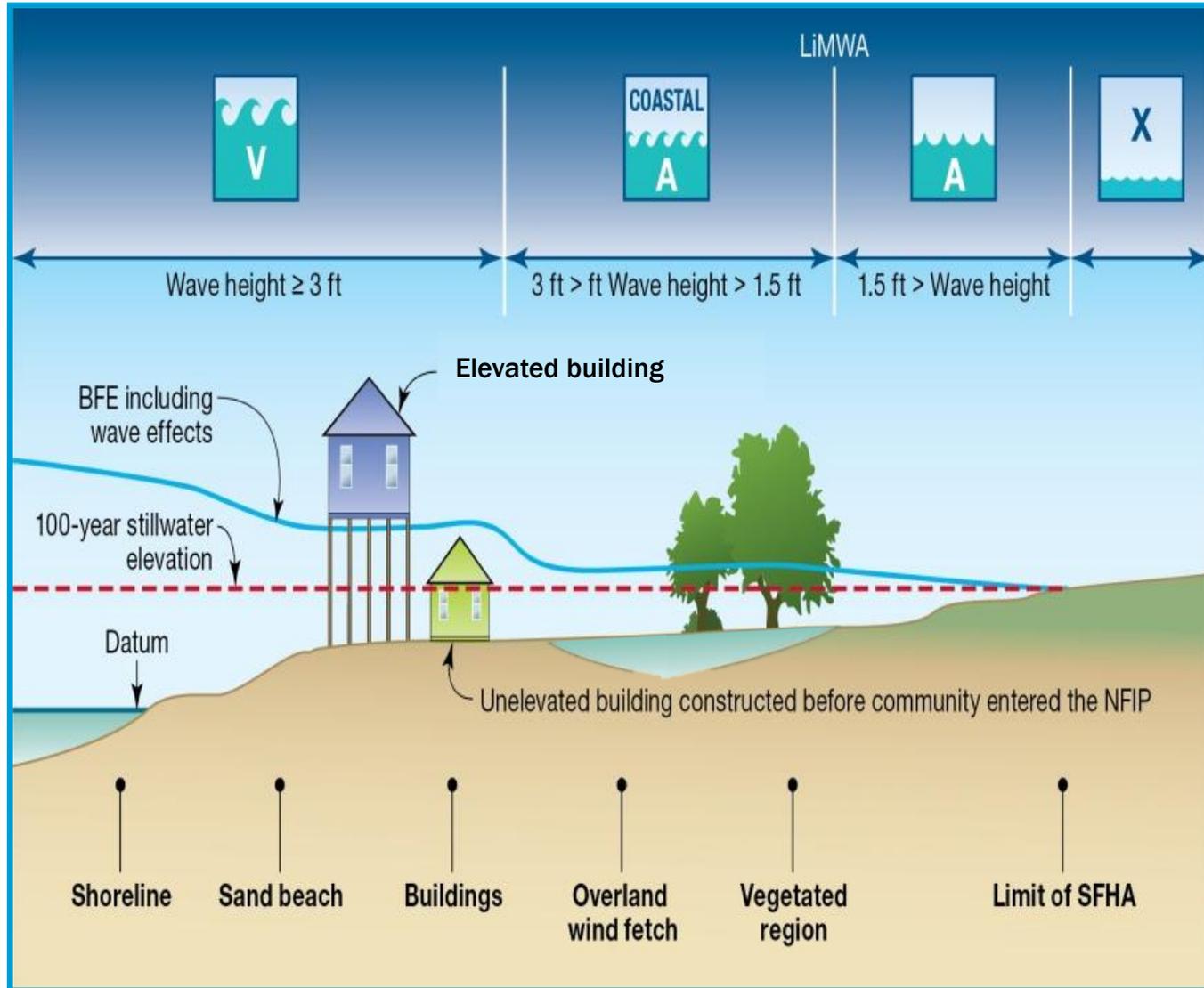
BEACH NOURISHMENT

- Houses are protected/maintained (to design criteria)
- Flood/erosion benefits are gained for owners (damages avoided)
- Recreational benefits are realized for owners and visitors
- Government bears cost for protection (currently)

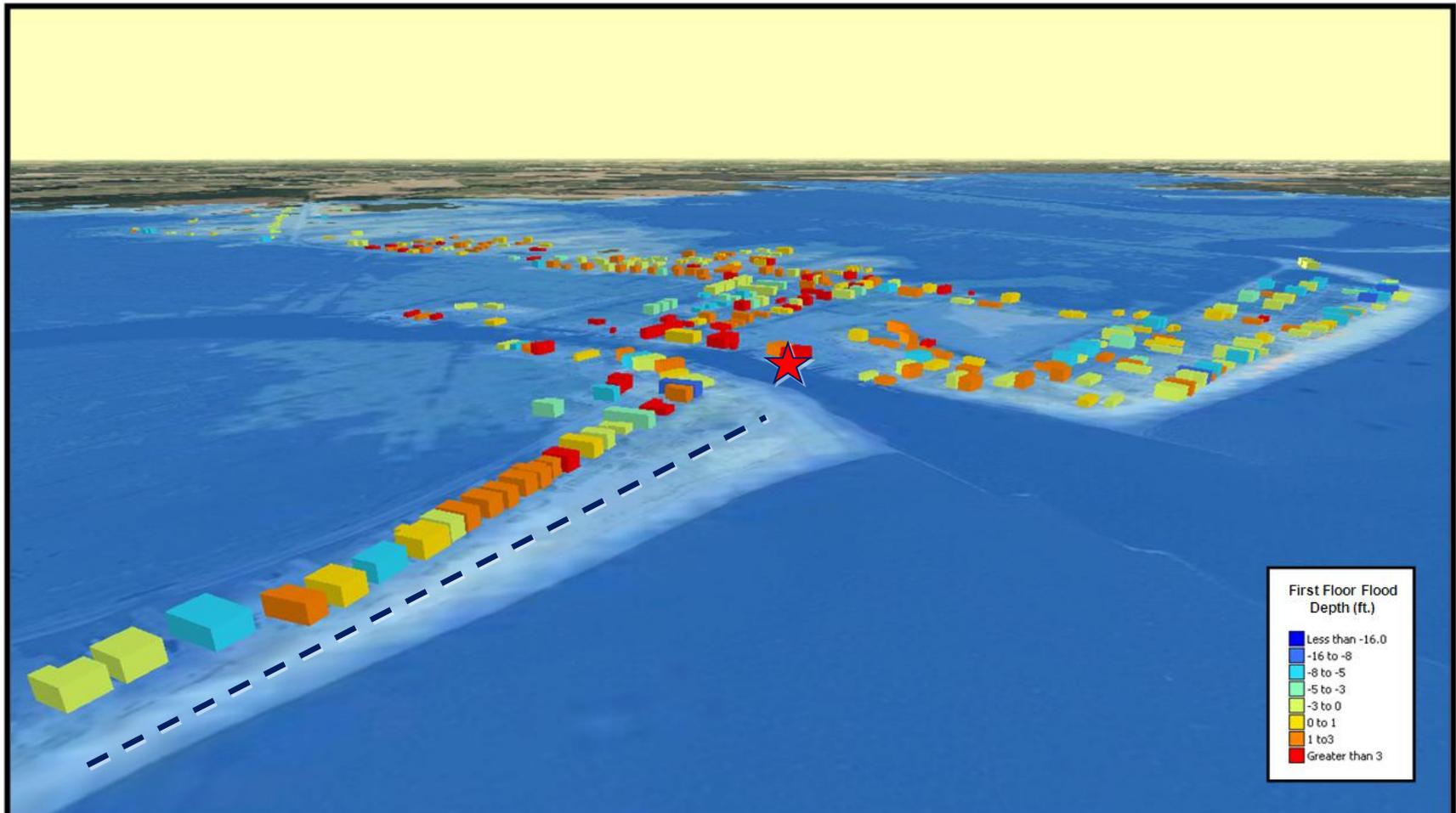
RETREAT

- Houses (select) are removed systematically
- Some communities lose all houses others only a portion
- Flood/erosion benefits are gained (damages avoided)
- Recreational benefits are gained from maintained/increased beach widths
- Government bears the costs for removal

Flood/Erosion Impact Assessment



Database/GIS Product - Current



*Delaware Bay Shore
Economic Analysis*

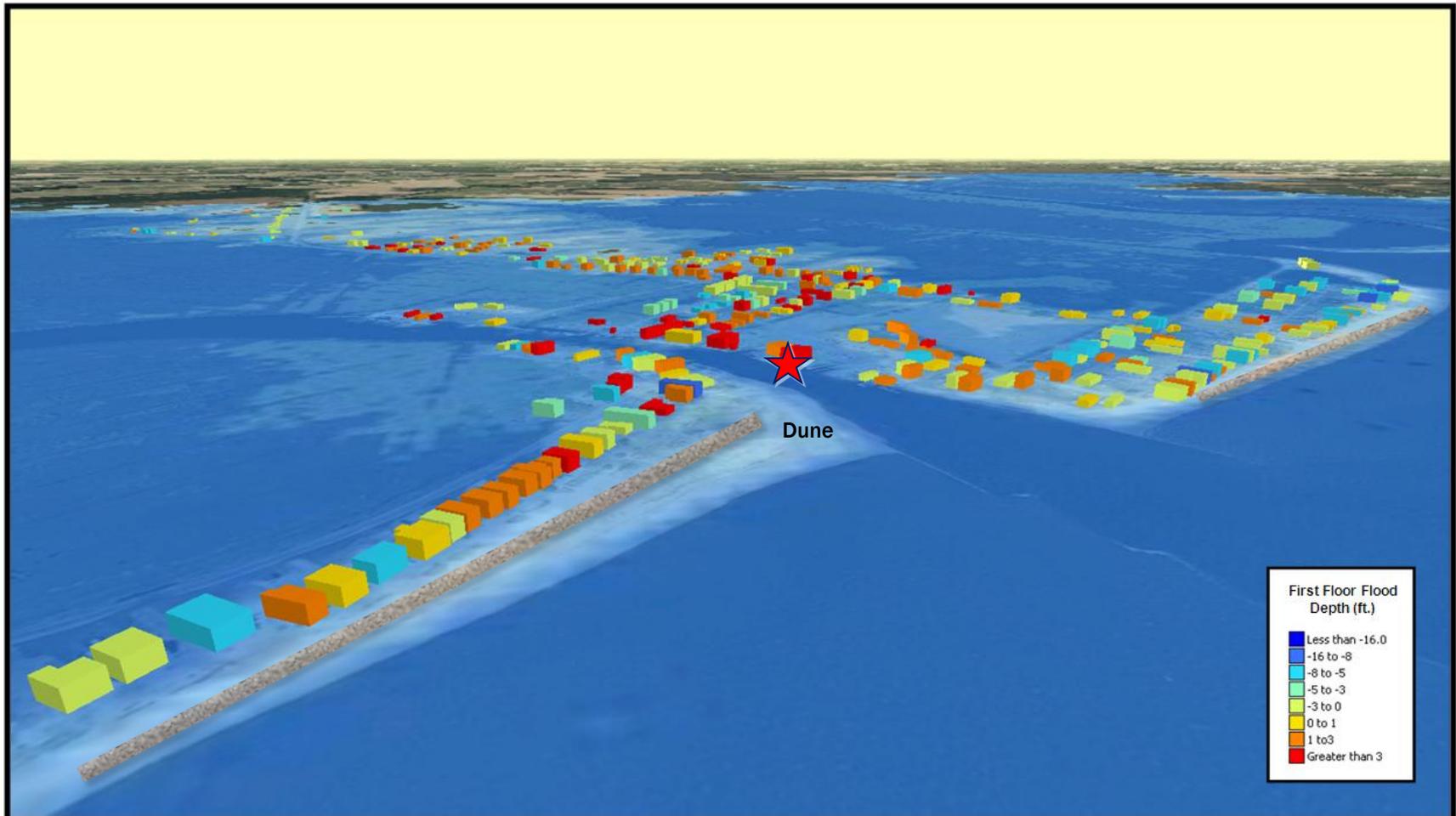
Date: May 1, 2012

1%-Annual-Chance Stillwater First Floor Flood Depths (2011 Conditions)

Bowers Beach & South Bowers, DE

Baker

Beach Nourishment



*Delaware Bay Shore
Economic Analysis*

Date: May 1, 2012

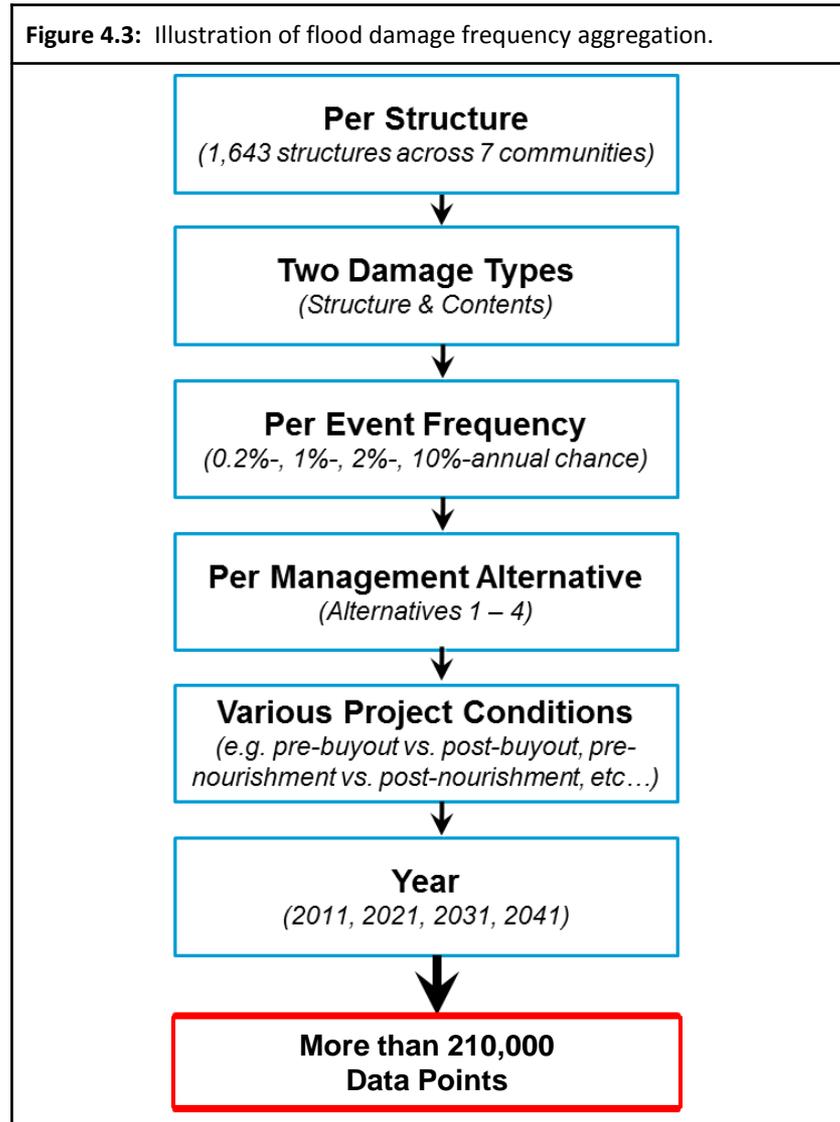
1%-Annual-Chance Stillwater First Floor Flood Depths (2011 Conditions)

Bowers Beach & South Bowers, DE

Baker

Flood Damage Avoidance Data

Figure 4.3: Illustration of flood damage frequency aggregation.

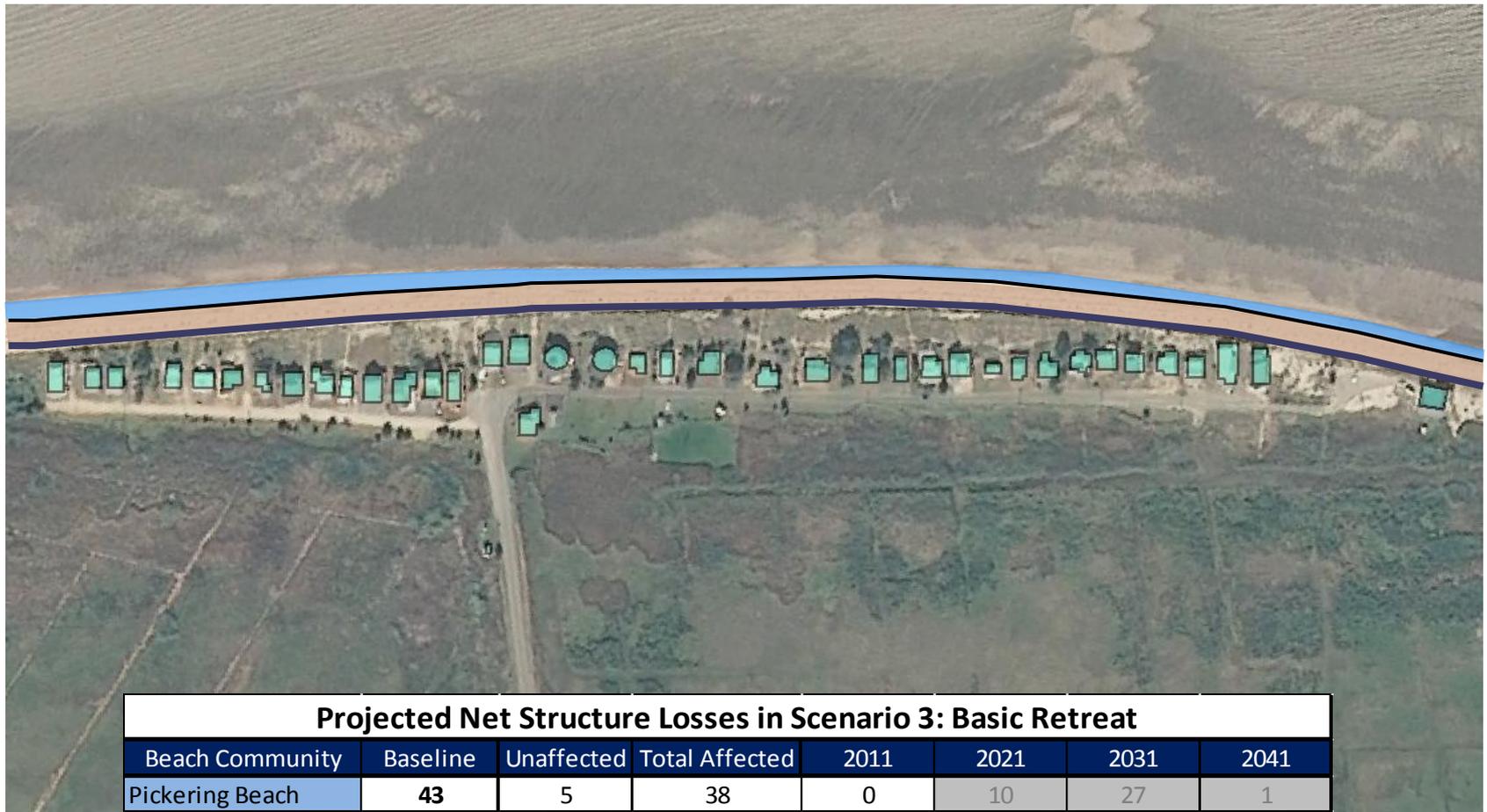


Projected Shorelines/Beach Widths



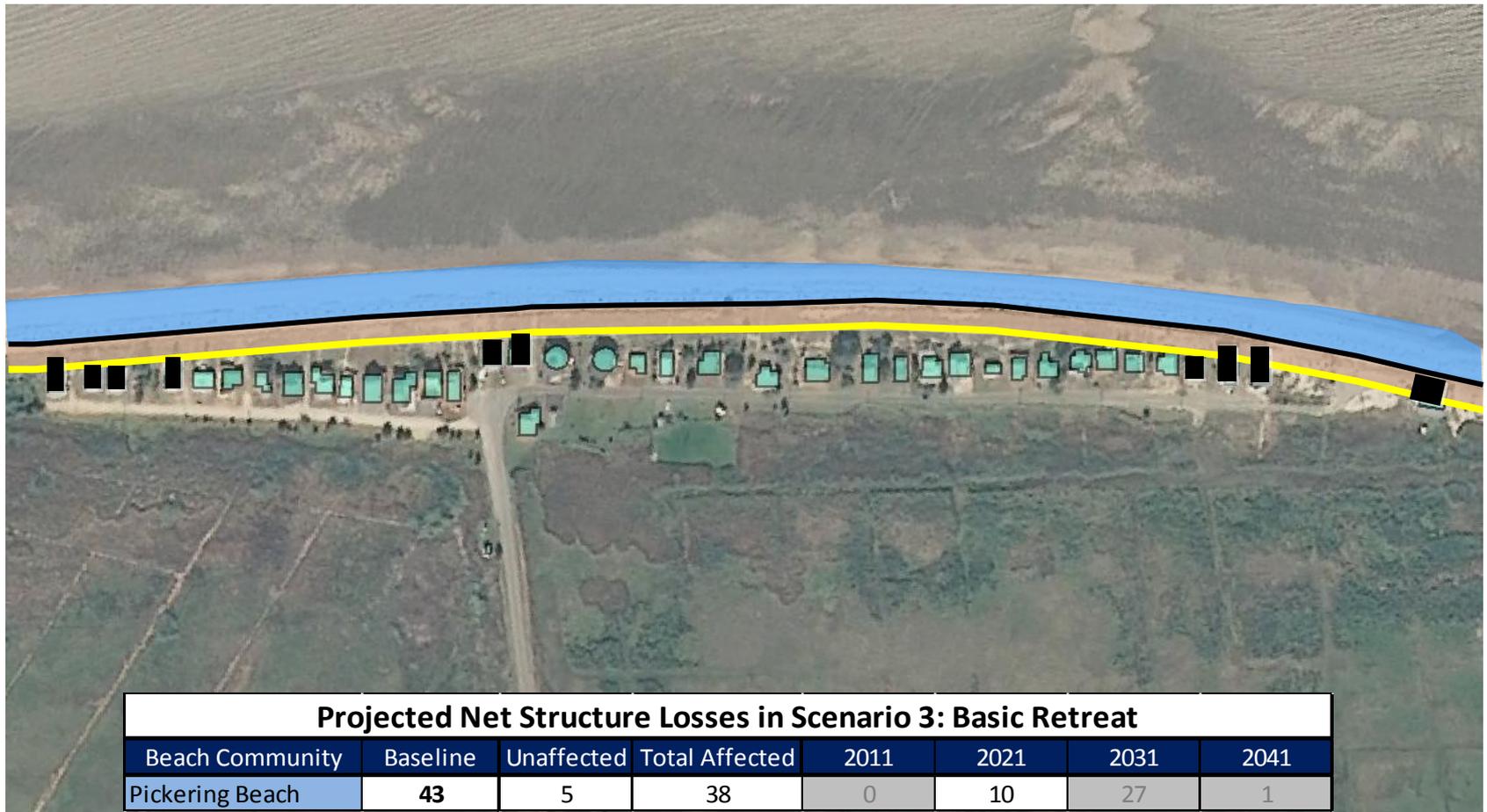
Pickering Beach

Scenario 3 – 2011 Shoreline



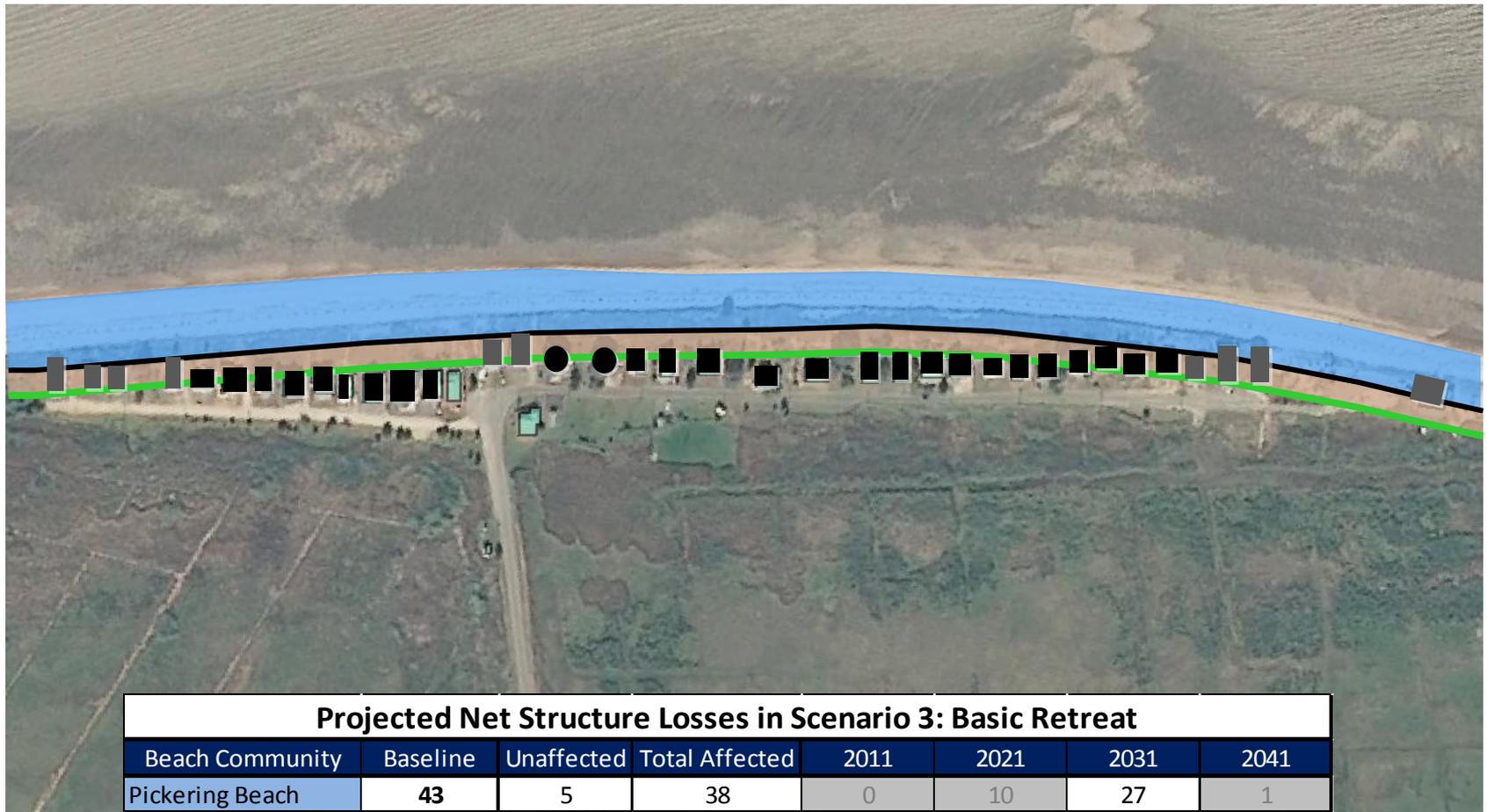
Pickering Beach

Scenario 3 – 2021 Shoreline



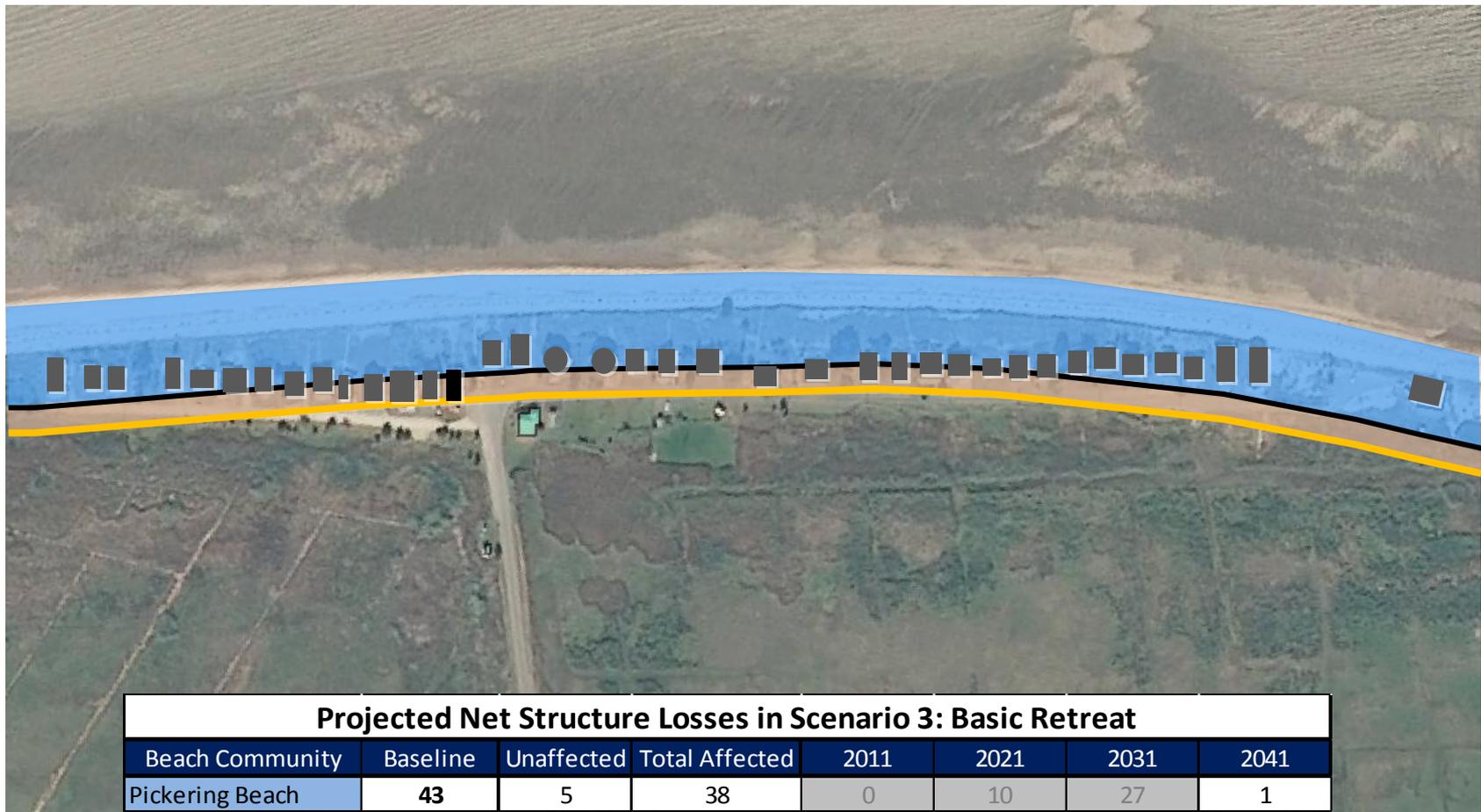
Pickering Beach

Scenario 3 – 2031 Shoreline



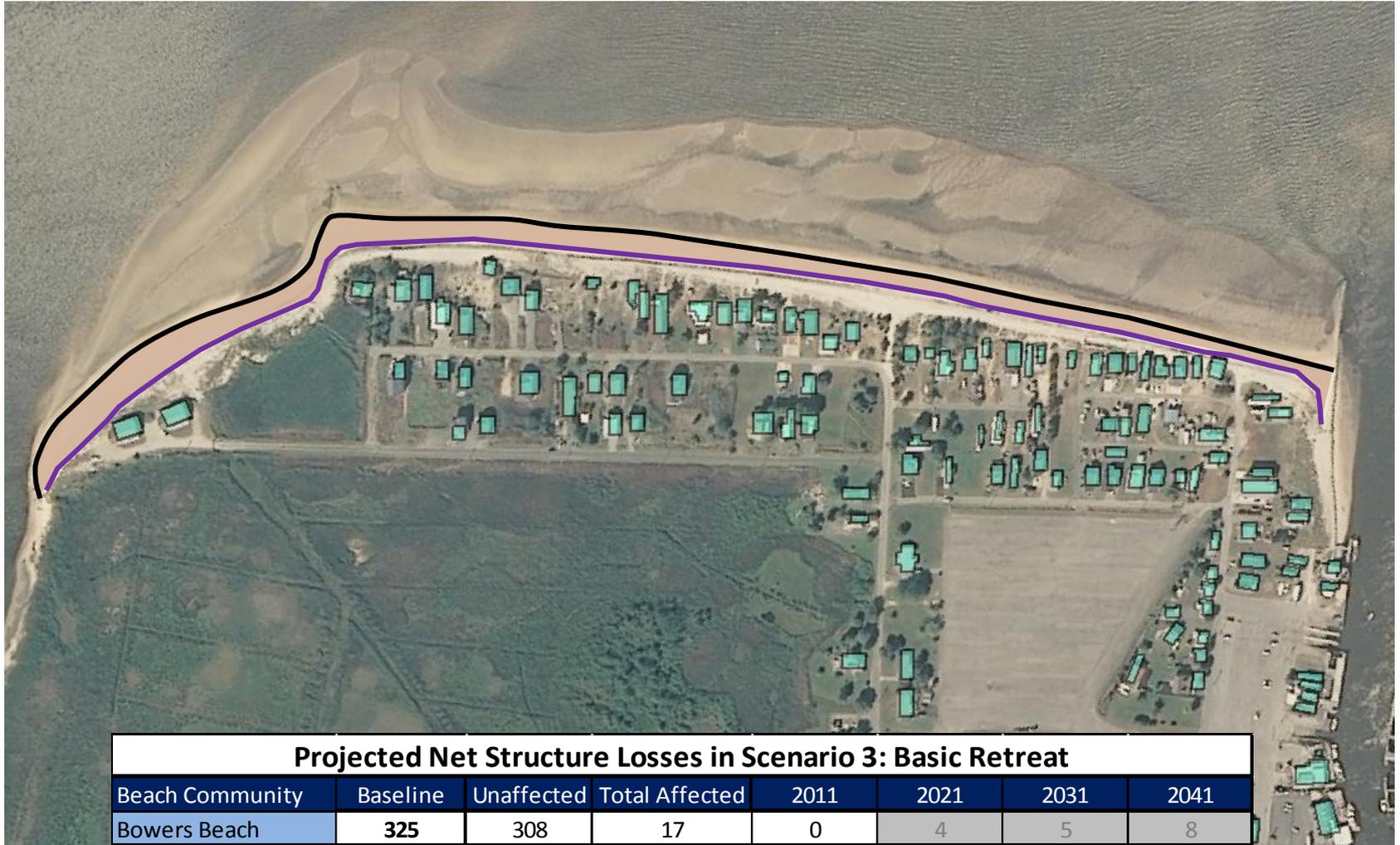
Pickering Beach

Scenario 3 – 2041 Shoreline



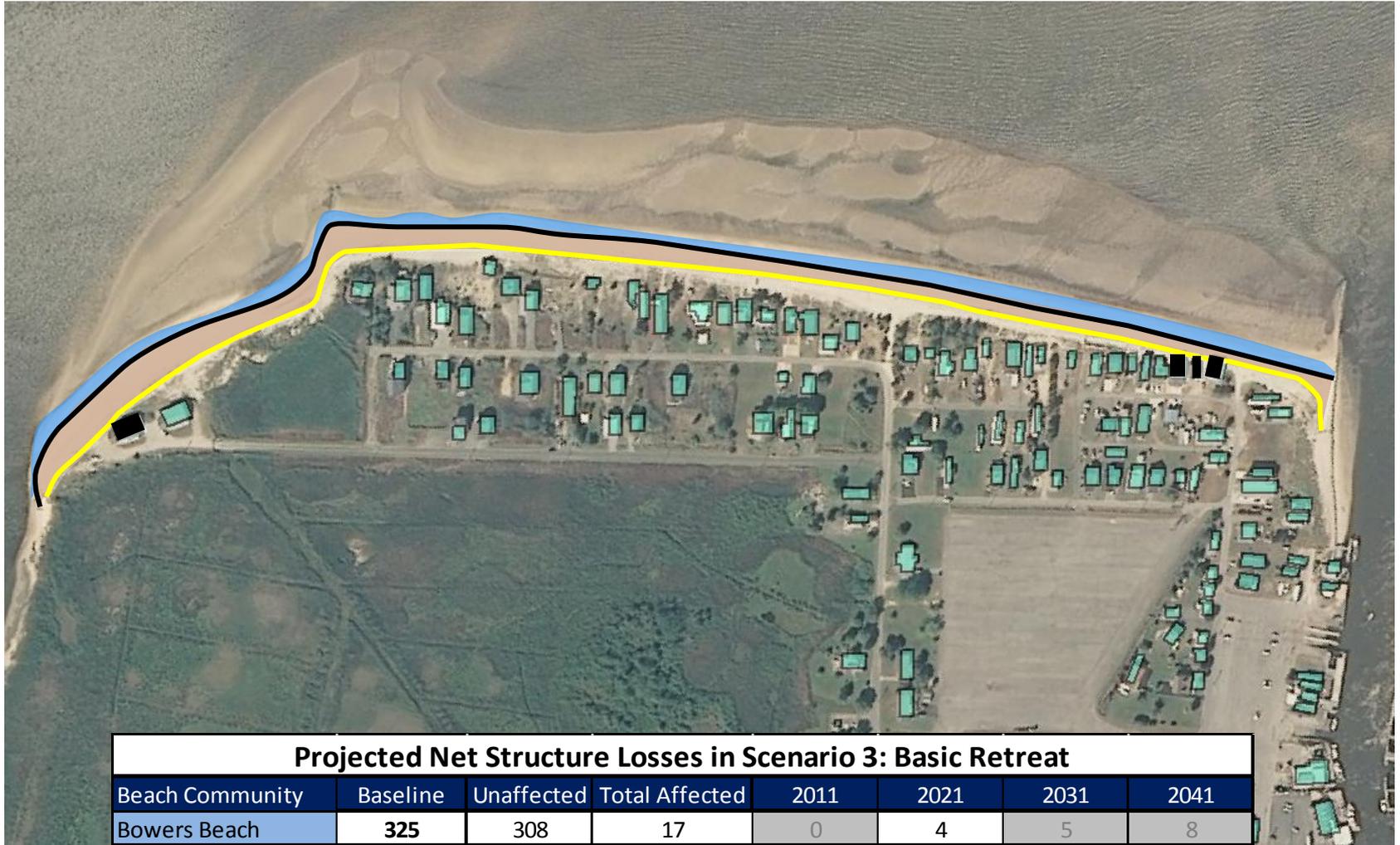
Bowers Beach

Scenario 3 – 2011 Shoreline



Bowers Beach

Scenario 3 – 2021 Shoreline



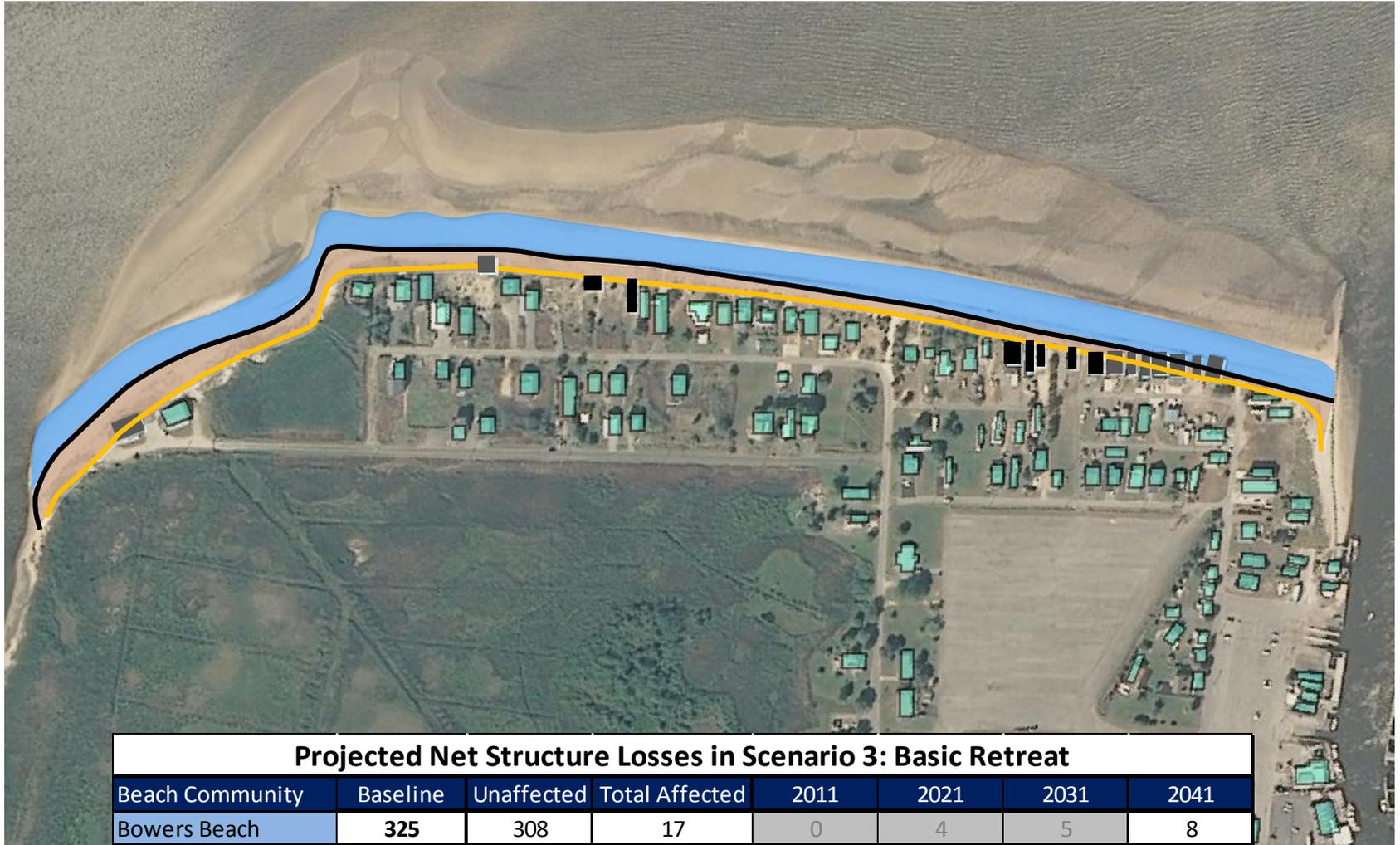
Bowers Beach

Scenario 3 – 2031 Shoreline



Bowers Beach

Scenario 3 – 2041 Shoreline



ECONOMIC ANALYSES -

- Categories of Economic Effects Analyzed/Quantified
 - Structures/Assets Damages
 - Recreation
 - Tourism Revenues
 - Property values
 - Local/Statewide business revenues
 - Population demographics – shifts
 - Natural Resource Capital Valuation
 - Wetlands, Wildlife, Fisheries, Etc.
 - Others

Structure Losses By Scenario

Projected Net Structure Losses in Scenario 2: Strategic Retreat							
Beach Community	Baseline Total Structures	Unaffected	Affected	2011	2021	2031	2041
Pickering Beach	43	4	39	38	1	0	0
Kitts Hummock	114	42	72	52	10	9	1
Bowers Beach	325	282	43	35	4	2	2
South Bowers Beach	69	57	12	8	2	1	1
Slaughter Beach	310	265	45	5	5	14	21
Prime Hook	185	122	63	63	0	0	0
Broadkill Beach	583	404	179	92	24	39	24
Total	1629	1176	453	293	46	65	49

Projected Net Structure Losses in Scenario 3: Basic Retreat							
Beach Community	Total Structures	Unaffected	Affected	2011	2021	2031	2041
Pickering Beach	43	5	38	0	10	27	1
Kitts Hummock	114	63	51	0	9	18	24
Bowers Beach	325	308	17	0	4	5	8
South Bowers Beach	69	62	7	0	1	4	2
Slaughter Beach	310	306	4	0	0	0	4
Prime Hook	185	173	12	0	1	6	5
Broadkill Beach	583	467	116	2	53	36	25
Total	1629	1384	245	2	78	96	69

Projected Net Structure Losses in Scenario 4: Do Nothing							
Beach Community	Baseline Total Structures	Unaffected	Affected	2011	2021	2031	2041
Pickering Beach	43	5	38	0	2	14	22
Kitts Hummock	114	83	31	0	0	13	18
Bowers Beach	325	321	4	0	0	2	2
South Bowers Beach	69	66	3	0	0	1	2
Slaughter Beach	310	310	0	0	0	0	0
Prime Hook	185	181	4	0	0	0	4
Broadkill Beach	583	534	49	0	4	12	33
Total	1629	1500	129	0	6	42	81

Big Picture Results

- **By Scenario for All Communities**
- **By Community for All Scenarios**
- **Distribution of Costs and Benefits**

ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS - BENEFITS AND COSTS BY SCENARIOS: TOTALS

Community	Structures		Costs				Benefits				Net Impact (D-C) (\$mill)	Impact per Structure [(D-C)/A] (\$thousand)
	Existing (A)	Removed (B)	Demolition (\$mill)	House Value (\$mill)	Nourishment (\$mill)	Total Cost (C) (\$mill)	Property Owners		Non Resident	Total Benefits (D) (\$mill)		
							Avoided Flood / Erosion Loss (\$mill)	Recreation (\$mill)	Recreation (\$mill)			
Scenario 1 Total	1763	0	\$0	\$0	\$61.65	\$61.65	\$2.72	\$3.13	\$12.93	\$18.79	-\$42.87	-24.3
Scenario 2 Total	1763	451	\$5.12	\$149.5	\$0	\$154.58	\$10.64	\$0.88	\$9.88	\$21.40	-\$133.18	-75.5
Scenario 3 Total	1763	244	\$1.13	\$61.1	\$0	\$62.28	\$2.99	\$1.40	\$10.13	\$14.52	-\$47.76	-27.1
Scenario 4 Total	1763	129	\$0.60	\$0	\$0	\$0.60	-\$18.19	\$0.00	\$0.00	-\$18.19	-\$18.79	-10.7

NOTES: (1) All values reported 2011 dollars. The figures are the present value of the stream of costs and benefits aggregated across 30 years (from 2011 to 2041) and discounted at 4%. (2) House value reflects purchase costs (reported in Table 5.1-5.3 of the Baker reports). Demolition costs are from JMT file, Bay_shore_cost_estimates_rev_discount.xls. (3) Scenario 1, 2, & 3 involve only voided flood benefits to owners, and Scenario 4 reflects only avoided erosion loss.

SOURCE: Baker. 2012. Economic Analysis of Delaware Bay Shores Management Alternatives. Phase 1C, 1D, & 2C Report. August 29, 2012.

ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS - BENEFITS AND COSTS BY SCENARIOS: BY COUNTY

Community	Structures		Costs				Benefits				Net Impact (D-C) (\$mill)	Impact per Structure [(D-C)/A] (\$thousand)
	Existing (A)	Removed (B)	Demolition (\$mill)	Public		Total Cost (C) (\$mill)	Property Owners		Non Resident	Total Benefits (D) (\$mill)		
				House Value (\$mill)	Nourishment (\$mill)		Avoided Flood / Erosion Loss (\$mill)	Recreation (\$mill)	Recreation (\$mill)			
Kent County												
Scenario 1	604	0	\$0	\$0	\$23.75	\$23.75	\$0.26	\$0.91	\$1.94	\$3.11	-\$20.64	-\$34.17
Scenario 2	604	165	\$2	\$26	\$0.00	\$27.62	\$3.63	\$0.30	\$1.37	\$5.29	-\$22.33	-\$36.96
Scenario 3	604	112	\$0	\$13	\$0.00	\$13.21	\$0.76	\$0.48	\$1.56	\$2.80	-\$10.39	-\$17.21
Scenario 4	604	76	\$0	\$0	\$0.00	\$0.33	-\$5.65	\$0.00	\$0.00	-\$5.65	-\$5.98	-\$9.90
Sussex County												
Scenario 1	1159	0	\$0	\$0	\$37.90	\$37.90	\$2.46	\$2.22	\$10.99	\$15.67	-\$22.23	-\$19.18
Scenario 2	1159	286	\$3	\$124	\$0.00	\$126.96	\$7.01	\$0.58	\$8.52	\$16.11	-\$110.85	-\$95.65
Scenario 3	1159	132	\$1	\$48	\$0.00	\$49.07	\$2.23	\$0.92	\$8.57	\$11.61	-\$37.46	-\$32.32
Scenario 4	1159	53	\$0	\$0	\$0.00	\$0.27	-\$12.54	\$0.00	\$0.00	-\$12.54	-\$12.81	-\$11.05

ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS - BENEFITS AND COSTS BY SCENARIOS

Community	Structures		Costs				Benefits				Net Impact (D-C) (\$mill)	Impact per Structure [(D-C)/A] (\$thousand)
	Existing (A)	Removed (B)	Demolition (\$mill)	Public		Total Cost (C) (\$mill)	Property Owners		Non Resident	Total Benefits (D) (\$mill)		
				House Value (\$mill)	Nourishment (\$mill)		Avoided Flood / Erosion Loss (\$mill)	Recreation (\$mill)	Recreation (\$mill)			
SCENARIO 1: BEACH NOURISHMENT - COMPARED TO SCENARIO 4: NO ACTION												
Pickering	44	0	\$0	\$0	\$6.41	\$6.41	-\$0.10	\$0.17	\$0.49	\$0.56	-\$5.85	-133.0
Kitts Hummock	122	0	\$0	\$0	\$7.81	\$7.81	\$0.05	\$0.27	\$0.35	\$0.68	-\$7.13	-58.5
Bowers	354	0	\$0	\$0	\$4.89	\$4.89	\$0.17	\$0.40	\$0.77	\$1.34	-\$3.55	-10.0
South Bowers	84	0	\$0	\$0	\$4.64	\$4.64	\$0.14	\$0.06	\$0.33	\$0.53	-\$4.11	-48.9
Slaughter	372	0	\$0	\$0	\$14.60	\$14.60	\$0.57	\$0.65	\$1.74	\$2.96	-\$11.64	-31.3
Primehook	195	0	\$0	\$0	\$7.32	\$7.32	\$0.37	\$0.49	\$0.60	\$1.46	-\$5.86	-30.0
Broadkill	592	0	\$0	\$0	\$15.98	\$15.98	\$1.52	\$1.08	\$8.65	\$11.25	-\$4.73	-8.0
Scenario 1 Total	1763	0	\$0	\$0	\$61.65	\$61.65	\$2.72	\$3.13	\$12.93	\$18.79	-\$42.87	-24.3
SCENARIO 2: ENHANCED RETREAT - COMPARED TO SCENARIO 4: NO ACTION												
Pickering	44	39	\$0.25	\$5.52	\$0	\$5.77	\$0.74	-\$0.04	\$0.21	\$0.91	-\$4.86	-110.5
Kitts Hummock	122	72	\$0.73	\$10.7	\$0	\$11.40	\$1.69	\$0.08	\$0.20	\$1.97	-\$9.43	-77.3
Bowers	354	42	\$0.52	\$7.43	\$0	\$7.95	\$0.73	\$0.23	\$0.70	\$1.66	-\$6.29	-17.8
South Bowers	84	12	\$0.22	\$2.28	\$0	\$2.50	\$0.47	\$0.03	\$0.26	\$0.76	-\$1.74	-20.7
Slaughter	372	45	\$0.46	\$10.6	\$0	\$11.06	\$0.33	\$0.55	\$1.64	\$2.52	-\$8.54	-22.9
Primehook	195	63	\$1.29	\$37.6	\$0	\$38.89	\$1.64	-\$0.21	-\$0.16	\$1.27	-\$37.62	-192.9
Broadkill	592	178	\$1.65	\$75.4	\$0	\$77.01	\$5.04	\$0.24	\$7.03	\$12.31	-\$64.70	-109.3
Scenario 2 Total	1763	451	\$5.12	\$149.5	\$0	\$154.58	\$10.64	\$0.88	\$9.88	\$21.40	-\$133.18	-75.5

ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS - BENEFITS AND COSTS BY SCENARIOS

Community	Costs					Benefits					Net Impact (D-C)	Impact per Structure [(D-C)/A]
	Structures		Public			Property Owners		Non Resident		Total Benefits (D)		
	Existing (A)	Removed (B)	Demolition	House Value	Nourishment	Total Cost (C)	Avoided Flood / Erosion Loss	Recreation	Recreation			
SCENARIO 3: STRATEGIC RETREAT - COMPARED TO SCENARIO 4: NO ACTION												
Pickering	44	38	\$0.05	\$3.40	\$0	\$3.45	\$0.21	\$0.05	\$0.25	\$0.52	-\$2.93	-66.7
Kitts Hummock	122	51	\$0.15	\$4.70	\$0	\$4.85	\$0.34	\$0.14	\$0.20	\$0.67	-\$4.18	-34.3
Bowers	354	16	\$0.08	\$3.90	\$0	\$3.98	\$0.11	\$0.19	\$0.39	\$0.69	-\$3.29	-9.3
South Bowers	84	7	\$0.05	\$0.88	\$0	\$0.93	\$0.10	\$0.10	\$0.72	\$0.92	\$0.01	0.12
Slaughter	372	4	\$0.03	\$0.89	\$0	\$0.92	\$0.06	\$0.43	\$1.16	\$1.64	\$0.72	1.9
Primehook	195	12	\$0.11	\$4.68	\$0	\$4.79	\$0.08	\$0.02	\$0.04	\$0.04	-\$4.75	-24.4
Broadkill	592	116	\$0.66	\$42.7	\$0	\$43.36	\$2.09	\$0.47	\$7.37	\$9.93	-\$33.43	-56.5
Scenario 3 Total	1763	244	\$1.13	\$61.1	\$0	\$62.28	\$2.99	\$1.40	\$10.13	\$14.52	-\$47.76	-27.1
SCENARIO 4: NO ACTION												
Pickering	44	38	\$0.15	\$0	\$0	\$0.15	-\$2.54	\$0.00	\$0.00	-\$2.54	-\$2.69	-61.1
Kitts Hummock	122	31	\$0.12	\$0	\$0	\$0.12	-\$2.41	\$0.00	\$0.00	-\$2.41	-\$2.53	-20.7
Bowers	354	4	\$0.03	\$0	\$0	\$0.03	-\$0.42	\$0.00	\$0.00	-\$0.42	-\$0.45	-1.3
South Bowers	84	3	\$0.03	\$0	\$0	\$0.03	-\$0.28	\$0.00	\$0.00	-\$0.28	-\$0.31	-3.7
Slaughter	372	0	\$0.00	\$0	\$0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	0.0
Primehook	195	4	\$0.04	\$0	\$0	\$0.04	-\$1.19	\$0.00	\$0.00	-\$1.19	-\$1.23	-6.3
Broadkill	592	49	\$0.23	\$0	\$0	\$0.23	-\$11.35	\$0.00	\$0.00	-\$11.35	-\$11.58	-19.6
Scenario 4 Total	1763	129	\$0.60	\$0	\$0	\$0.60	-\$18.19	\$0.00	\$0.00	-\$18.19	-\$18.79	-10.7

NOTES: (1) All values reported 2011 dollars. The figures are the present value of the stream of costs and benefits aggregated across 30 years (from 2011 to 2041) and discounted at 4%. (2) House value reflects purchase costs (reported in Table 5.1-5.3 of the Baker reports). Demolition costs are from JMT file, Bay_shore_cost_estimates_rev_discount.xls. (3) Scenario 1, 2, & 3 involve only voided flood benefits to owners, and Scenario 4 reflects only avoided erosion loss.

SOURCE: Baker. 2012. Economic Analysis of Delaware Bay Shores Management Alternatives. Phase 1C, 1D, & 2C Report. August 29, 2012.

ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS - SUMMARY OF BENEFITS AND COSTS BY COMMUNITY

Community & Scenario	Structures		Costs				Benefits					Net Impact (D-C) (\$mill)	Impact per Structure [(D-C)/A] (\$thousand)
	Existing (A)	Removed (B)	Public			Total Cost (C) (\$mill)	Property Owners			Non residents	Total Benefits (D) (\$mill)		
			Demolition (\$mill)	House Value (\$mill)	Nourishment (\$mill)		Avoided Flood / Erosion Loss (\$mill)	Recreation (\$mill)	Total (Owners) (\$mill)	Recreation (\$mill)			
KENT COUNTY													
Pickering													
Scenario 1	44	0	\$0	\$0	\$6.41	\$6.41	-\$0.10	\$0.17	\$0.07	\$0.49	\$0.56	-\$5.85	-\$133
Scenario 2	44	39	\$0.25	\$5.52	\$0	\$5.77	\$0.74	-\$0.04	\$0.70	\$0.21	\$0.91	-\$4.86	-\$110
Scenario 3	44	38	\$0.05	\$3.40	\$0	\$3.45	\$0.21	\$0.05	\$0.26	\$0.25	\$0.52	-\$2.93	-\$67
Scenario 4	44	38	\$0.15	\$0.00	\$0	\$0.15	-\$2.54	\$0.00	-\$2.54	\$0.00	-\$2.54	-\$2.69	-\$61
Kitts Hummock													
Scenario 1	122	0	\$0	\$0	\$7.81	\$7.81	\$0.05	\$0.27	\$0.32	\$0.35	\$0.68	-\$7.13	-\$58
Scenario 2	122	72	\$0.73	\$10.70	\$0	\$11.43	\$1.69	\$0.08	\$1.77	\$0.20	\$1.97	-\$9.46	-\$78
Scenario 3	122	51	\$0.15	\$4.70	\$0	\$4.85	\$0.34	\$0.14	\$0.48	\$0.20	\$0.67	-\$4.18	-\$34
Scenario 4	122	31	\$0.12	\$0.00	\$0	\$0.12	-\$2.41	\$0.00	-\$2.41	\$0.00	-\$2.41	-\$2.53	-\$21
Bowers													
Scenario 1	354	0	\$0	\$0	\$4.89	\$4.89	\$0.17	\$0.40	\$0.57	\$0.77	\$1.34	-\$3.55	-\$10
Scenario 2	354	42	\$0.52	\$7.43	\$0	\$0.52	\$0.73	\$0.23	\$0.96	\$0.70	\$1.66	\$1.14	\$3
Scenario 3	354	16	\$0.08	\$3.90	\$0	\$0.08	\$0.11	\$0.19	\$0.30	\$0.39	\$0.69	\$0.61	\$2
Scenario 4	354	4	\$0.03	\$0.00	\$0	\$0.03	-\$0.42	\$0.00	-\$0.42	\$0.00	-\$0.42	-\$0.45	-\$1
South Bowers													
Scenario 1	84	0	\$0	\$0	\$4.64	\$4.64	\$0.14	\$0.06	\$0.20	\$0.33	\$0.53	-\$4.11	-\$49
Scenario 2	84	12	\$0.22	\$2.28	\$0	\$2.50	\$0.47	\$0.03	\$0.50	\$0.26	\$0.76	-\$1.74	-\$21
Scenario 3	84	7	\$0.05	\$0.88	\$0	\$0.93	\$0.10	\$0.10	\$0.20	\$0.72	\$0.92	-\$0.01	\$0
Scenario 4	84	3	\$0.03	\$0.00	\$0	\$0.03	-\$0.28	\$0.00	-\$0.28	\$0.00	-\$0.28	-\$0.31	-\$4

ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS - SUMMARY OF BENEFITS AND COSTS BY COMMUNITY

Community & Scenario	Structures		Costs				Benefits					Net Impact (D-C) (\$mill)	Impact per Structure [(D-C)/A] (\$thousand)
	Existing (A)	Removed (B)	Demolition (\$mill)	House Value (\$mill)	Nourishment (\$mill)	Total Cost (C) (\$mill)	Property Owners			Non residents	Total Benefits (D) (\$mill)		
							Avoided Flood / Erosion Loss (\$mill)	Recreation (\$mill)	Total (Owners) (\$mill)	Recreation (\$mill)			
SUSSEX COUNTY													
Slaughter													
Scenario 1	372	0	\$0	\$0	\$14.60	\$14.60	\$0.57	\$0.65	\$1.22	\$1.74	\$2.96	-\$11.64	-\$31
Scenario 2	372	45	\$0.46	\$10.60	\$0	\$11.06	\$0.33	\$0.55	\$0.88	\$1.64	\$2.52	-\$8.54	-\$23
Scenario 3	372	4	\$0.03	\$0.89	\$0	\$0.92	\$0.06	\$0.43	\$0.49	\$1.16	\$1.64	\$0.72	\$2
Scenario 4	372	0	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0
Prime Hook													
Scenario 1	195	0	\$0	\$0	\$7.32	\$7.32	\$0.37	\$0.49	\$0.86	\$0.60	\$1.46	-\$5.86	-\$30
Scenario 2	195	63	\$1.29	\$37.60	\$0	\$38.89	\$1.64	-\$0.21	\$1.43	-\$0.16	\$1.27	-\$37.62	-\$193
Scenario 3	195	12	\$0.11	\$4.68	\$0	\$4.79	\$0.08	\$0.02	\$0.10	\$0.04	\$0.04	-\$4.75	-\$24
Scenario 4	195	4	\$0.04	\$0.00	\$0	\$0.04	-\$1.19	\$0.00	-\$1.19	\$0.00	-\$1.19	-\$1.23	-\$6
Broadkill													
Scenario 1	592	0	\$0	\$0	\$15.98	\$15.98	\$1.52	\$1.08	\$2.60	\$8.65	\$11.25	-\$4.73	-\$8
Scenario 2	592	178	\$1.65	\$75.40	\$0	\$77.05	\$5.04	\$0.24	\$5.28	\$7.03	\$12.31	-\$64.74	-\$109
Scenario 3	592	116	\$0.66	\$42.70	\$0	\$43.36	\$2.09	\$0.47	\$2.56	\$7.37	\$9.93	-\$33.43	-\$56
Scenario 4	592	49	\$0.23	\$0.00	\$0	\$0.23	-\$11.35	\$0.00	-\$11.35	\$0.00	-\$11.35	-\$11.58	-\$20

NOTES: (1) Scenario 1 - beach nourishment; scenario 2 - enhanced retreat; scenario 3 - strategic retreat; scenario 4 - no action. (2) The figures are the

SOURCE: Baker. 2012. Economic Analysis of Delaware Bay Shores Management Alternatives. Phase 1C, 1D, & 2C Report. August 29, 2012.

**ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS -
DISTRIBUTION OF COSTS AND BENEFITS BY COMMUNITY**

Community	Scenario 1: Nourishment		Scenario 2: Enhanced Retreat		Scenario 3: Strategic Retreat		Scenario 4: No Action	
	Benefits (\$mill)	Costs (\$mill)	Benefits (\$mill)	Costs (\$mill)	Benefits (\$mill)	Costs (\$mill)	Benefits (\$mill)	Costs (\$mill)
KENT COUNTY								
Pickering								
Private	-\$0.10		\$0.74		\$0.21		-\$2.54	
Public	\$0.66	\$6.41	\$0.17	\$5.77	\$0.30	\$3.45	\$0	\$0.14
<i>Total</i>	<i>\$0.56</i>	<i>\$6.41</i>	<i>\$0.91</i>	<i>\$5.77</i>	<i>\$0.51</i>	<i>\$3.45</i>	<i>-\$2.54</i>	<i>\$0.14</i>
Net impact	-\$5.85		-\$4.86		-\$2.94		-\$2.68	
Kitts Hummock								
Private	\$0.05		\$1.69		\$0.34		-\$2.41	
Public	\$0.62	\$7.81	\$0.28	\$11.40	\$0.34	\$4.85	\$0	\$0.12
<i>Total</i>	<i>\$0.67</i>	<i>\$7.81</i>	<i>\$1.97</i>	<i>\$11.40</i>	<i>\$0.68</i>	<i>\$4.85</i>	<i>-\$2.41</i>	<i>\$0.12</i>
Net impact	-\$7.14		-\$9.43		-\$4.17		-\$2.53	
Bowers								
Private	\$0.17		\$0.73		\$0.11		-\$0.42	
Public	\$1.17	\$4.89	\$0.93	\$7.95	\$0.58	\$3.98	\$0	\$0.03
<i>Total</i>	<i>\$1.34</i>	<i>\$4.89</i>	<i>\$1.66</i>	<i>\$7.95</i>	<i>\$0.69</i>	<i>\$3.98</i>	<i>-\$0.42</i>	<i>\$0.03</i>
Net impact	-\$3.55		-\$6.29		-\$3.29		-\$0.45	
South Bowers								
Private	\$0.14		\$0.47		\$0.10		-\$0.28	
Public	\$0.39	\$4.64	\$0.29	\$2.50	\$0.82	\$0.93	\$0	\$0.03
<i>Total</i>	<i>\$0.53</i>	<i>\$4.64</i>	<i>\$0.76</i>	<i>\$2.50</i>	<i>\$0.92</i>	<i>\$0.93</i>	<i>-\$0.28</i>	<i>\$0.03</i>
Net impact	-\$4.11		-\$1.74		-\$0.01		-\$0.31	

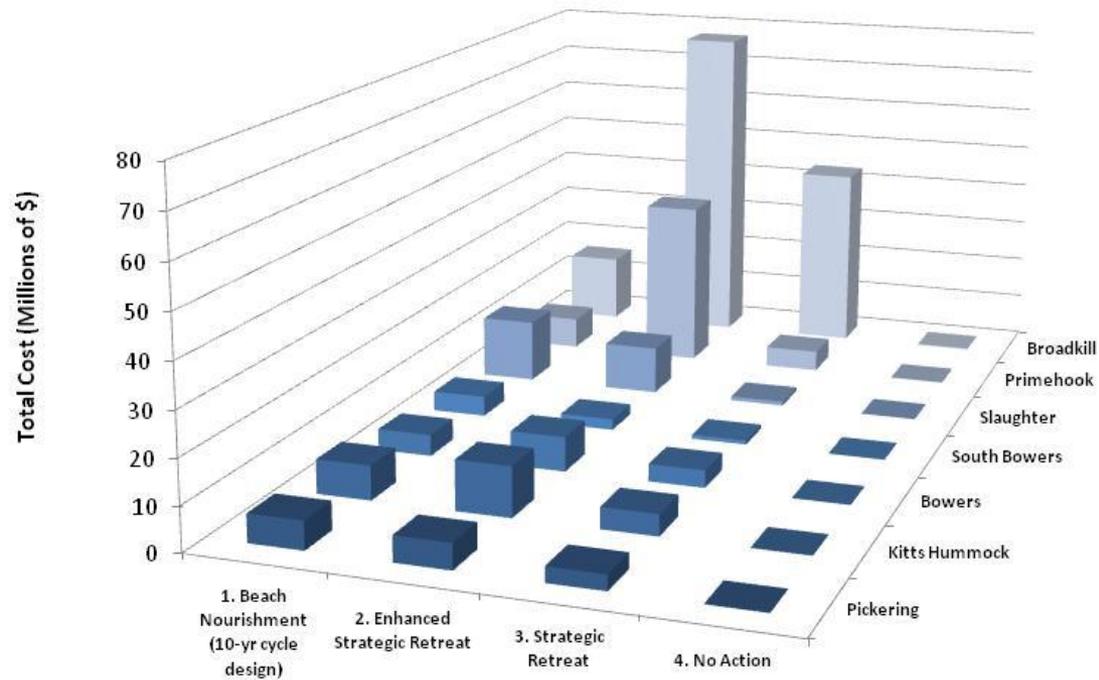
**ECONOMIC ANALYSIS OF DELAWARE BAY SHORE MANAGEMENT OPTIONS -
DISTRIBUTION OF COSTS AND BENEFITS BY COMMUNITY**

	Scenario 1: Nourishment		Scenario 2: Enhanced Retreat		Scenario 3: Strategic Retreat		Scenario 4: No Action	
	Benefits (\$mill)	Costs (\$mill)	Benefits (\$mill)	Costs (\$mill)	Benefits (\$mill)	Costs (\$mill)	Benefits (\$mill)	Costs (\$mill)
Community								
SUSSEX COUNTY								
Slaughter								
Private	\$0.57		\$0.33		\$0.06		\$0	
Public	\$2.39	\$14.60	\$2.19	\$11.06	\$1.59	\$0.92	\$0	\$0
<i>Total</i>	\$2.96	\$14.60	\$2.52	\$11.06	\$1.65	\$0.92	\$0	\$0
Net impact	-\$11.64		-\$8.54		\$0.73		\$0.00	
Prime Hook								
Private	\$0.37		\$1.64		\$0.08		-\$1.19	
Public	\$1.09	\$7.32	-\$0.37	\$38.89	\$0.06	\$4.79	\$0	\$0.04
<i>Total</i>	\$1.46	\$7.32	\$1.27	\$38.89	\$0.14	\$4.79	-\$1.19	\$0.04
Net impact	-\$5.86		-\$37.62		-\$4.65		-\$1.23	
Broadkill								
Private	\$1.52		\$5.04		\$2.09		-\$11.35	
Public	\$9.73	\$15.98	\$7.27	\$77.01	\$7.84	\$43.36	\$0	\$0.23
<i>Total</i>	\$11.25	\$15.98	\$12.31	\$77.01	\$9.93	\$43.36	-\$11.35	\$0.23
Net impact	-\$4.73		-\$64.70		-\$33.43		-\$11.58	

NOTES: (1) All values reported 2011 dollars. The figures are the present value of the stream of
(2) Private benefits reflect avoided losses to private property due to flooding or
(3) Public impacts include the direct costs of management option under each scenario

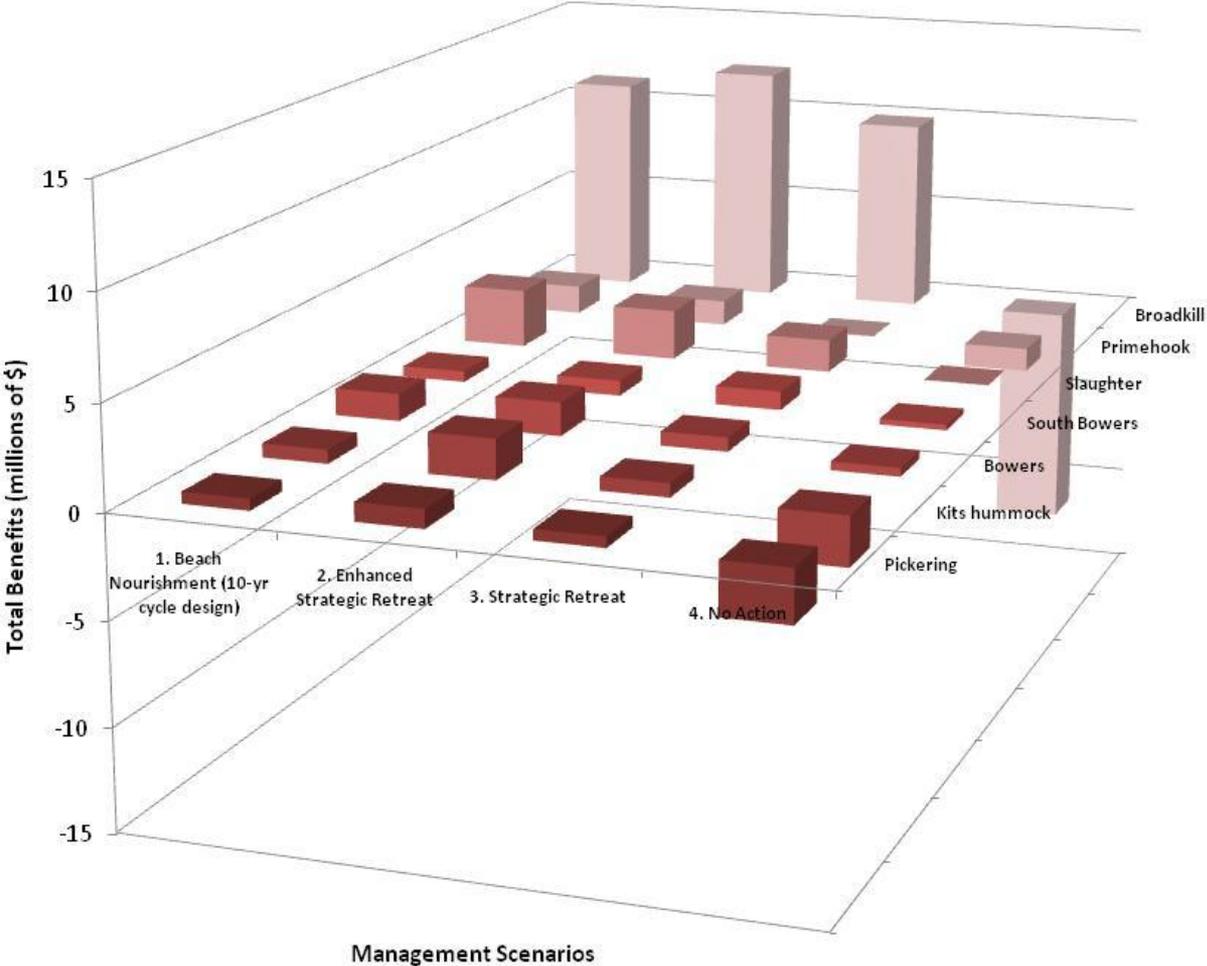
SOURCE: Baker. 2012. Economic Analysis of Delaware Bay Shores Management Alternatives.

Total Cost

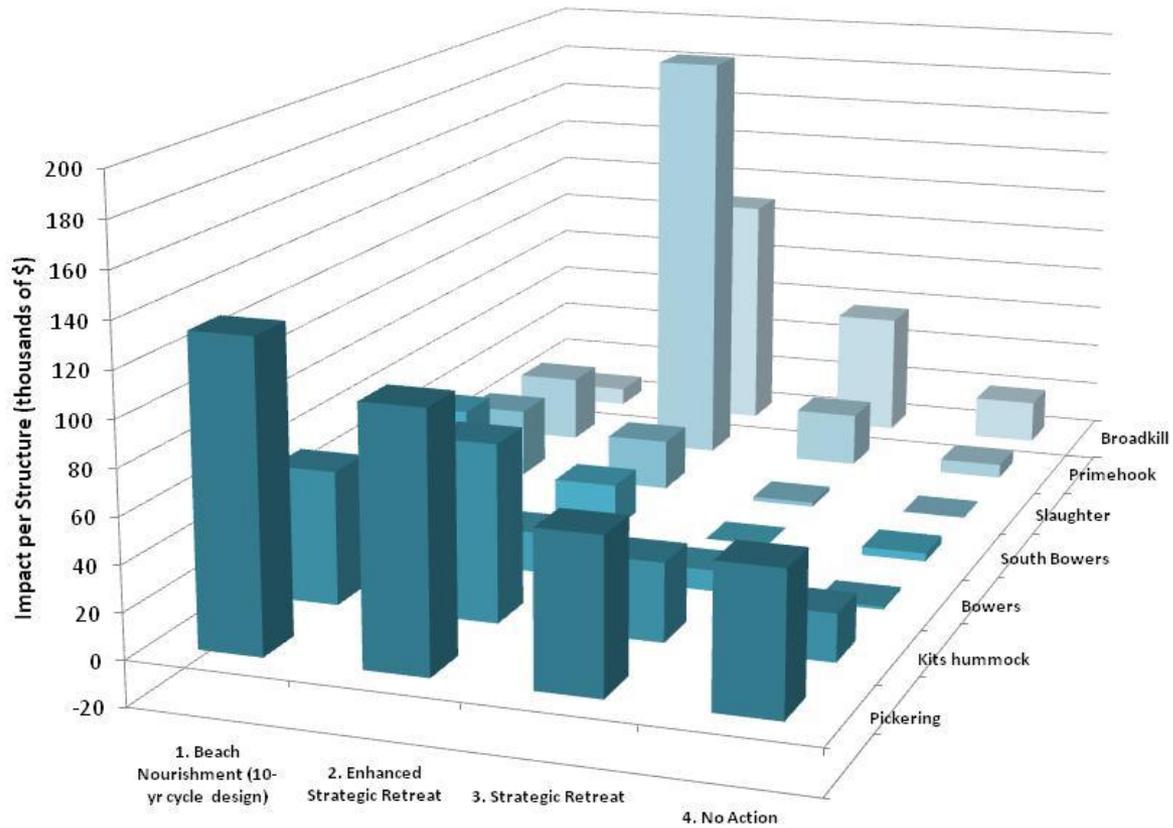


Management Scenarios

Total Benefits



Impact per structure

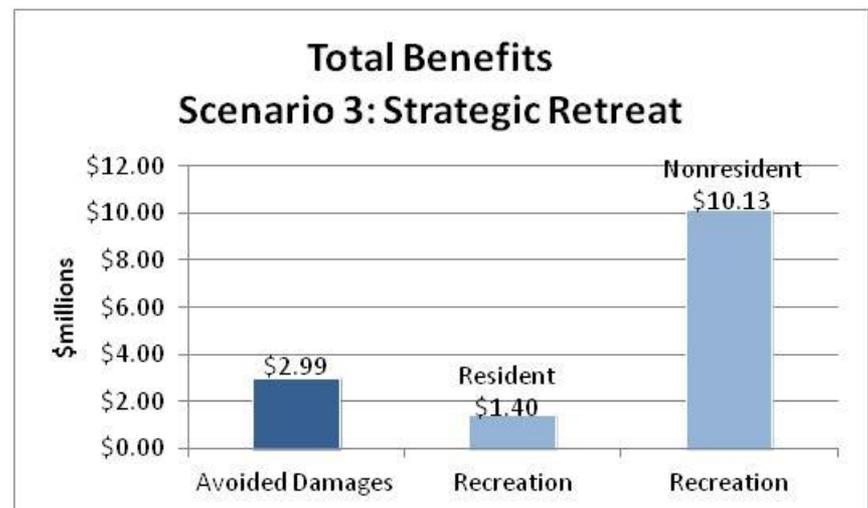
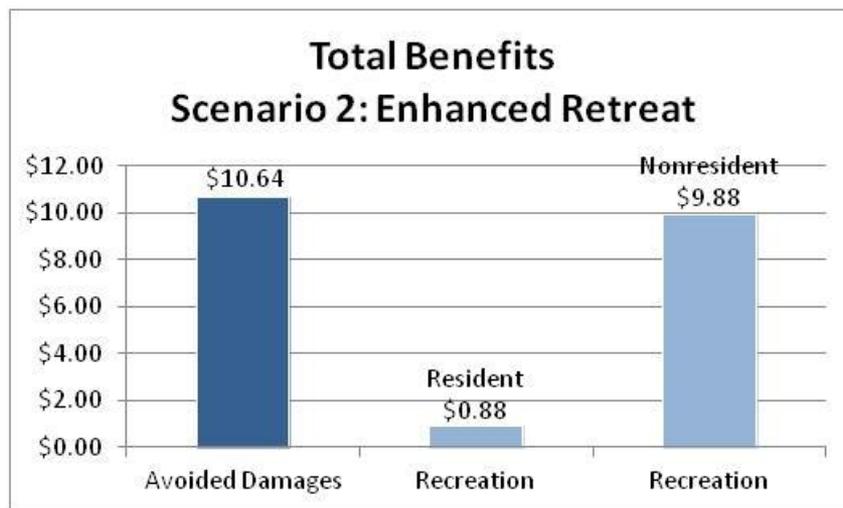
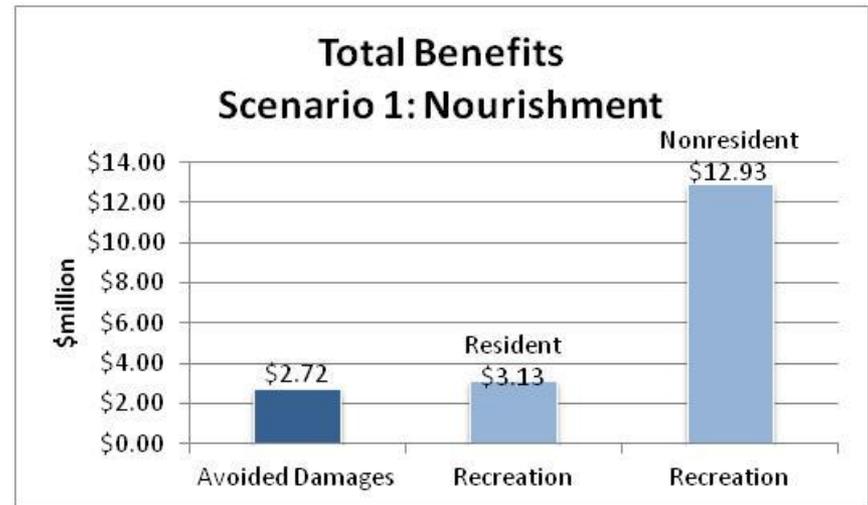
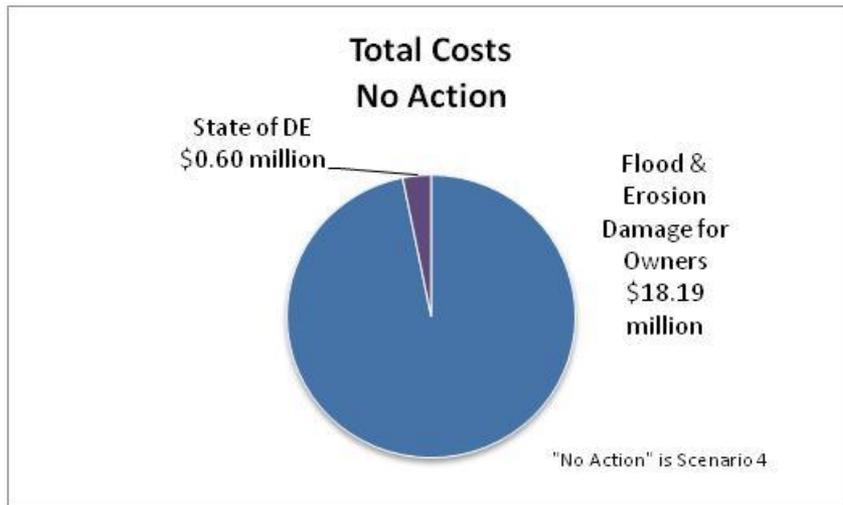


Managment Scenarios

Beach Nourishment Cost per Structure

Community	Structures	Nourishment (\$millions)	Nourishment/Structure (\$thousands)
Pickering	44	\$6.41	\$1.46
Kitts Hummock	122	\$7.81	\$0.64
Bowers	354	\$4.89	\$0.14
South Bowers	84	\$4.64	\$0.55
Slaughter	372	\$14.60	\$0.39
Primehook	195	\$7.32	\$0.38
Broadkill	592	\$15.98	\$0.27

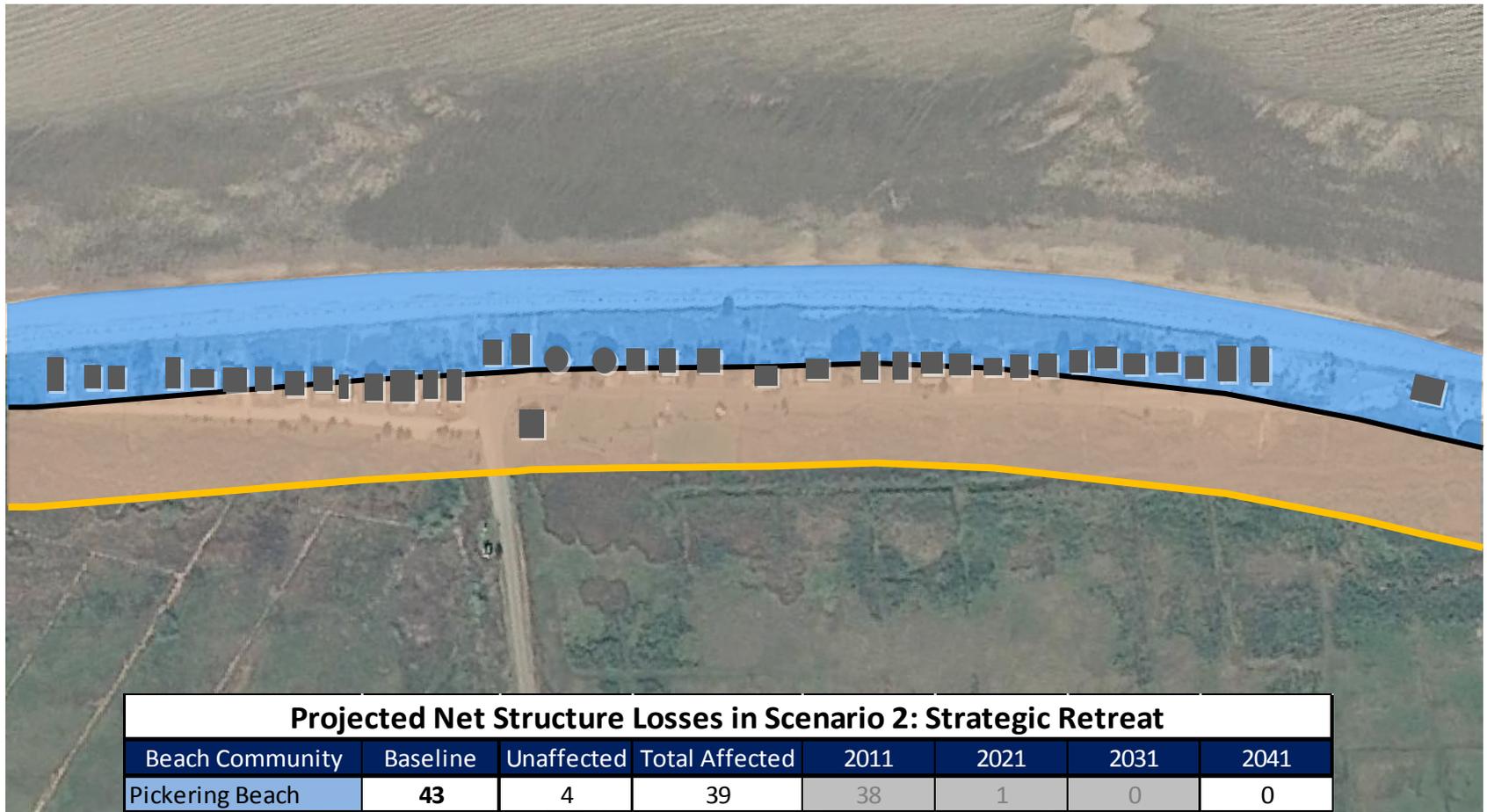
Total Benefits and Costs



Community Specific Results

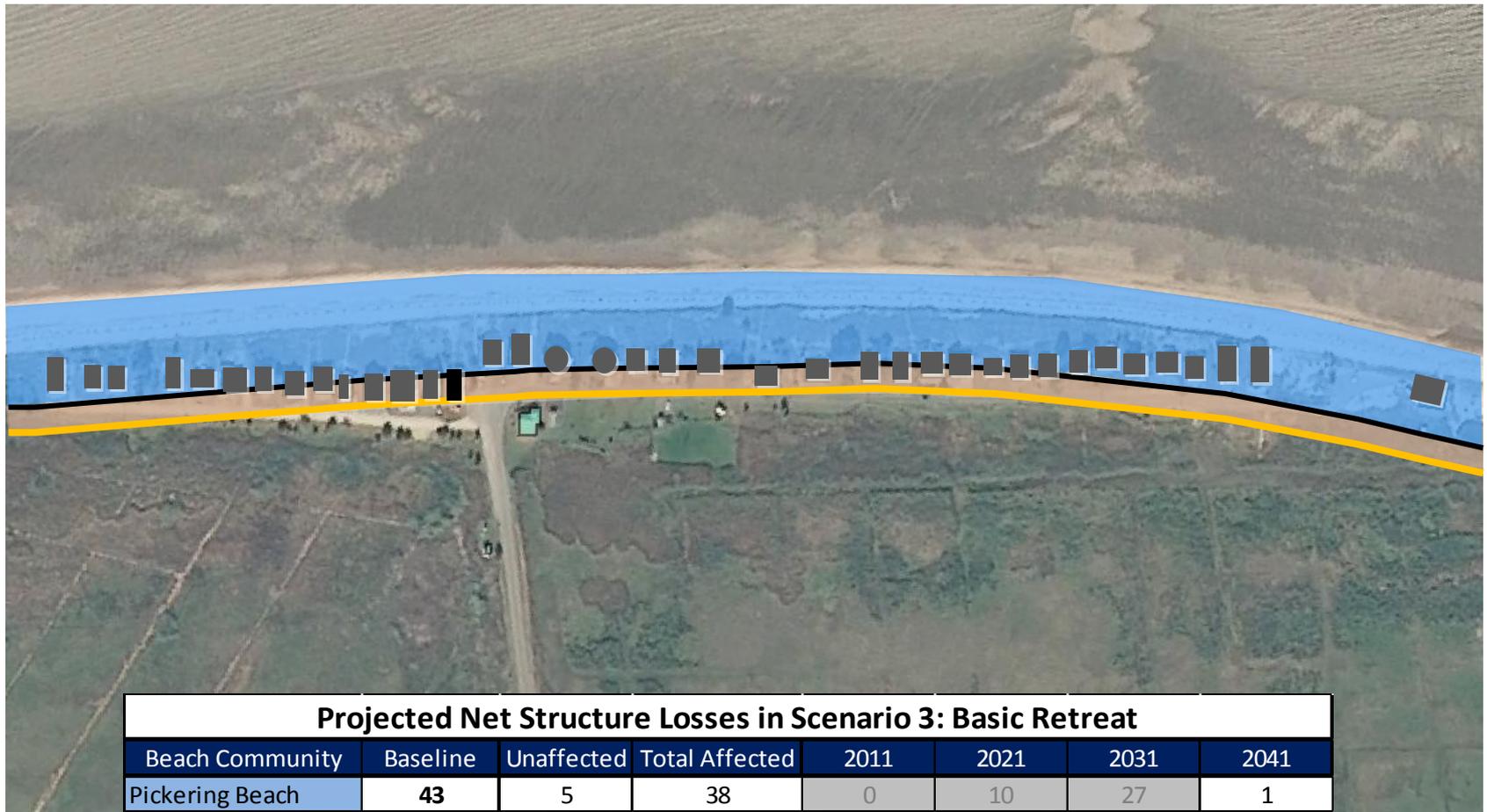
Pickering Beach

Scenario 2 – 2041 Shoreline



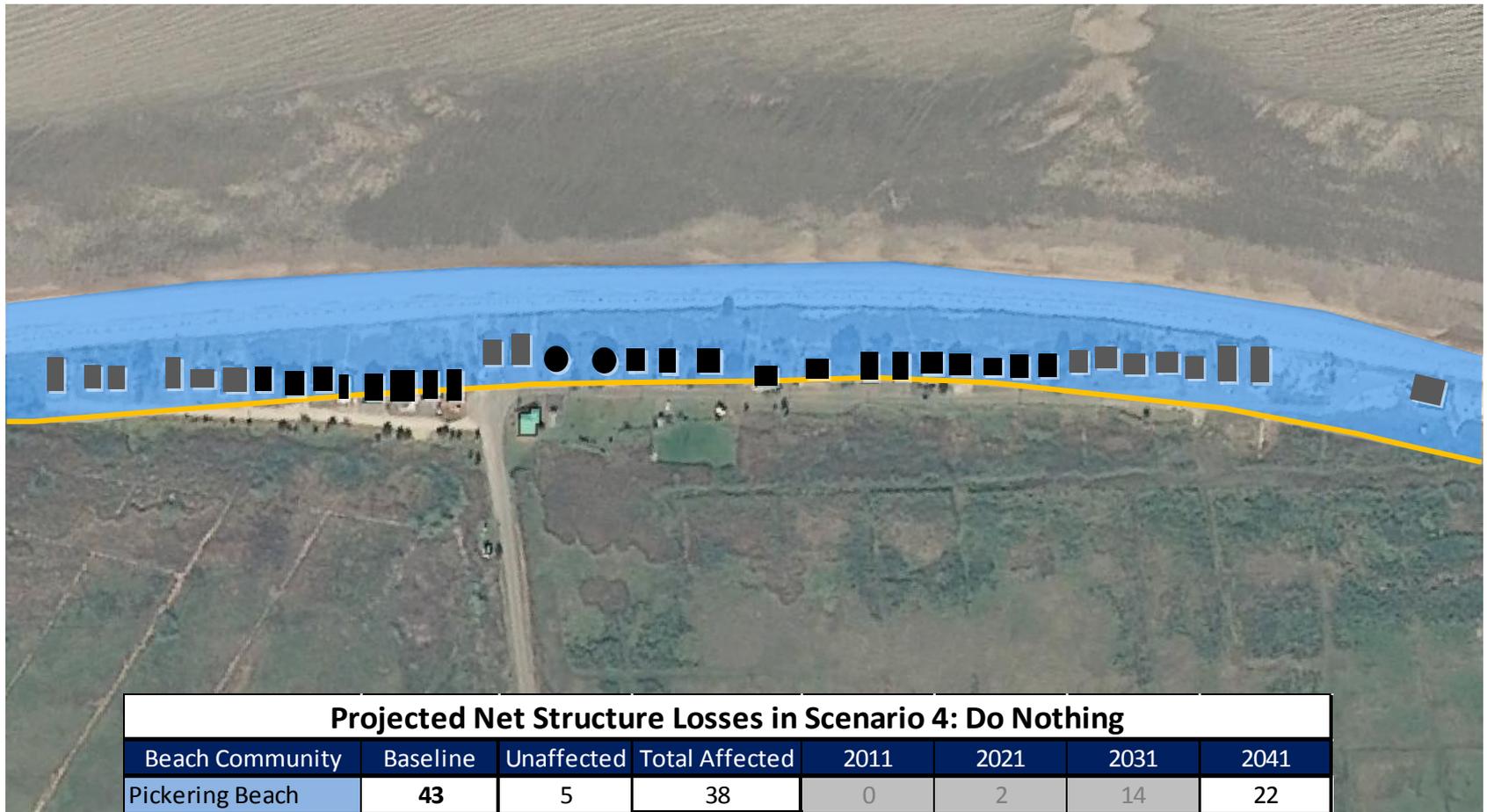
Pickering Beach

Scenario 3 – 2041 Shoreline



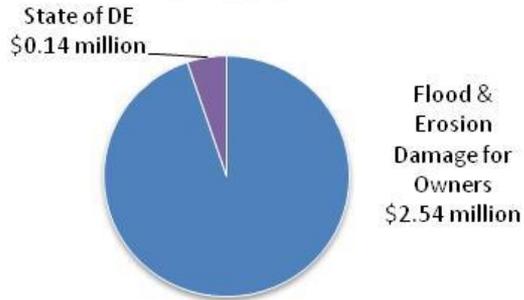
Pickering Beach

Scenario 4 – 2041 Shoreline



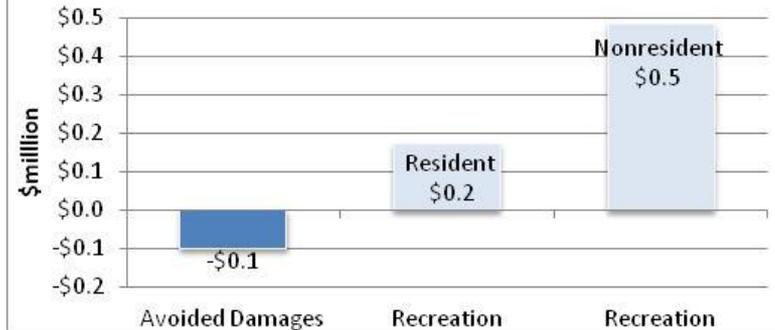
Pickering Beach

Pickering Costs No Action



"No Action" is Scenario 4

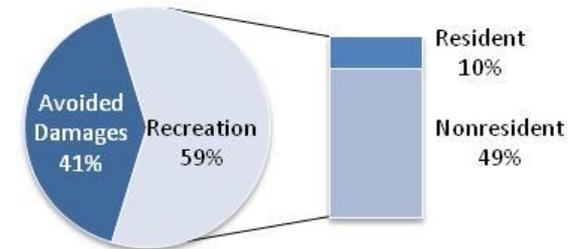
Pickering Benefits Scenario 1: Nourishment



Pickering Benefits Scenario 2: Enhanced Retreat

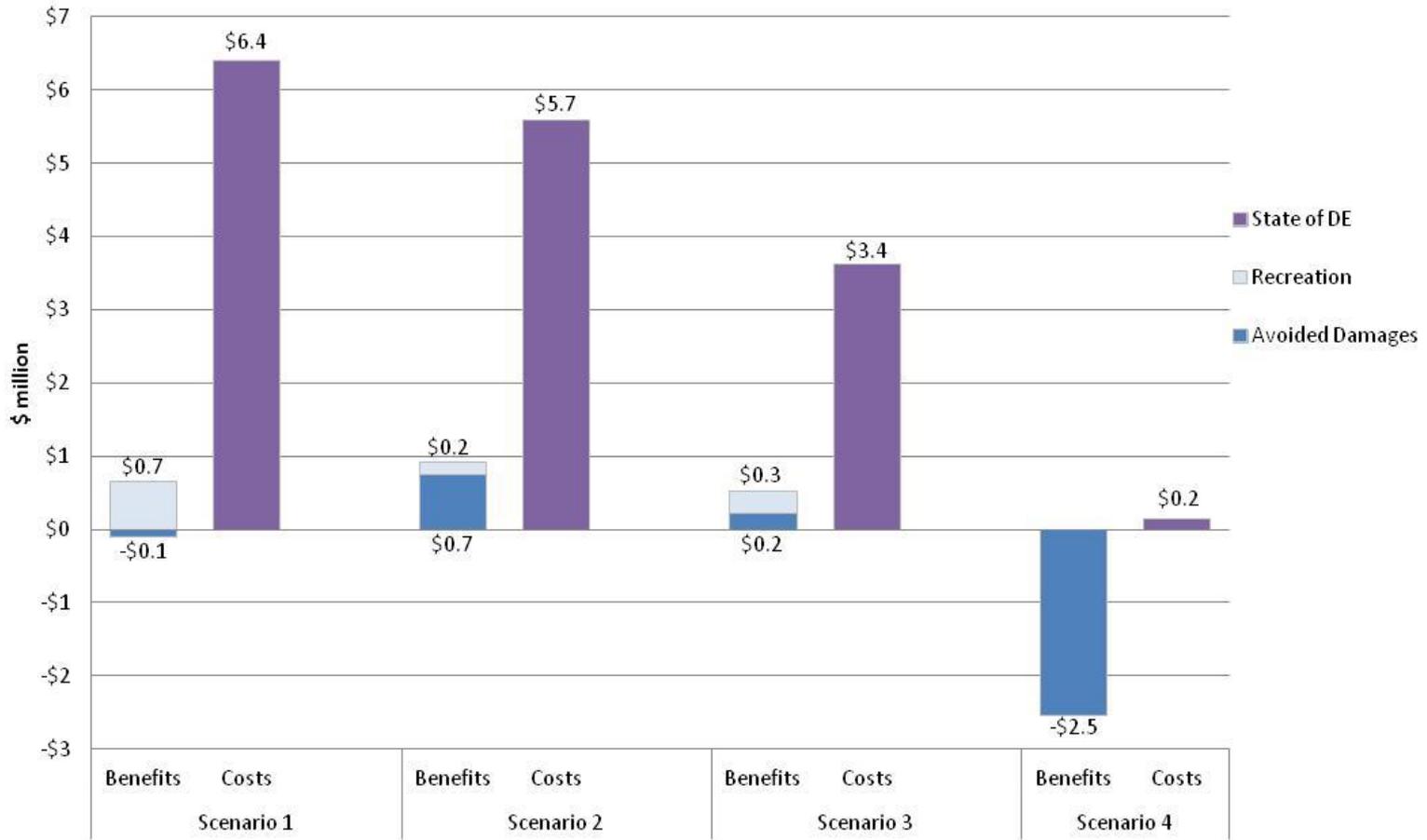


Pickering Benefits Scenario 3: Strategic Retreat



Pickering Beach

Pickering Scenario Costs and Benefits



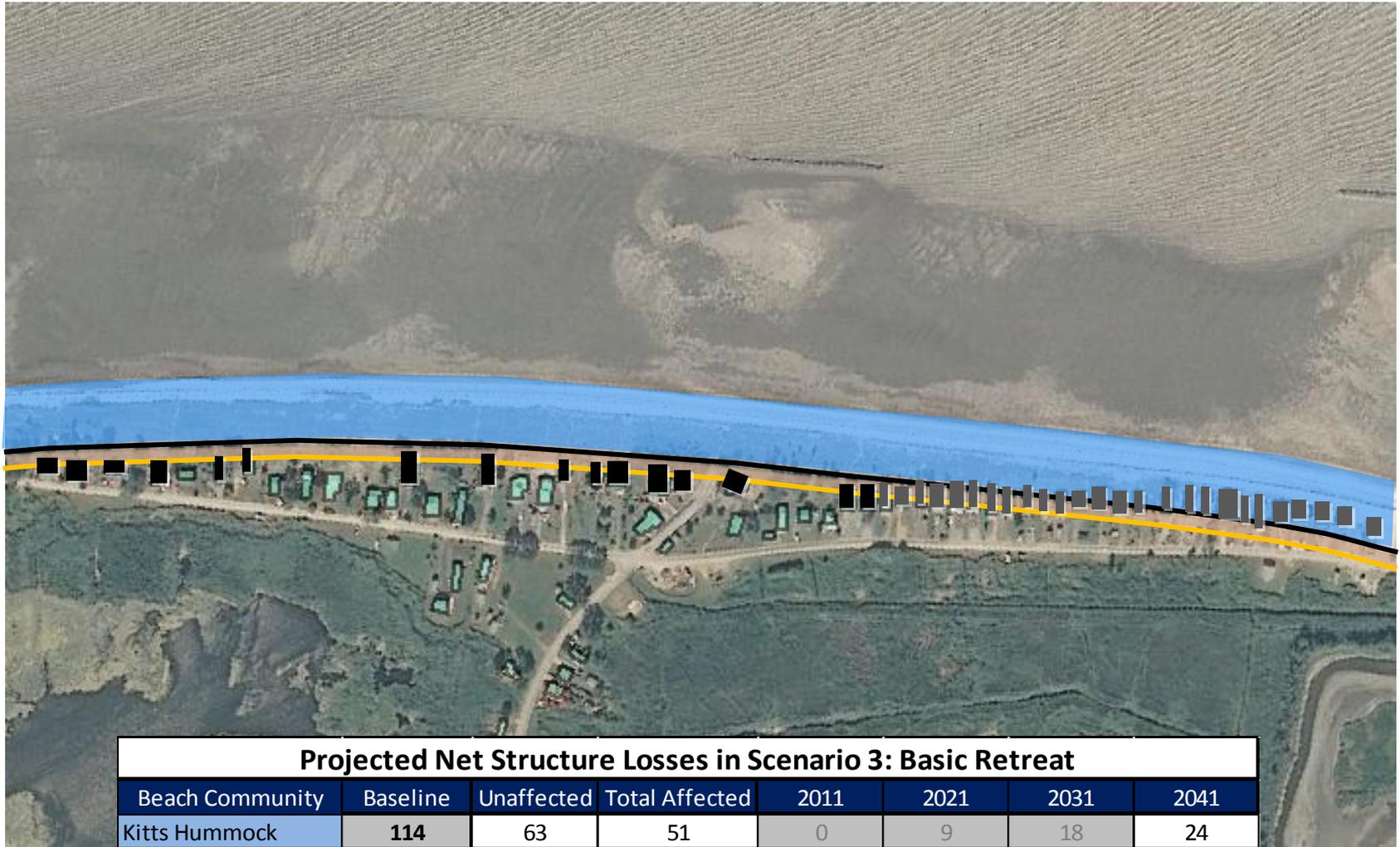
Kitts Hummock

Scenario 2 – 2041 Shoreline



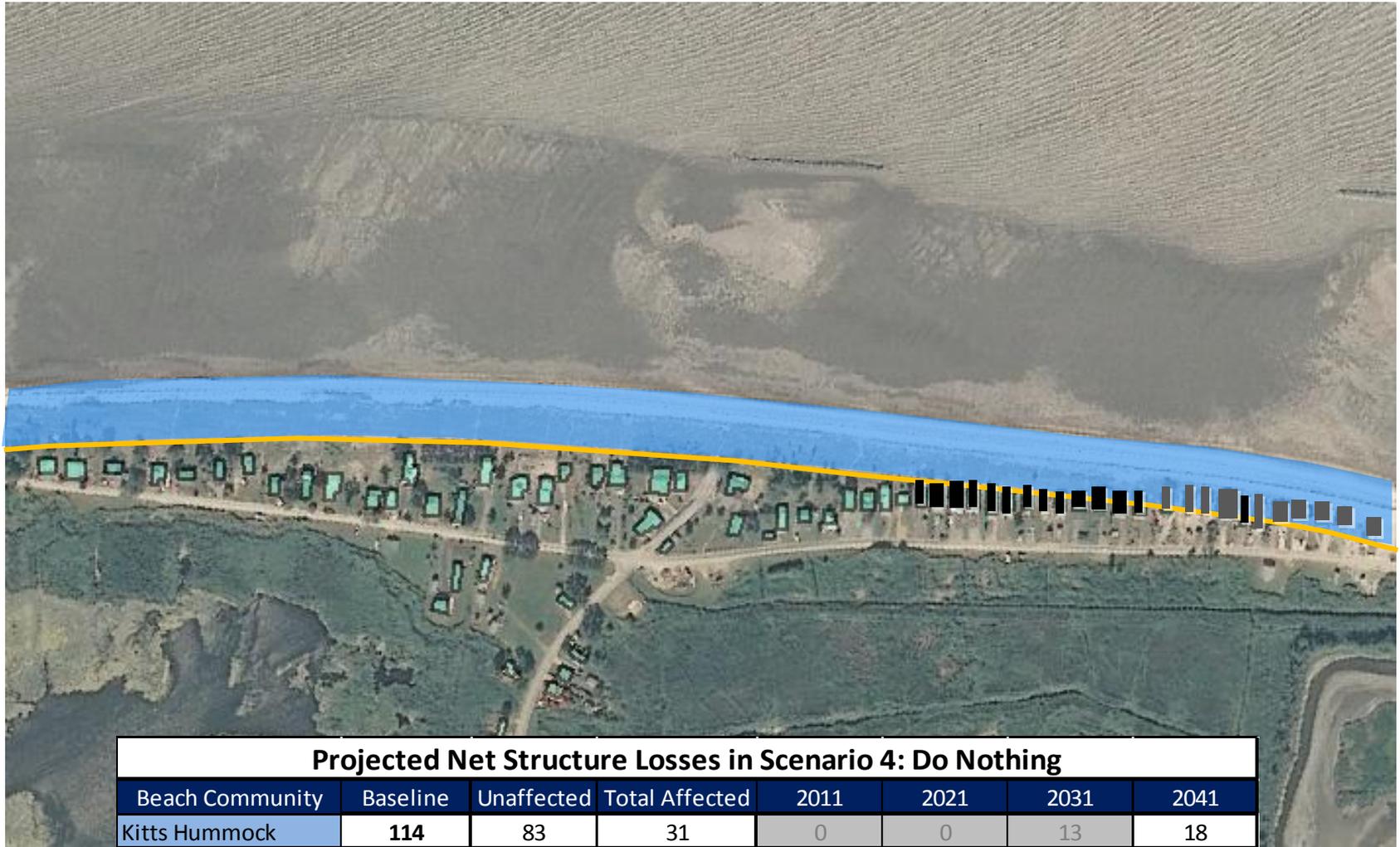
Kitts Hummock

Scenario 3 – 2041 Shoreline



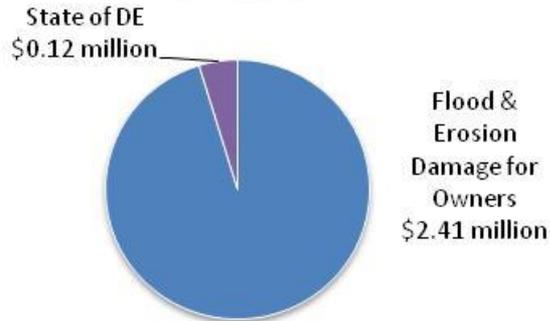
Kitts Hummock

Scenario 4 – 2041 Shoreline



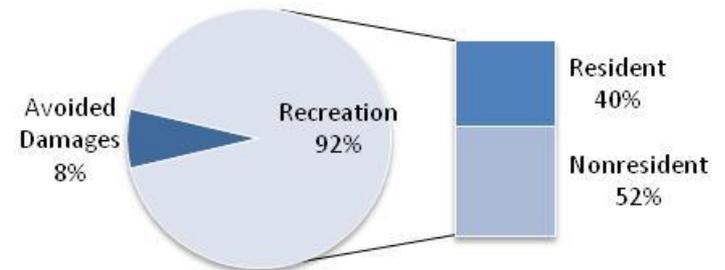
Kitts Hummock

Kitts Hummock Costs No Action

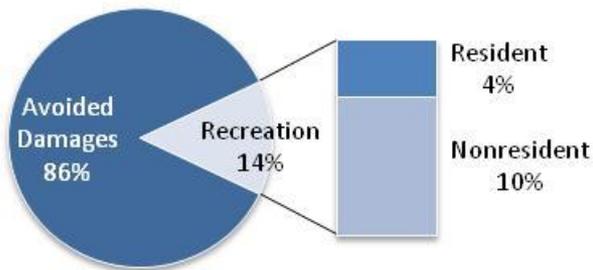


"No Action" is Scenario 4

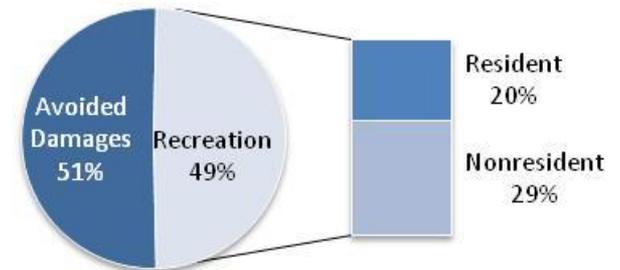
Kitts Hummock Benefits Scenario 1: Nourishment



Kitts Hummock Benefits Scenario 2: Enhanced Retreat

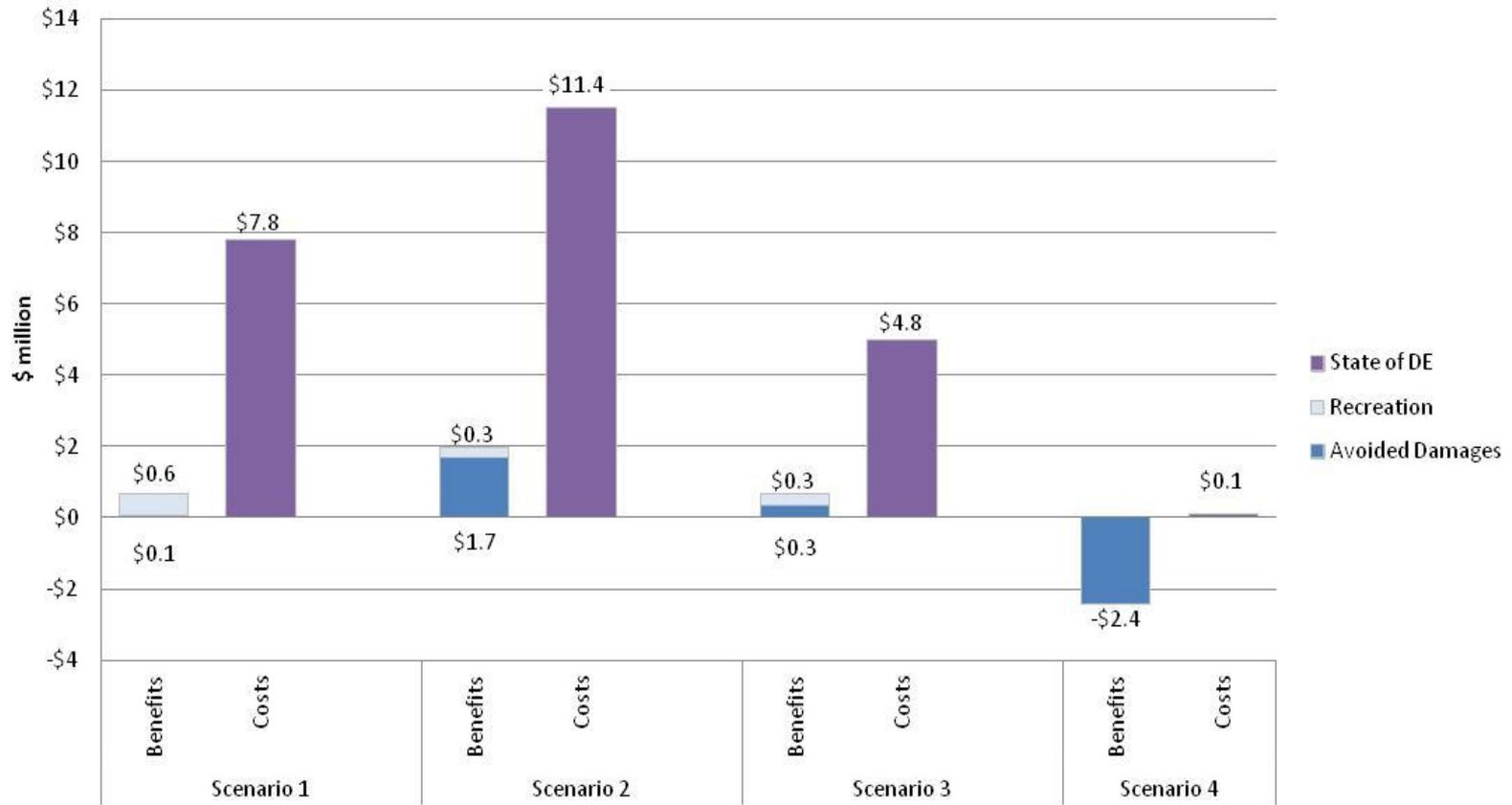


Kitts Hummock Benefits Scenario 3: Strategic Retreat



Kitts Hummock

Kitts Hummock Scenario Costs and Benefits



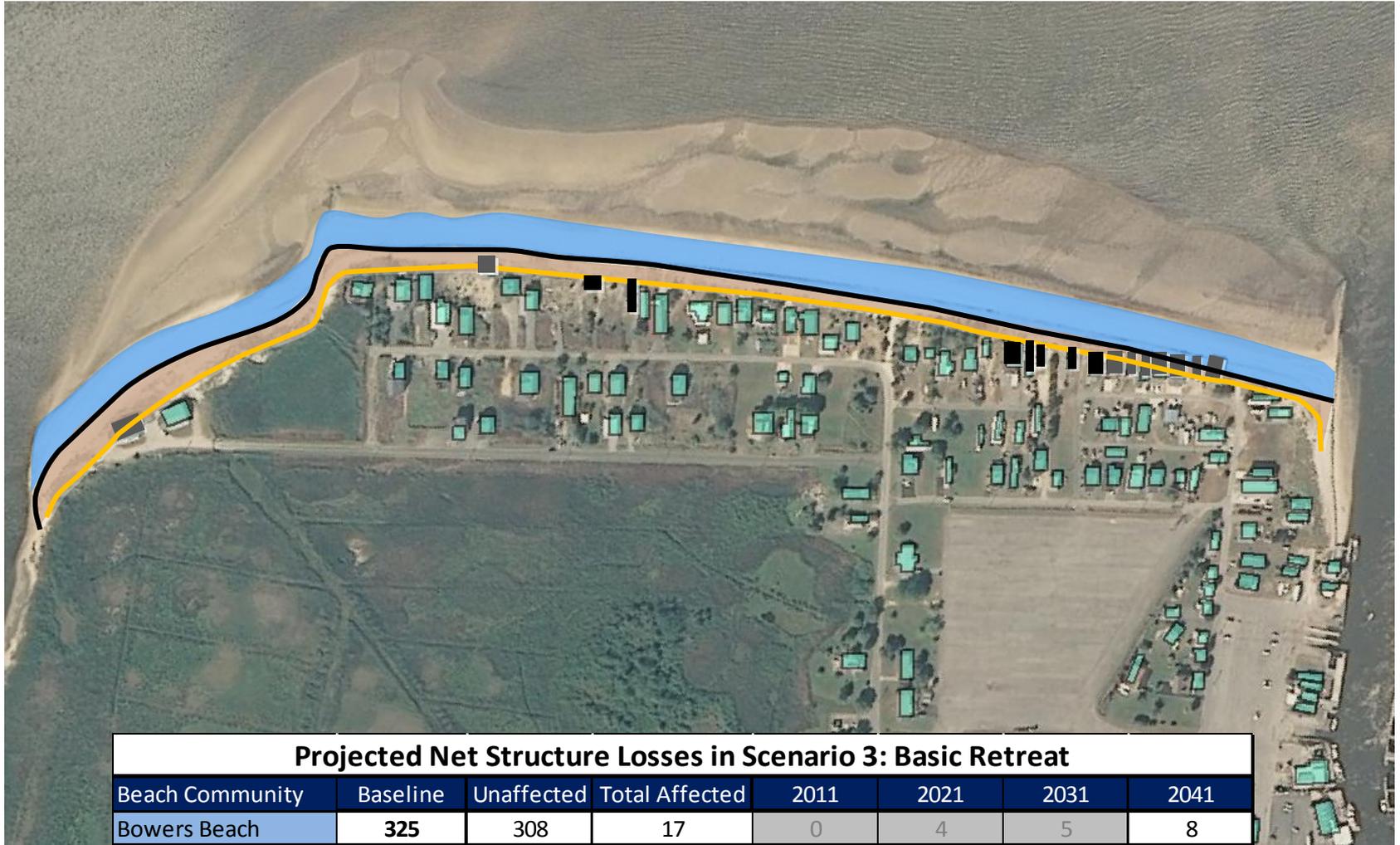
Bowers Beach

Scenario 2 – 2041 Shoreline



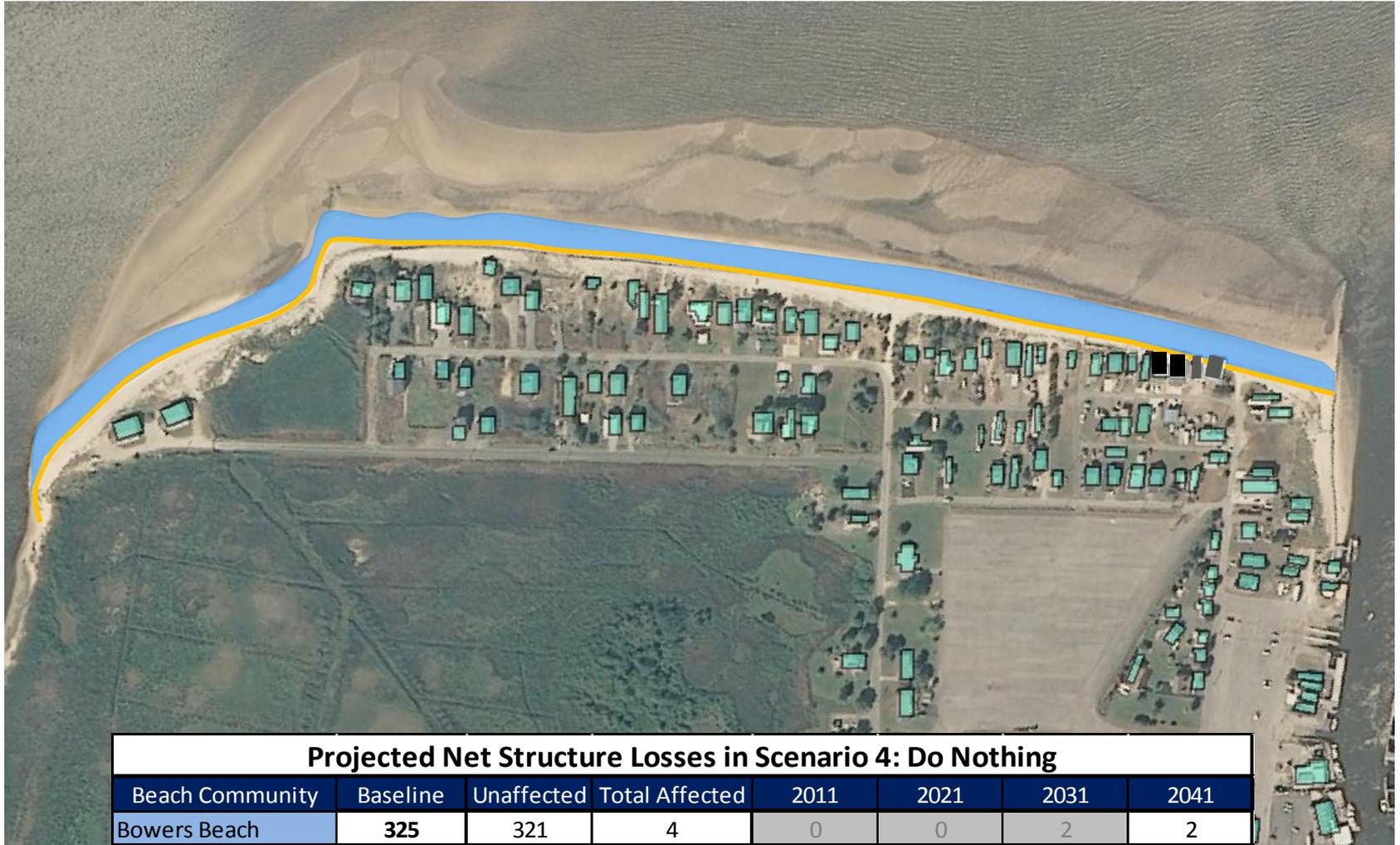
Bowers Beach

Scenario 3 – 2041 Shoreline



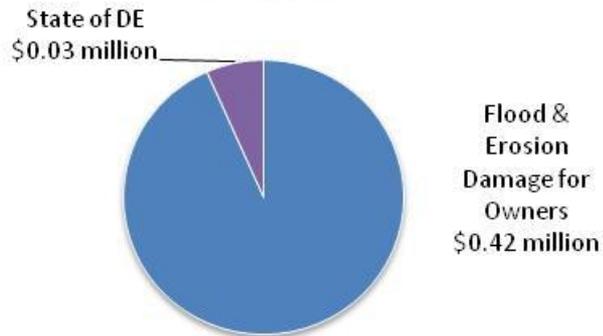
Bowers Beach

Scenario 4 – 2041 Shoreline



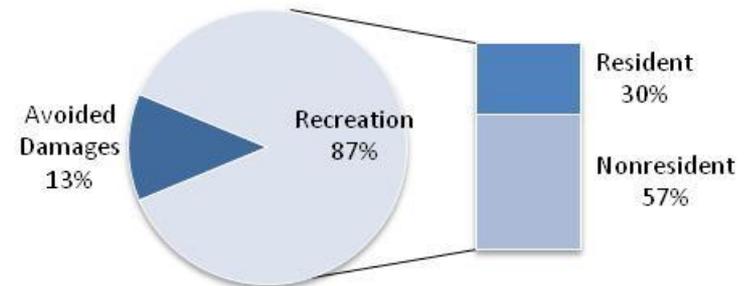
Bowers Beach

Bowers Costs No Action

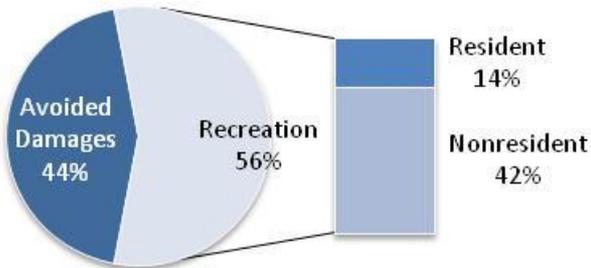


"No Action" is Scenario 4

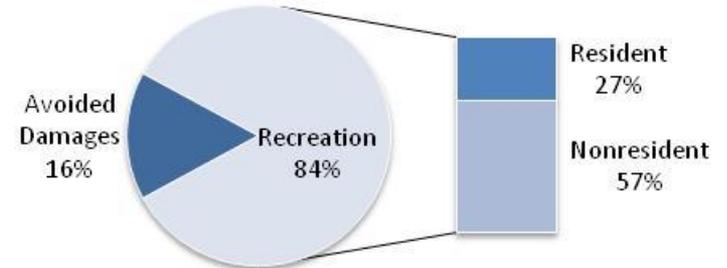
Bowers Benefits Scenario 1: Nourishment



Bowers Benefits Scenario 2: Enhanced Retreat

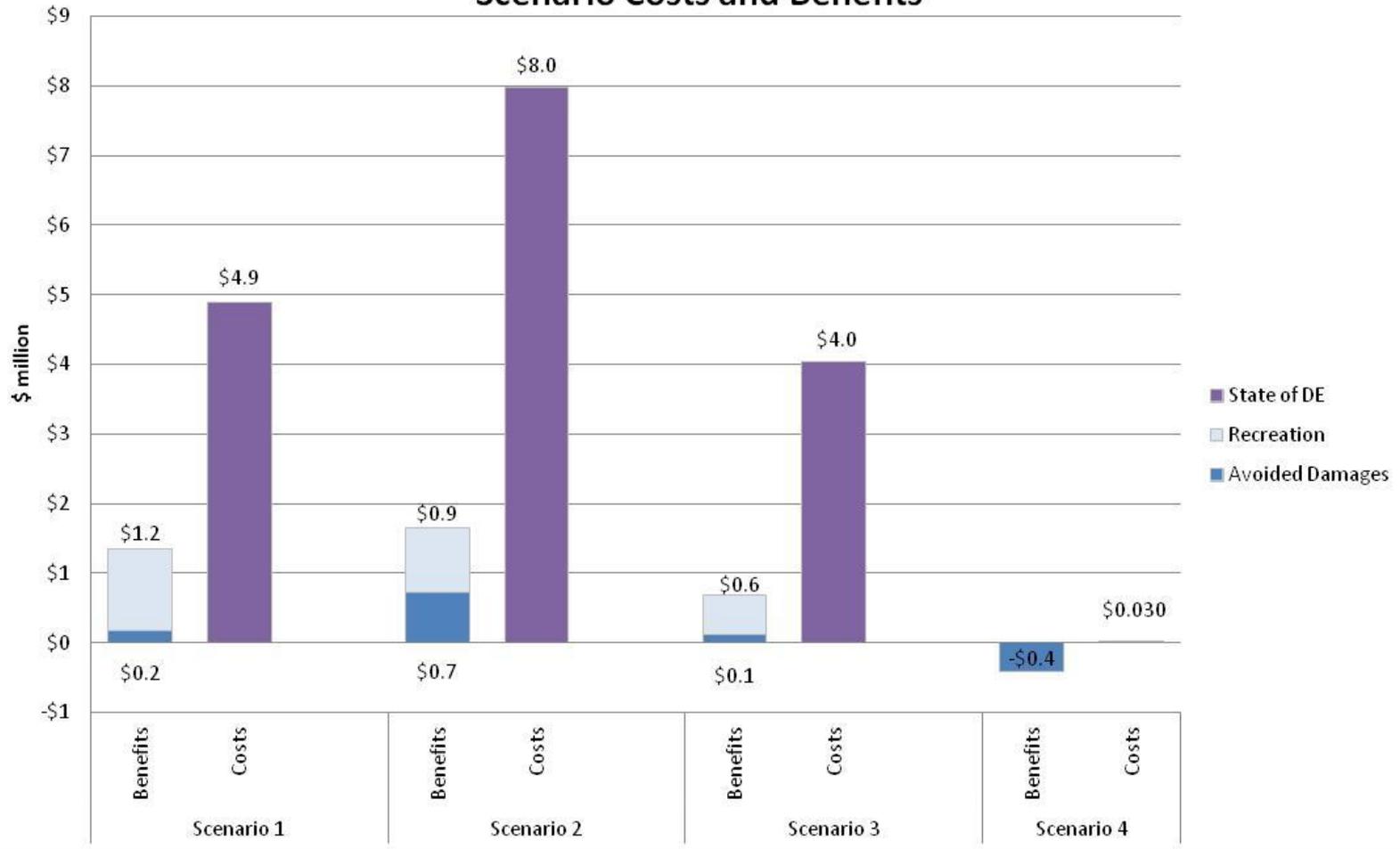


Bowers Benefits Scenario 3: Strategic Retreat



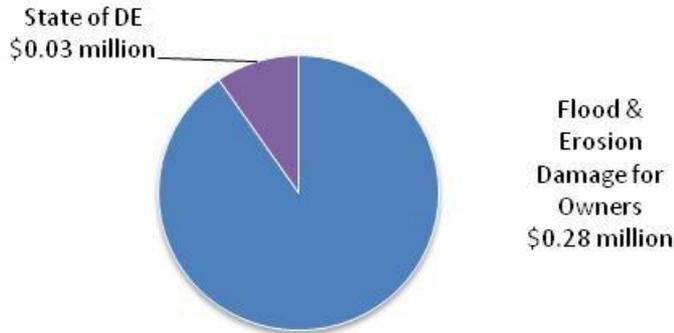
Bowers Beach

Bowers
Scenario Costs and Benefits



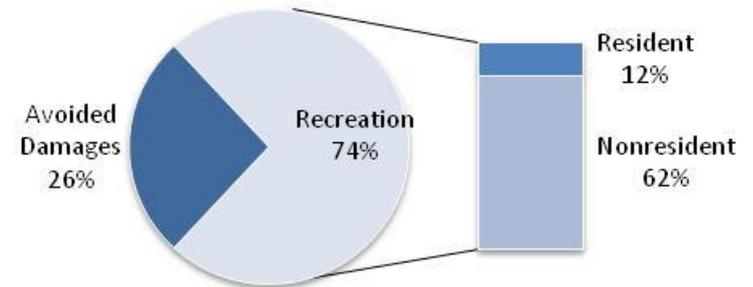
South Bowers Beach

South Bowers Costs No Action

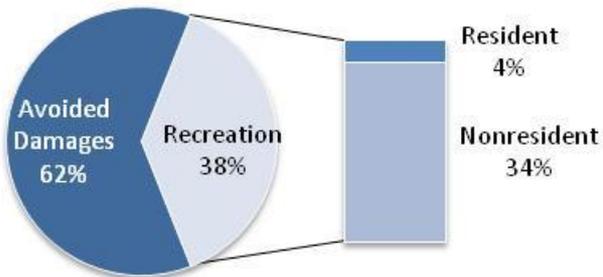


"No Action" is Scenario 4

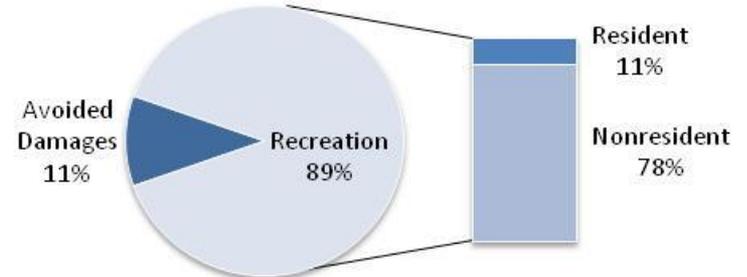
South Bowers Benefits Scenario 1: Nourishment



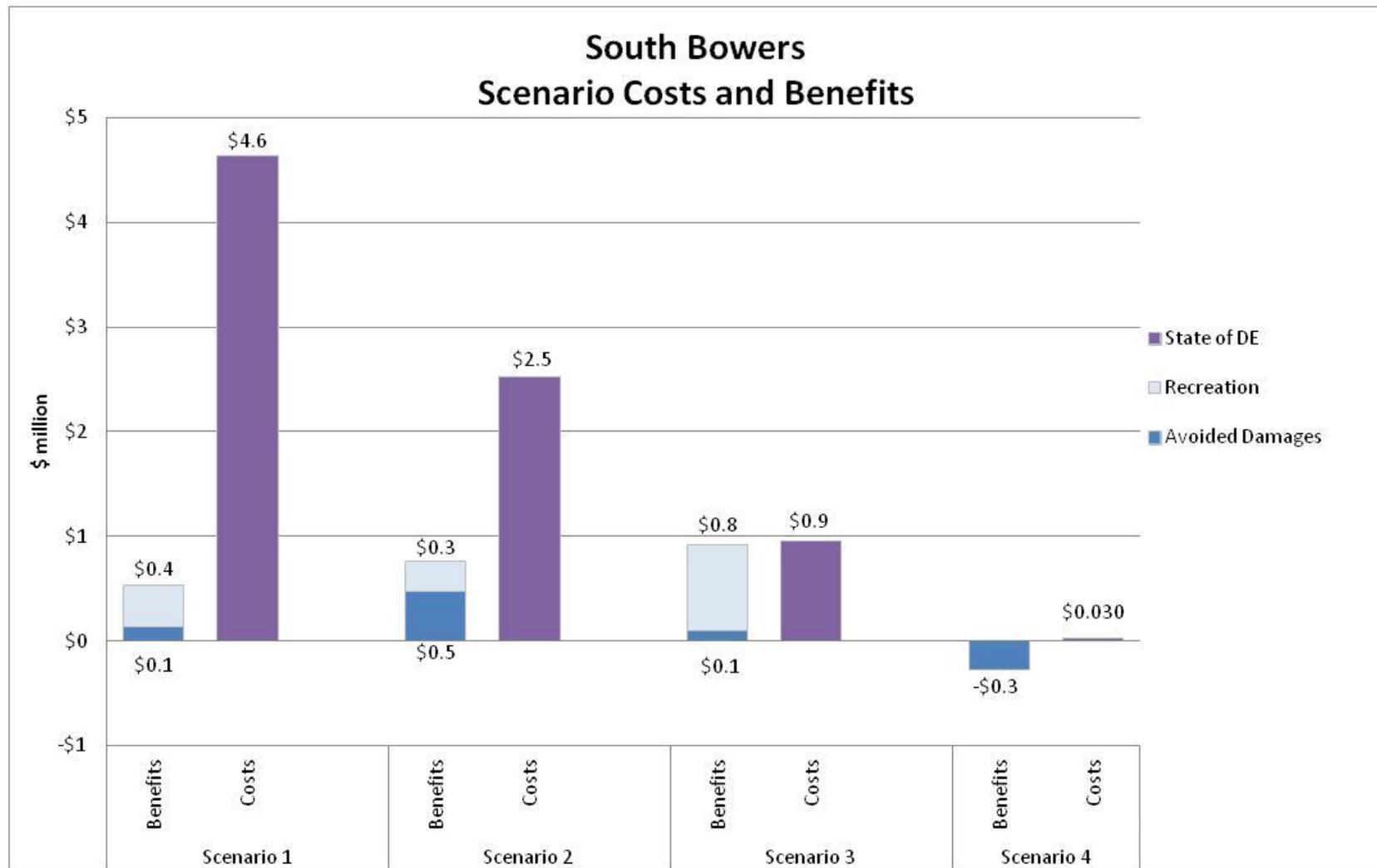
South Bowers Benefits Scenario 2: Enhanced Retreat



South Bowers Benefits Scenario 3: Strategic Retreat

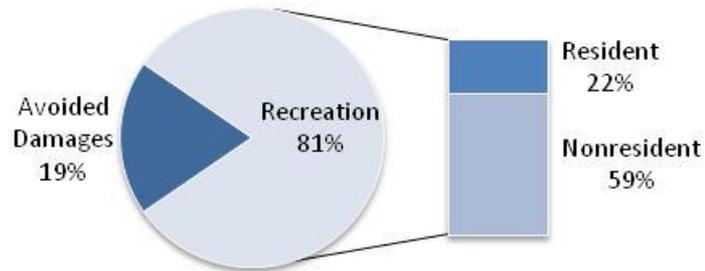


South Bowers Beach

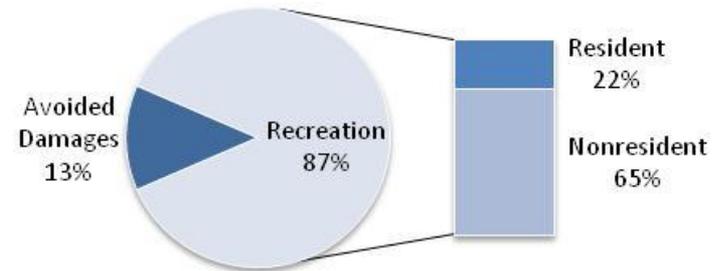


Slaughter Beach

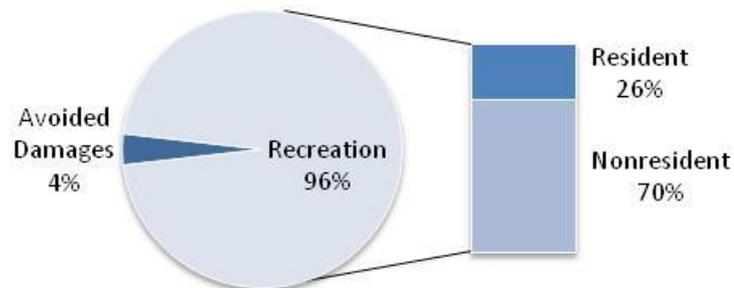
Slaughter Benefits Scenario 1: Nourishment



Slaughter Benefits Scenario 2: Enhanced Retreat

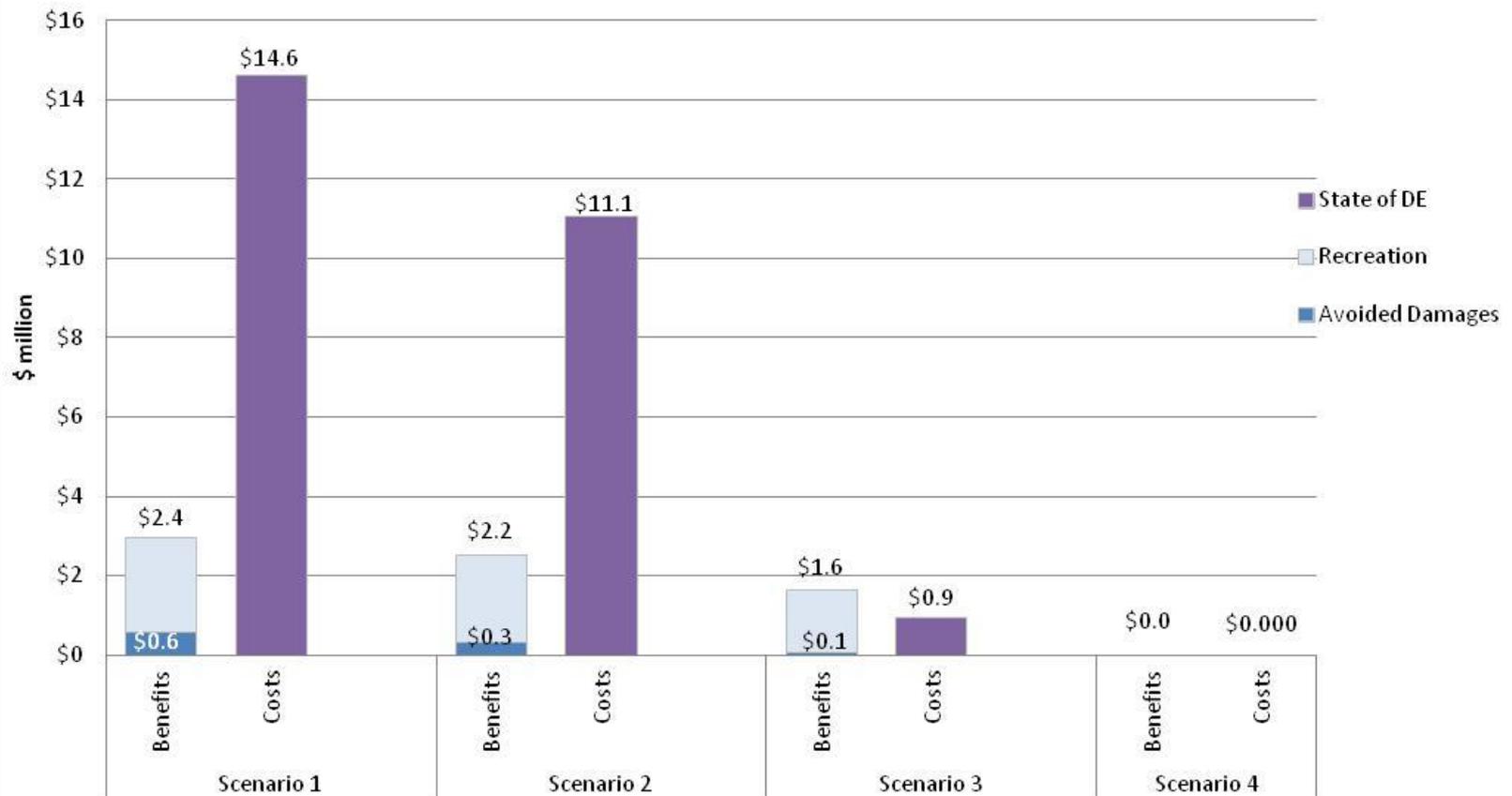


Slaughter Benefits Scenario 3: Strategic Retreat



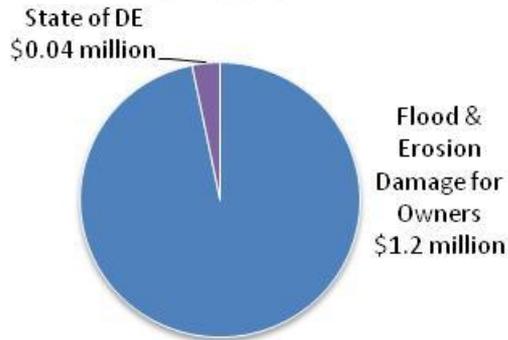
Slaughter Beach

Slaughter Scenario Costs and Benefits



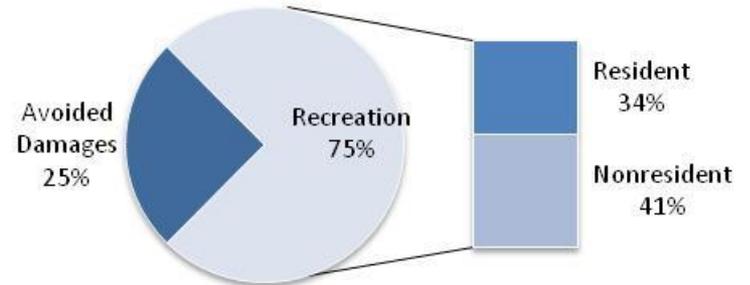
Prime Hook

Prime Hook Costs No Action



"No Action" is Scenario 4

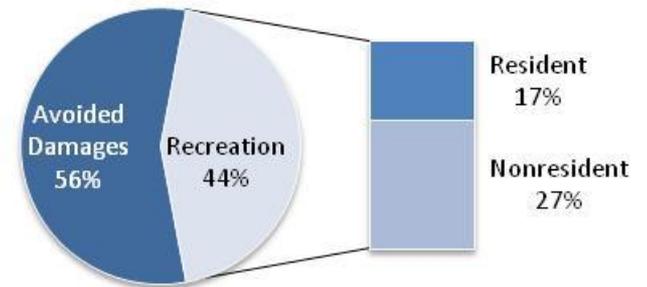
Prime Hook Benefits Scenario 1: Nourishment



Prime Hook Benefits Scenario 2: Enhanced Retreat

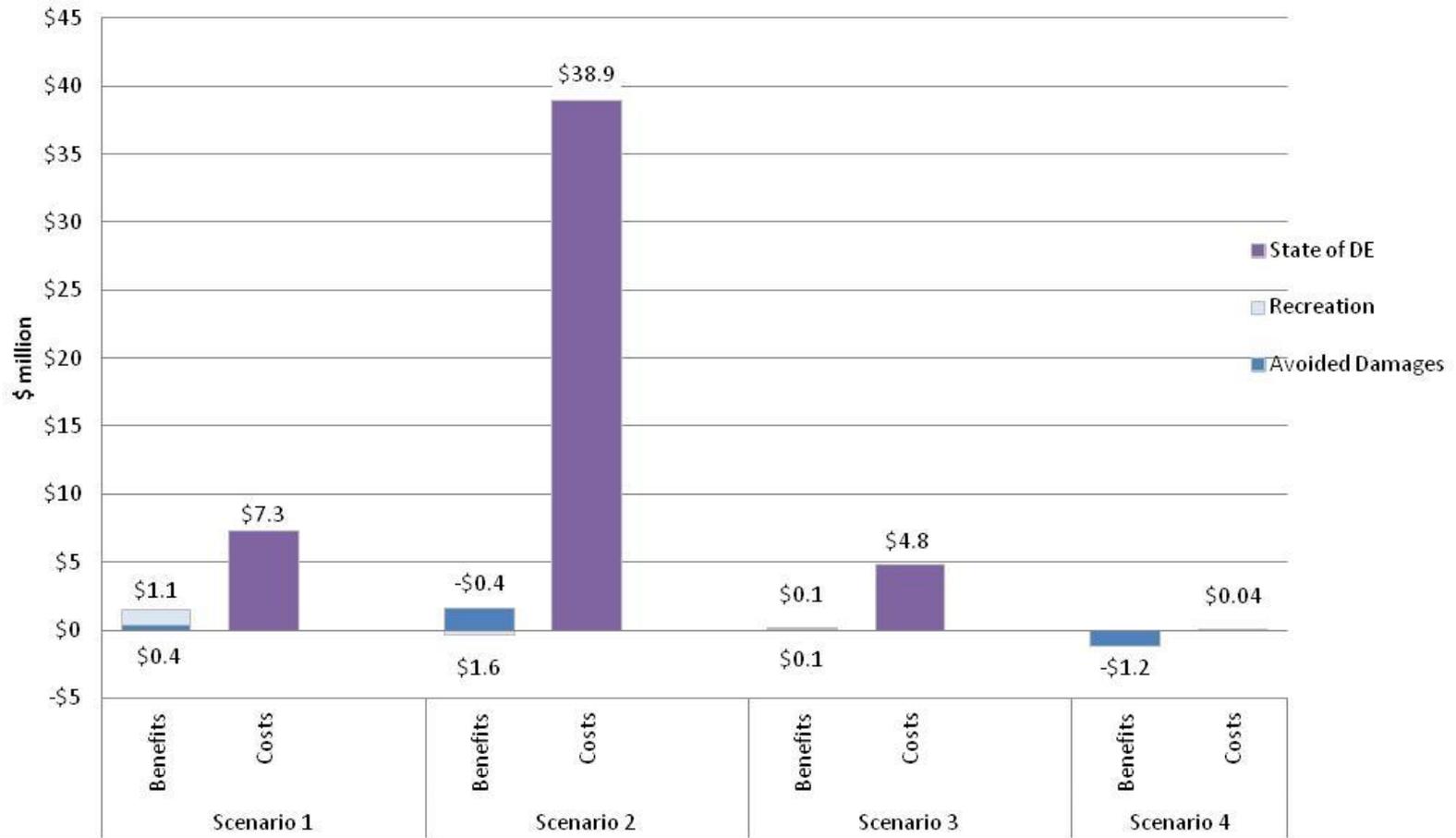


Prime Hook Benefits Scenario 3: Strategic Retreat



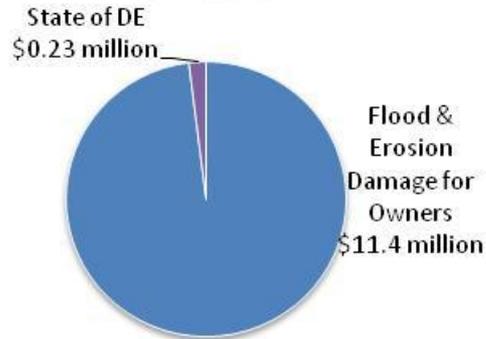
Prime Hook

Prime Hook Scenario Costs and Benefits



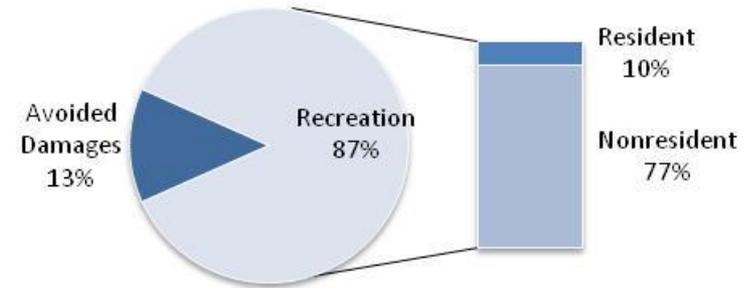
Broadkill

Broadkill Costs No Action

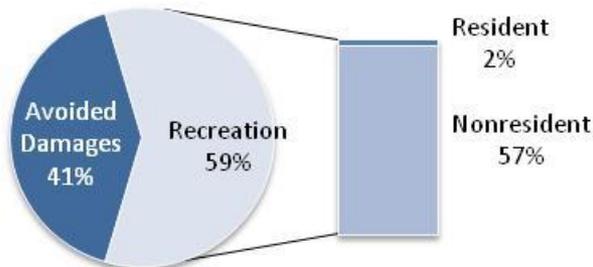


"No Action" is Scenario 4

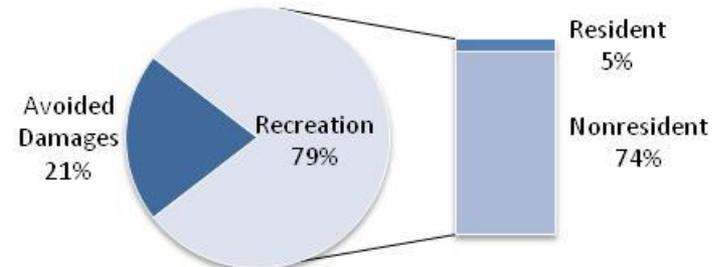
Broadkill Benefits Scenario 1: Nourishment



Broadkill Benefits Scenario 2: Enhanced Retreat

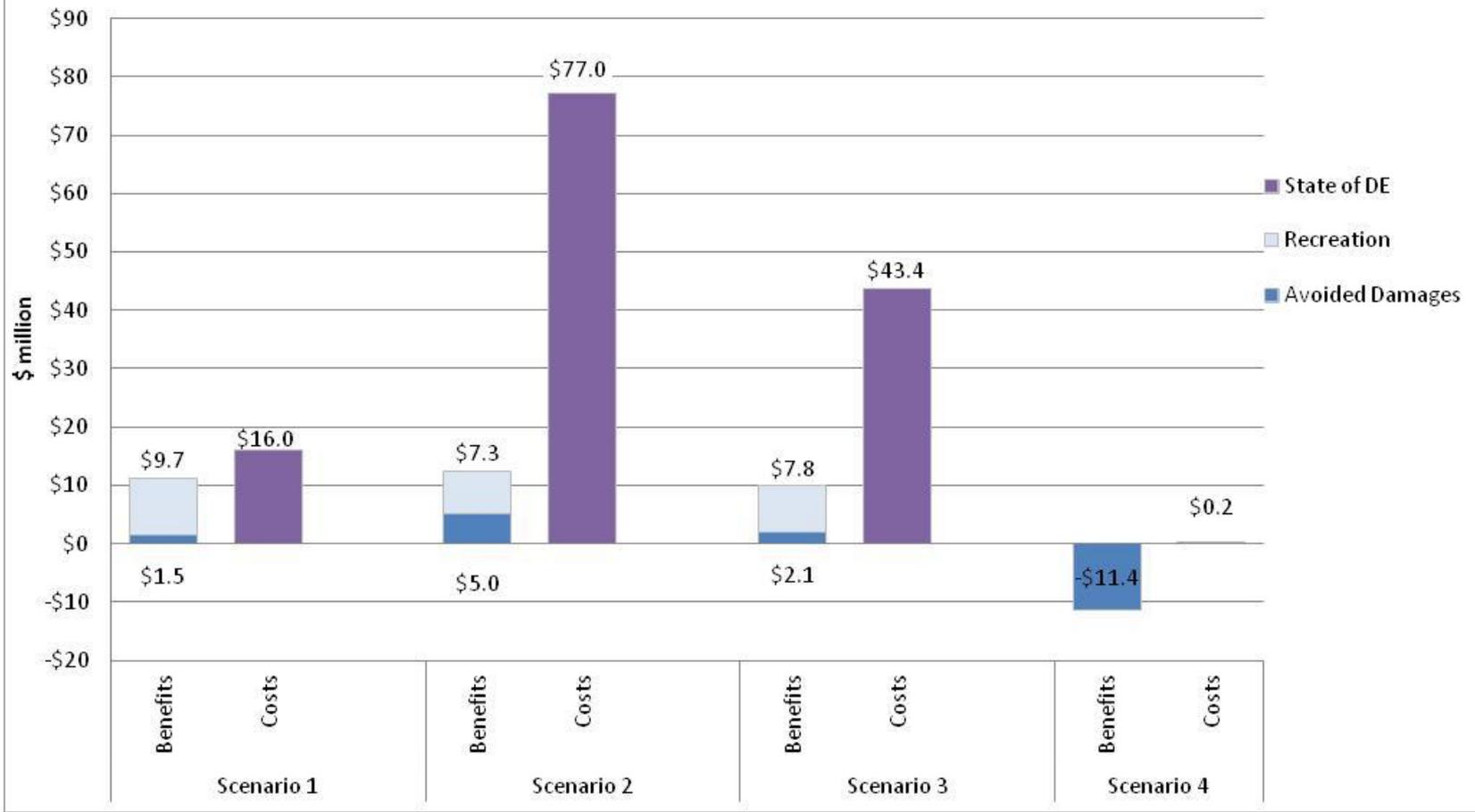


Broadkill Benefits Scenario 3: Strategic Retreat

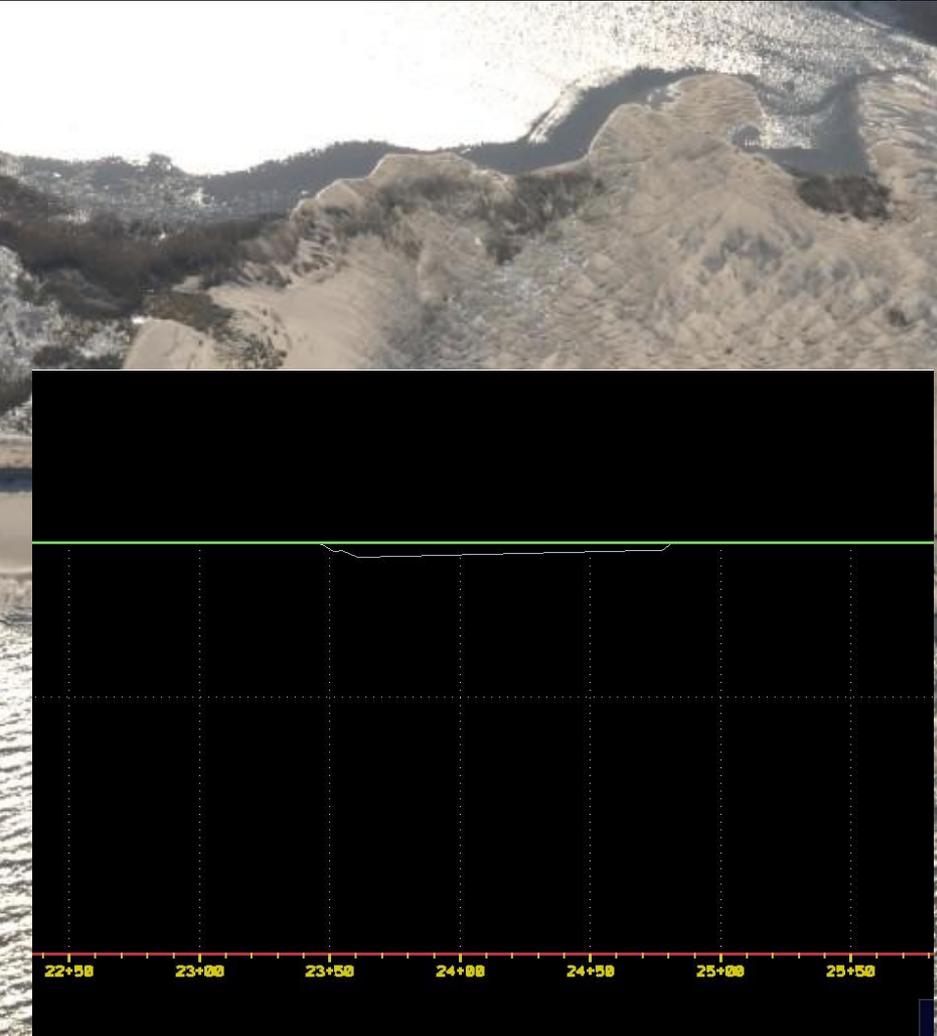
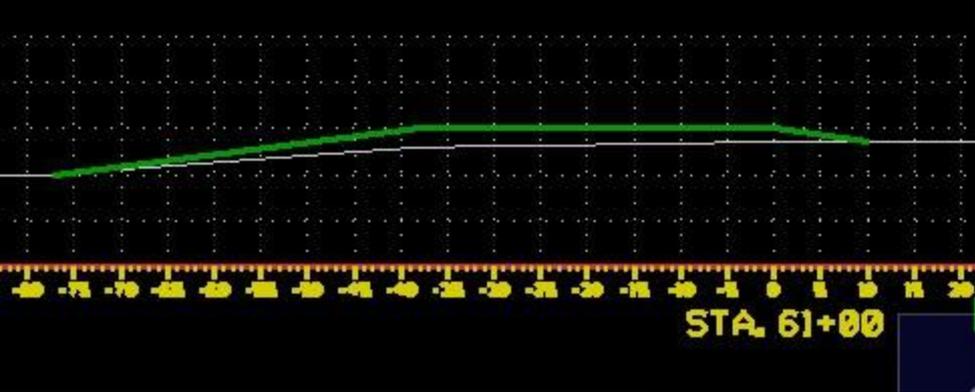


Broadkill

Broadkill Scenario Costs and Benefits



Beach Breach Analysis



Beach / Reach / Breach Comparison

Beach Community Nourishment**				Reach Nourishment***					Breach Fill Only****			
Beach	10-Year Fill (CY)	10-Year Typical Section Fill Cost (\$13/CY)	Total Cost*	Beach Reach	1962 Fill (CY)	10-Year Fill (CY)	1962 Typical Section Fill Cost* (\$13/CY)	10-Year Typical Section Fill Cost* (\$13/CY)	Breach	Plug Fill Volume	Plug Fill Cost (\$13/CY)	Total Cost Per Reach*
Pickering Beach	138,500	\$ 1,800,500	\$ 3,050,500									
				Reach 1	158,737	362,039	\$ 3,313,582	\$ 5,956,504	Breach 1A	10,864	\$ 141,235	\$ 1,391,235
Kitts Hummock	196,600	\$ 2,555,800	\$ 3,805,800									
				Reach 2	159,694	307,738	\$ 3,326,023	\$ 5,250,600	Breach 2A	3,957	\$ 51,442	\$ 1,301,442
Bowers Beach	76,000	\$ 988,000	\$ 2,238,000									
South Bowers	65,800	\$ 855,400	\$ 2,105,400									
				Reach 3	607,829	858,376	\$ 9,151,782	\$ 12,408,884	Breach 3A	1,921	\$ 24,978	\$ 1,848,266
									Breach 3B	11,526	\$ 149,843	
									Breach 3C	4,975	\$ 64,675	
									Breach 3D	13,179	\$ 171,331	
									Breach 3E	10,818	\$ 140,637	
									Breach 3F	3,600	\$ 46,803	
Slaughter	476,500	\$ 6,194,500	\$ 7,444,500									
				Reach 4	568,171	490,478	\$ 8,636,217	\$ 7,626,219	Breach 4A	32,808	\$ 426,505	\$ 1,834,178
									Breach 4B	12,129	\$ 157,673	
Primehook Beach	176,000	\$ 2,288,000	\$ 3,538,000									
				Reach 5	478,011	545,490	\$ 7,464,139	\$ 8,341,366	No Observed Breaches			
Broadkill Beach	528,000	\$ 6,864,000	\$ 8,114,000									
Beach Nourishment Total			\$ 30,296,200	Reach Nourishment Total				\$ 39,583,572	Breach Plug Only Total			\$ 6,375,121

*includes \$1.25M mobilization cost per Beach or Reach

** - Beach Nourishment costs represent a one time fill of the 10 year typical fill section

*** - Reach Nourishment between Beach areas (includes breach plug)

**** - Beach Plug includes filling breach areas to match elevation of adjacent un-breach area

Show the boards on the reaches and volumes if needed

General Findings

- **Benefits are limited to:**
 - **Avoided Flood Damages and Erosion Damages (Housing Services)**
 - **Recreational Benefits**
- **Tax revenue impacts are nominal for the communities and determined to be a “wash” for cost/benefit calculations**
- **Benefits (recreational/avoided damages) and their distribution were identified for each community**
- **Only a subset of the properties evaluated (those closest to the shoreline) recognized significant benefit for flood/erosion damage avoidance**

General Findings (cont.)

- Costs for all scenarios when compared to the No Action exceed identified total benefits and benefits assigned to the public
- Refined retreat scenarios, managed properly, could reduce overall costs if that management scenario is selected
- For some communities, such as Pickering Beach, if assumptions on erosion rates are true, and management activities cease, the community would be lost over the planning horizon
- While some communities will continue to be viable without intervention, composition will change and still be at risk
- All scenarios assumed State of Delaware (government) funding
 - Costs identified are significant for any of the communities/counties
 - Alternative sources of revenue generation could be required if other parties are to participate in funding

Where Do We Go from Here

- **We have all of this data (technical and financial) – what next?**
- **Given the information developed today, what would be the path forward to develop a Course of Action for Delaware for the Bay Beach Communities?**

QUESTIONS