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# **COASTAL TEXAS SHORELINE PROTECTION AND RESTORATION**

*Appendix E-2: South Padre Island CSRM Economics*

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# South Padre Island CSRM Economics Appendix

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## 1 INTRODUCTION

### 1.1 DEMOGRAPHICS

The city of South Padre Island lies on Padre Island in South Texas and is within the boundaries of Cameron County. According to the 2012-2016 American Community Survey published by the U.S. Census Bureau, the estimated population of South Padre Island is 2,888, which is less than one percent of the total county population of 418,875. The population is 52% female and 48% male for both the city and the county. For the city, 96.4% of the population is White, 1% Black, and 2.9% identified as other race. For the county, 93.8% is White, 0.7% Black, 0.8% Asian, and 5.2% identified as some other race. The median age for South Padre Island is 60 years and 31 for the county. The unemployment rate for South Padre Island was 1.8% and 9.4% for the county. The median household income for South Padre Island is \$42,825, while for the county it is \$34,578. In the city of South Padre Island, 18.8% of the population had incomes below the poverty level, and for Cameron County, the ratio is 33%.

### 1.2 HISTORICAL EVENTS

South Padre Island has not been the target of a significant number of storms. Two storms of significance were Beulah in 1967 that caused 15 death in Texas and \$217 million in damages in the region; and Dolly in 2008, which cause storm surges ranging from 2-4 feet along the mid and southern Texas coast. Damages specific were to South Padre Island were not reported.

## 2 EXISTING CONDITIONS AND FUTURE WITHOUT-PROJECT CONDITIONS

Early in the analysis, based preliminary engineering assessments, the study area for the South Padre Island area was defined as the first tier of structures along the beach within the city of South Padre Island, with the western boundary defined as Gulf Boulevard. A windshield survey of the area was done to collect occupancy type, construction materials, and finished floor elevations. Preliminary values were obtained from county appraisal district information, and a sample was evaluated using Marshall & Swift Estimation software to derive depreciated replacement values.

### 2.1 SUMMARY OF THE STRUCTURE INVENTORY

There were 206 structures in the study area. Of these, 121 pile foundation with enclosed ground level areas, including single family residences and multifamily residences. There were 74 beach front high rises, which included resorts, hotels and multifamily residences. There were five two story residential structures, five commercial non engineered structures, primarily restaurants and clubs, and one pile foundation with an open ground level area. The depreciated replacement value of the structures ranged from \$8,000 to \$45,056,363, with a total structure valuation of \$640,018,157. Total value of structures and contents was estimated at \$852,276, 536.

## 2.2 FUTURE WITHOUT-PROJECT DAMAGES

The study area was divided into seven reaches, as show in Figure 1. Reach 6\_Park contained no damage elements. Depth damage curves were adopted from the North Atlantic Comprehensive Study, January 2015, and included Pile Foundation Enclosure, Pile Foundation Open, Beach High Rise, Single Story Residence (No Basement), Two Story Residence (No Basement), and Commercial Non-Engineered Structure. Using a discount rate of 2.75% and a period of analysis of 50 years, Beach-fx computed the present value of damages for 300 iterations of storm events. The average of those 300 iterations, along with number of damage elements and an annual average of damages is presented in Table 1.

**Table 1. Number of Damage Elements and Average of Present Value Damages and Annual Average Damages by Reach, 50-Year Period of Analysis, 2.75% Discount Rate, 300 Iterations**

Future Without-Project Damages							
	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Total
Number of Damage Elements	2	29	53	36	53	33	206
Average of Present Value of Damages	\$56,442	\$4,920,927	\$16,856,174	\$32,906,063	\$66,984,336	\$22,282,889	\$144,006,831
Annual Average Damages	\$2,091	\$182,276	\$624,368	\$1,218,871	\$2,481,161	\$825,379	\$5,334,145



**Figure 1. Damage Reaches**

### 3 FUTURE WITH-PROJECT CONDITIONS

#### 3.1 PRELIMINARY SCREENING OF ALTERNATIVES

For preliminary screening analysis, 18 dune and berm templates were evaluated. For each of the 18 resulting templates, a Beach-fx simulation occurred in which the entire study area (R1-R6; excluding the park) was renourished on an “as-needed” basis. A relative benefit-to-cost ratio was computed for each reach that did not consider mobilization costs (Figure 2). It should be emphasized that the relative BCR is not reflective of the actual BCR in each reach, but rather allows the reaches that benefit the most from implementation of a renourishment project to be identified. In Figure 2, the darker hues indicate a higher relative BCR. It can be seen that reaches R3, R4, and R5 returned the largest relative BCRs. Note that although Reach R5 returned the largest damages, it did not receive the largest relative BCRs due to the high cost of renourishing.

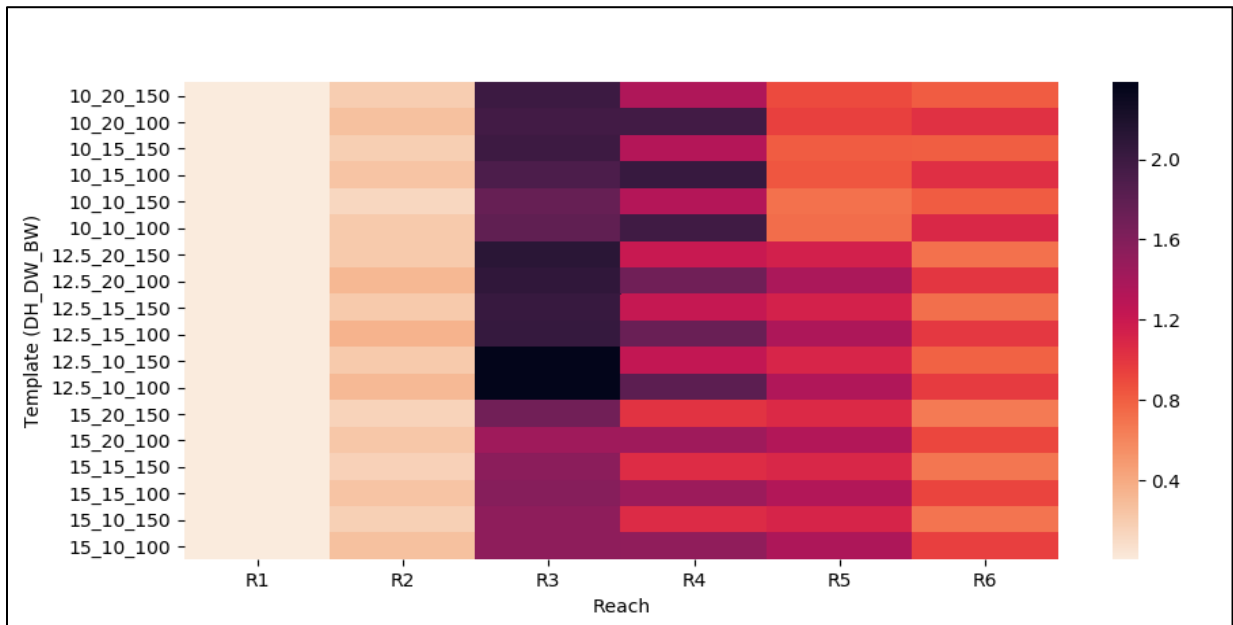


Figure 2. Heat map of relative benefit-to-cost ratios

Of the 18 original nourishment templates, eight were considered for further analysis by running additional Beach-fx simulations. For these simulations, cost assumptions were a \$3 million mobilization cost and \$40 per cubic yard for placement of planned nourishment material. One set of simulations considered renourishing only reaches R3 and R4, whereas the other considered reaches R3, R4, and R5. Similar to the previous simulations, Beach-fx was configured to be renourished on an “as-needed” basis. The resulting average BCRs<sup>1</sup> across 300 lifecycles are shown in Table 2 and Table 3. The results show that simulations in which reach R5 is included, result in a 13-43% reduction in the average BCR. As previously discussed, this is due to the high cost of renourishing reach R5. From it can be seen that the template

<sup>1</sup> Note that the simulations shown in Table 16 and the resulting average BCRs do not consider reach planform rates, and are thus not reflective of the actual average BCR. Reach planform rates were applied following the identification of a nourishment dune and berm template.



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corresponding to a dune height of 12.5 ft., a dune width of 20 ft., and a berm width of 100 ft. returned the largest BCR. This template was considered for further analysis.

**Table 2. Cost, Damages Reduced and Net Benefits for Nourishment of Reaches 3, 4 and 5 (2.75% Discount Rate, 50-Year Period of Analysis, 300 Iterations)**

Alternate	Reaches 3, 4, and 5										
	Present Value Planned Mobilization Cost	Present Value Planned Placement Cost	Present Value Total Cost	Present Value Without-Project Damages	Present Value With-Project Damages	Average Annual Cost	Annual Average Without-Project Damages	Annual Average With-Project Damages	Annual Average Benefits	Net Benefits	Benefit to Cost Ratio
15_15_100	\$57,832,840	\$46,457,424	\$104,290,264	\$144,006,831	\$73,939,919	\$3,863,007	\$5,334,145	\$2,738,803	\$2,595,343	-\$1,267,664	0.67
15_10_100	58,570,908	45,289,121	103,860,029	144,006,831	74,372,697	3,847,071	5,334,145	2,754,833	2,579,312	-1,267,759	0.67
12.5_20_100	47,526,820	39,618,378	87,145,198	144,006,831	77,914,596	3,227,938	5,334,145	2,886,028	2,448,117	-779,821	0.76
12.5_15_100	48,321,492	40,175,437	88,496,929	144,006,831	77,230,410	3,278,008	5,334,145	2,860,685	2,473,460	-804,548	0.75
12.5_10_150	64,462,888	46,651,262	111,114,150	144,006,831	82,125,343	4,115,770	5,334,145	3,041,998	2,292,147	-1,823,623	0.56
12.5_10_100	47,647,621	38,672,525	86,320,146	144,006,831	78,228,402	3,197,378	5,334,145	2,897,652	2,436,493	-760,884	0.76
10_20_100	23,975,541	24,513,763	48,489,304	144,006,831	108,009,876	1,796,088	5,334,145	4,000,785	1,333,360	-462,728	0.74
10_15_100	18,919,748	22,987,924	41,907,672	144,006,831	112,205,026	1,552,299	5,334,145	4,156,177	1,177,968	-374,331	0.76

**Table 3. Cost, Damages Reduced and Net Benefits for Nourishment of Reaches 3 and 4 (2.75% Discount Rate, 50-Year Period of Analysis, 300 Iterations)**

Alternate	Reaches 3 and 4										
	Present Value Planned Mobilization Cost	Present Value Planned Placement Cost	Present Value Total Cost	Present Value Without-Project Damages	Present Value With-Project Damages	Annual Average Cost	Annual Average Without-Project Damages	Annual Average With-Project Damages	Annual Average Benefits	Net Benefits	Benefit to Cost Ratio
15_15_100	\$14,537,392	\$26,797,867	\$41,335,259	\$144,006,831	\$99,878,312	\$1,531,096	\$5,334,145	\$3,699,585	\$1,634,561	\$103,465	1.07
15_10_100	15,642,314	26,322,523	41,964,837	144,006,831	100,440,542	1,554,416	5,334,145	3,720,410	1,613,735	59,319	1.04
<b>12.5_20_100</b>	<b>8,433,632</b>	<b>19,817,285</b>	<b>28,250,917</b>	<b>144,006,831</b>	<b>106,930,051</b>	<b>1,046,440</b>	<b>5,334,145</b>	<b>3,960,787</b>	<b>1,373,358</b>	<b>326,918</b>	<b>1.31</b>
12.5_15_100	8,704,075	19,165,900	27,869,975	144,006,831	107,727,530	1,032,330	5,334,145	3,990,327	1,343,819	311,489	1.30
12.5_10_150	12,416,326	24,854,508	37,270,834	144,006,831	104,004,970	1,380,546	5,334,145	3,852,440	1,481,706	101,160	1.07
12.5_10_100	9,097,668	18,519,168	27,616,836	144,006,831	109,253,715	1,022,953	5,334,145	4,046,858	1,287,287	264,334	1.26
10_20_100	2,976,623	9,744,826	12,721,449	144,006,831	132,855,867	471,214	5,334,145	4,921,103	413,042	-58,172	0.88
10_15_100	2,561,406	8,213,454	10,774,860	144,006,831	134,756,282	399,111	5,334,145	4,991,497	342,649	-56,462	0.86

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## 4 EVALUATION OF FINAL REACHES

For the final evaluation of Reaches 3 and 4, the “renourishment as need” assumption was dropped and various renourishment intervals were considered. In total, 10 renourishment intervals were considered (1, 2, 3, 4, 5, 7, 10, 12, 15, and 20 years), and both the BCR and net benefits were computed for each lifecycle (300 lifecycles). The results of these runs are presented in Table 4. From the analysis, the 10-year renourishment cycle was identified as the recommended configuration. While a 15-year cycle presented greater net benefits, from an engineering perspective, it was felt the waiting time was too great to be a practical consideration, given the greater potential for damages.

## 5 OPTIMIZATION OF FINAL REACHES

In an attempt to best validate and optimize the engineering assumptions for the Beach-fx runs, several discussions were held with subject matter experts, both within the Corps and from the private section. The outcome of those discussions led the PDT to consider altering settings related to depth of closure.

Within Beach-fx, these two values dictate how nourishment material is placed, as well as how much material is eroded due to sea level change. The depth of closure and width of active profile were originally specified as 30ft. and 4000ft. respectively. These values were updated to 23ft. and 3000ft. A depth of closure of 23ft. was selected to be consistent with the depth of closure implemented in the volume calculations. Furthermore, WIS data at the South Padre Island indicates a depth of closure of 19-23ft. The width of active profile was determined from the submerged profile data based on the updated depth of closure.

Whereas the updated depth of closure and width of active profile resulted in negligible changes to the FWOP conditions, the FWP conditions saw more significant changes.

Renourishment cycles of 5, 10, and 15 years were re-simulated and the results shown in Table 5. It can be seen that the BCR and net benefits resulting from the new depth of closure increase regardless of the renourishment interval. Additionally, it can be seen that there is little variation in the FWP Damages, but that the change in BCR and net benefits are caused by a reduction in project costs. The larger variation between the FWP costs are attributed to the decreased depth of closure. Within Beach-fx, the volume (and costs) are proportionately related to the depth of closure. Therefore, a decreased depth of closure results in a decreased cost. For all three simulations, the resulting BCRs increase between 18-20%, and the rank ordering of the BCRs are the same as that of the original runs. It is expected that regardless of the plan or renourishment interval selected, the increase in BCR will remain the same (~20%). Consequently, it is not necessary to rerun all of the simulations. Rather, the originally selected TSP remains the selected plan, although there are changes to the economic values.

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The NED plan for the South Padre Island component, based on this analysis would be the 12.5-20-100 template alternative with a 10-year renourishment cycle. The average annual net benefits are \$82,614, with a benefit-to-cost ratio of 1.07.

**Table 4. Cost, Damages Reduced and Net Benefits for Nourishment of Reaches 3 and 4, Alternative 12.5\_20\_100 with Varying Nourishment Cycles (2.75% Discount Rate, 50-Year Period of Analysis, 300 Iterations)**

Nourishment Cycle (Yearly Interval)	Reaches 3, 4, Alternative 12.5_20_100										
	Present Value Planned Mobilization Cost	Present Value Planned Placement Cost	Present Value Total Cost	Present Value Without-Project Damages	Present Value With-Project Damages	Annual Average Cost	Annual Average Without-Project Damages	Annual Average With-Project Damages	Annual Average Benefits	Net Benefits	Benefit to Cost Ratio
1	\$57,490,927	\$58,787,600	\$116,278,527	\$144,006,831	\$99,705,105	\$4,307,064	\$5,334,145	\$3,693,169	\$1,640,977	-\$2,666,087	0.38
2	29,080,589	67,484,035	96,564,624	144,006,831	100,571,334	3,576,842	5,334,145	3,725,255	1,608,891	-1,967,952	0.45
3	19,752,753	70,176,689	89,929,442	144,006,831	101,643,730	3,331,069	5,334,145	3,764,977	1,569,168	-1,761,901	0.47
4	15,030,771	66,869,654	81,900,425	144,006,831	102,912,854	3,033,667	5,334,145	3,811,987	1,522,159	-1,511,508	0.50
5	11,716,899	55,585,658	67,302,557	144,006,831	103,634,456	2,492,949	5,334,145	3,838,716	1,495,430	-997,519	0.60
7	9,046,952	48,796,562	57,843,514	144,006,831	105,213,049	2,142,577	5,334,145	3,897,188	1,436,957	-705,620	0.67
<b>10</b>	<b>5,771,000</b>	<b>32,838,513</b>	<b>38,609,513</b>	<b>144,006,831</b>	<b>109,239,669</b>	<b>1,430,132</b>	<b>5,334,145</b>	<b>4,046,338</b>	<b>1,287,808</b>	<b>-142,324</b>	<b>0.90</b>
12	5,480,095	35,262,351	40,742,446	144,006,831	110,365,051	1,509,138	5,334,145	4,088,023	1,246,122	-263,015	0.83
15	4,258,940	29,610,978	33,869,918	144,006,831	112,619,297	1,254,573	5,334,145	4,171,522	1,162,623	-91,950	0.93
20	3,145,493	23,273,952	26,419,445	144,006,831	119,693,419	978,601	5,334,145	4,433,554	900,591	-78,009	0.92

**Table 5. Cost, Damages Reduced and Net Benefits for Nourishment of Reaches 3 and 4, Alternative 12.5\_20\_100 with Varying Nourishment Cycles (2.75% Discount Rate, 50-Year Period of Analysis, 300 Iterations), 23-foot depth of closure**

Nourishment Cycle (Yearly Interval)	Reaches 3, 4, Alternative 12.5_20_100, 23-foot depth of closure										
	Average of Present Value Planned Mobilization Cost	Average of Present Value Planned Placement Cost	Present Value Total Cost	Average of Present Value Without-Project Damages	Average of Present Value With-Project Damages	Annual Average Cost	Annual Average Without-Project Damages	Annual Average With-Project Damages	Annual Average Benefits	Net Benefits	Benefit to Cost Ratio
5	11,718,029	44,211,660	55,929,689	144,200,580	103,874,211	2,071,687	5,341,322	3,847,596	1,493,726	-577,961	0.72
10	<b>5,778,624</b>	<b>26,693,957</b>	<b>32,472,581</b>	<b>144,200,580</b>	<b>109,497,650</b>	<b>1,202,814</b>	<b>5,341,322</b>	<b>4,055,894</b>	<b>1,285,428</b>	<b>82,614</b>	<b>1.07</b>
15	4,258,940	24,353,178	28,612,118	144,200,580	112,973,620	1,059,819	5,341,322	4,184,647	1,156,675	96,856	1

## 5.1 ADDITIONAL REFINEMENTS

Following technical reviews and public comments, some of the underlying model assumptions were revisited and additional analysis was conducted. These refinements included:

1. The original planform rates were based on the fill placement creating a 100 ft offset from the adjacent shoreline. These rates were revised to reflect a 20 ft offset. The reduction in planform rates from the prior analysis of fill in reaches 3 and 4 results in an increase in benefits and a reduction in costs.
2. The cost per cubic yard of material was reduced from \$40 to \$27 based on a review of other project costs
3. Evaluation of planned renourishment periods of 10- and 15-year cycle
4. Consideration of 80- and 120-foot berm widths
5. Sea Level Change (SLC) Sensitivity

Through all of the simulations, Beach-fx did not trigger nourishments in reaches 1,2, and 6. As a result, only reaches 3,4, and 5 were set for nourishment in the model moving forward. Two combinations were considered, just reaches 3 and 4 as previously identified, and reaches 3,4 and 5. The original 12.5-foot dune height and 20-foot dune width were maintained, and 80, 100- and 120-foot berm widths were modeled for the 15-year nourishment cycle. The results of those runs are shown in Table 6. As shown in the table, the reach/profile combinations with the highest net benefits are those that include reaches 3,4 and 5, and those net benefits are fairly close. Of those, the 120-foot berm width on reaches 3,4 and 5 have the highest net benefit, with a present value of \$7 million.

**Table 6. 15 Year Planned Nourishment - Intermediate SLC Damages and Benefits (\$1,000, 2.75% Interest Rate, October 2017 Prices) Template - 12.5 DH\_20 DW, Various Berms**

Berm Width	Reaches	Without-Project Damages (PV)	With-Project Damages (PV)	Damages Avoided (PV)	Nourishment Cost (PV)	Net Benefits (PV)	Benefit to Cost Ratio
80	3,4	\$144,275	\$130,480	\$13,795	\$8,948	\$4,847	1.5
80	3,4,5	144,275	126,089	18,186	11,464	6,722	1.6
100	3,4	144,275	130,246	14,029	9,228	4,801	1.5
100	3,4,5	144,275	122,969	21,306	15,043	6,263	1.4
120	3,4	144,275	129,444	14,831	9,808	5,023	1.5
120	3,4,5	144,275	120,602	23,673	16,672	7,001	1.4

With reach 3,4,5 showing the highest net benefits, the model was rerun with a 5 year and 10-year nourishment cycle and 100- and 120-foot berm widths for those reaches. The results are shown in Table 7. The 15-year, 120-foot berm from Table 6 for comparison. As can be seen, the 120-foot berm with a 10-year nourishment cycle over reaches 3,4 and 5 has the highest net benefits, in present value terms, of \$11,726. The two 5-year nourishment cycles have very



similar net benefits, but they do have higher costs for those similar benefits. Based on these results, the 120-foot berm with a 10-year nourishment cycle was selected as the plan to carry forward and develop detailed costs. Additional detail of this plan, by reach, is shown in Table 8.

**Table 7. 5 and 10Year Planned Nourishment, Reaches 3,4 and 5 - Intermediate SLC Damages and Benefits (\$1,000, 2.75% Interest Rate, October 2017 Prices) Template - 12.5 DH\_20 DW, Various Berms**

Nourishment Cycle	Berm Width	Without-Project Damages (PV)	With-Project Damages (PV)	Damages Avoided (PV)	Nourishment Cost (PV)	Net Benefits (PV)	Benefit to Cost Ratio
5	100	\$144,275	\$98,466	\$45,809	\$34,700	\$11,109	1.3
5	120	144,275	97,198	47,077	36,484	10,593	1.3
10	100	144,275	116,774	27,501	19,082	8,419	1.4
10	120	144,275	111,331	32,944	21,218	11,726	1.6
15	120	144,275	120,602	23,673	16,672	7,001	1.4

**Table 8. 10 Year Planned Nourishment - Intermediate SLC Damages and Benefits (\$1,000, 2.75% Interest Rate, October 2017 Prices) Template - 12.5 DH\_20 DW\_120 Berm-Reach 3,4 and 5 Nourishment, Half Planform Rate**

Reach	Annual Erosion (ft.)	Without-Project Damages (PV)	With-Project Damages (PV)	With-Project Damages Avoided (PV)	Nourishment Costs (PV)	Net Benefits (PV)	Benefit-to-Cost Ratio	Average Number Nourishments over 50 Planning Horizon	Average Material per Event (1,000 CY)
R1	-3.8	\$53	\$52	\$1	\$0	\$1			
R2	-2.6	4910	4,234	676	0	676			
R3	1.7	16904	3,779	13,125	3,632	9493	3.6	2.7	94
R4	-4.2	32856	25,111	7,745	3,485	4260	2.2	1.3	217
R5	-5.7	67040	55,982	11,058	4,727	6331	2.3	1.0	192
R6	-7.7	22512	22,173	339	0	339			
R6 Park	-7.7	0	0	0	0	0			
<b>Mobilization</b>					9,374	-9,374			
<b>Total</b>		\$144,275	\$111,331	\$32,944	\$21,218	\$11,726	1.55		

Using quantities estimated by Beach-fx, USACE Cost Engineering developed a schedule of costs for the plan carried forward. The schedule of these costs, including present value and average annual cost is shown in Table 9.

**Table 9. Schedule of Nourishment Costs and Average Annual Cost (\$1,000, October 2019 Price Level 2.75% Interest Rate)**

Year	Nourishment	PED	Construction Management	Cultural	Lands and Damages	In House Real Estate	Total Construction Cost	Present Value of Costs
2036	\$9,007	\$1,351	\$540	\$185	\$18,300	\$710	\$30,093	\$22,943
2046	9,007	1,351	540				10,898	6,334
2056	9,007	1,351	540				10,898	4,829
2066	9,007	1,351	540				10,898	3,682
Totals							\$62,787	\$37,789
Average Annual Cost								\$1,400

Using the benefits estimated in Beach-fx updated to the October 2019 and the costs from Table 9, the net benefits and benefit-to-cost ratios (BCR) were calculated, and shown in Table 10. Values are shown in both present value and average annual terms. With refined cost and updated price levels, the CSR plan has net benefits of -\$3,572 and a benefit-to-cost ratio of 0.91. While not economically justified on CSR benefits alone, the benefits needed to reach a BCR of 1.0 allow recreation benefits to be considered towards that justification.

**Table 10. Benefits and Costs Expressed as Present Value and Average Annuals (\$1,000, 2.75% Interest Rate, October 2019 Prices)**

Cost Terms	Without-Project Damages	With-Project Damages	Damages Avoided	Costs	Net Benefits	Benefit-to-Cost Ratio
Present Value	\$150,046	\$115,784	\$34,262	\$37,789	-\$3,572	0.91
Average Annual Values	\$5,558	\$4,289	\$1,269	\$1,400	-\$131	0.91

## 5.2 RECREATION

USACE policy provides for the consideration of incidental recreation benefits for project economic justification as outlined in ER-11-5-2-100:

*Shore protection projects are formulated to provide hurricane and storm damage reduction. Recreation is incidental. The Corps participates only in those projects formulated exclusively for hurricane and storm damage reduction, and justified (BCR ≥ 1.0) based solely on damage reduction benefits, or a combination of damage reduction benefits plus (at most) a like amount of incidental recreation benefits. In other words, recreation benefits useable to establish Corps participation may not be more than fifty percent of the total benefits required for justification, which in turn means they may not exceed an amount equal to fifty percent of costs. If the criterion for participation is met, then all recreation benefits are included in the BCR.*

For the South Padre Island CSR component of the Coastal Texas Study, formulation for shoreline protection was done for the entire reduction of storm risk, as measured in a reduction in expected annual damages. However, given the importance of recreation benefits to

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users of the Padre Island beach and the regional economic development, recreation benefits are considered along with the CSRM benefits for justification.

As previously described, the study area for CSRM protection includes the shoreline within the City of South Padre Island. This includes six miles of beach, from the southern tip of Padre Island to the northern city limits. All of the beach is open to the public, and there is a mix of large hotels, high-rise condominium rentals, and smaller single and multi-family beach house rentals along this stretch, and some commercial shops, restaurants, and taverns intermixed. The study area was divided into five reaches. Based on information from the city, Reaches 1, 2, 5 and 6 contain the majority of the full-service properties and approximately 25 percent of select service properties. Reaches 3 and 4 are comprised of about 75 percent of the select service properties. A full-service property is classified as offering hotel sleeping rooms, meeting space and a catering restaurant with a full menu. A select service hotel only has sleeping rooms. This would be indicative that Reaches 1,2,5 and 6 would have the highest concentration of beach visitors given their immediacy to properties with higher occupancy capacities.

### **5.2.1 BEACH ACCESS**

Access to the beach at South Padre Island is free. There are numerous public access points, most with dune walkovers, including:

- Beach Circle
- Moonlight Circle
- Neptune Circle (handicap)
- Aurora Circle (stairs)
- Seaside Circle (handicap)
- Bougainvillea Circle
- Starlight Circle
- Good Hope Circle
- Blue Water Circle (handicap)
- Poinsettia Circle
- Aquarius Circle
- Fantasy Circle
- Treasure Island Circle
- Surf Circle
- Gulf Circle
- Harbor St. Circle

In addition to public access points, most of the hotels are condominium rentals offer beach access to their guests.

Free public parking is available designated areas along streets near the beach access points. Additional for fee parking is available in Reach 1 at Isla Blanca Park and in Reach 6 at Andy Bowie County Park.

## 5.2.2 METHODOLOGY

Recreation benefits were developed using the unit day value approach, as outlined in Economic Guidance Memorandum 20-03, Unit Day Values for Recreation for Fiscal Year 2020. Recreation criteria for the with- and without project condition are assigned points based on judgment factors, as shown in Two categories of outdoor recreation days, general and specialized, may be differentiated for evaluation purposes. "General" refers to a recreation day involving primarily those activities that are attractive to the majority of outdoor users and that generally require the development and maintenance of convenient access and adequate facilities. "Specialized" refers to a recreation day involving those activities for which opportunities in general are limited, intensity of use is low, and a high degree of skill, knowledge, and appreciation of the activity by the user may often be involved. For this analysis, general values are assumed. Points from worksheet in Table 12 are summed and then compared to point values in Table 11 to convert the points to a monetary value. This unit day value is then multiplied by the number of annual visitors to the beach to determine the annual recreation benefit.

**Table 11. Conversion of Point Values to Monetary Values**

Point Values	General Recreation Values <sup>1</sup>	General Fishing and Hunting Values <sup>1</sup>	Specialized Fishing and Hunting Values <sup>2</sup>	Specialized Recreation Values Other Than Fishing and Hunting <sup>2</sup>
0	\$ 4.21	\$ 6.06	\$ 29.49	\$ 17.12
10	5.00	6.85	30.28	18.17
20	5.53	7.37	30.81	19.49
30	6.32	8.16	21.60	21.07
40	7.90	8.95	32.39	22.38
50	8.95	9.74	32.55	28.28
60	9.74	10.80	38.71	27.91
70	10.27	11.32	41.08	33.71
80	11.32	12.11	44.24	39.24
90	12.11	12.38	47.40	44.77
100	12.64	12.64	50.04	50.04

<sup>1</sup> Values from Assigning Points for General Recreation

<sup>2</sup> Values from Assigning Points for Specialized Recreation

Table 12 on the following page.

Two categories of outdoor recreation days, general and specialized, may be differentiated for evaluation purposes. "General" refers to a recreation day involving primarily those activities that are attractive to the majority of outdoor users and that generally require the development and maintenance of convenient access and adequate facilities. "Specialized" refers to a recreation day involving those activities for which opportunities in general are limited, intensity of use is low, and a high degree of skill, knowledge, and appreciation of the activity by the user may often be involved. For this analysis, general values are assumed. Points from worksheet in Table 12 are summed and then compared to point values in Table 11 to convert the points to a monetary value. This unit day value is then multiplied by the number of annual visitors to the beach to determine the annual recreation benefit.

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40	7.90	8.95	32.39	22.38
50	8.95	9.74	32.55	28.28
60	9.74	10.80	38.71	27.91
70	10.27	11.32	41.08	33.71
80	11.32	12.11	44.24	39.24
90	12.11	12.38	47.40	44.77
100	12.64	12.64	50.04	50.04

<sup>1</sup> Values from Assigning Points for General Recreation

<sup>2</sup> Values from Assigning Points for Specialized Recreation

**Table 12. Worksheet for Assigning Point Values for General Recreation**

Criteria	Judgment Factors				
Recreation Experience <sup>1</sup> Total Points: 30	Two general activities <sup>2</sup>	Several general activities	Several general activities: one high value activity <sup>3</sup>	Several general activities; more than one high quality activity	Numerous high-quality value activities; some general activities
Point Value Range	0-4	5-10	11-16	17-23	24-30
Point Value					
Availability of opportunity <sup>4</sup> Total Points: 18	Several within 1 hr. travel time; a few within 30 min. travel time	Several within 1 hr. travel time; none within 45 min. travel time.	One or two within 1 hr. travel time; none within 45 min travel time	None within 1 hour. travel time	None within 2-hour travel time.
Point Value Range	0-3	4-6	7-10	11-14	15-18
Point Value					
Carrying Capacity <sup>5</sup> Total Points: 14	Maximum facility for development for public health and safety	Basic facility to conduct activity(ies)	Adequate facilities to conduct without deterioration of the resource or activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Point Value Range	0-2	3-5	6-8	9-11	12-14
Point Value					
Accessibility Total Points: 18	Limited access by means to site or within site	Fair access, poor quality roads to site, limited access within site	Fair access, fair road to site; fair access, good roads within site	Good access, good roads to site; fair access, good roads within site	Good access, high standard road to site; good road access within site
Point Value Range	0-3	4-6	7-10	11-14	15-18
Point Value					
Environmental Quality Total Points: 20	Low aesthetic factors <sup>6</sup> that significantly lower quality <sup>7</sup>	Average aesthetic quality; factors exist that lower quality to minor degree	Above average aesthetic quality, any limiting factors can be reasonably rectified	High aesthetic quality; no factors exist that lower quality	Outstanding aesthetic quality, no factors exist that lower quality
Point Value Range	0-2	3-6	7-10	11-15	16-20
Point Value					

<sup>1</sup> Value for water-orientated activities should be adjusted if significant seasonal water level changes occur

<sup>2</sup> General activities include those that are common to the region and that are usually of normal quality. This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.

<sup>3</sup> High quality value activities include those that are not common to the region and/or Nation, and usually of high quality.

<sup>4</sup> Likelihood of success at fishing and hunting.

<sup>5</sup> Value should be adjusted for overuse.

<sup>6</sup> Major aesthetic qualities to be considered include geology and topography, water, and vegetation.

<sup>7</sup> Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

In March 2020, a group of five representatives from the South Padre Island community participated in developing point values for the criteria presented above. The panel included members of the City of South Padre Island, Cameron County, the South Padre Island Chamber of Commerce and business owners related to beach recreation. Their assignments of point values for the five criteria are shown in Table 13.

**Table 13. Summary of the Community Assigned Point Values**

Criteria	Point Values	
	Without-Project	With-Project
Recreation Experience	9	27
Availability of Opportunity	1	18
Carrying Capacity	3	9
Accessibility	15	15
Environmental Quality	2	15
<b>Total</b>	<b>42</b>	<b>84</b>

The key criteria are recreation experience, availability of opportunity and carrying capacity. A number of unique events, in addition to the natural conditions of the beach, were identified for higher with project values, and include:

- Watercross (JetSki Racing Competition)
- USLA National Lifeguard Championships
- Annual Sand Crab 5k and 10k Beach Run
- Annual Sandcastle Days Festival and Competition
- Texas International Fishing Tournament
- Parasailing
- Kiteboarding
- Windsurfing
- Kayaking

The without project point value of 42 translated into a unit day value of \$7.90 and the With-Project point value of 84 translates to a unit day value of \$11.32. Current policy limits the unit day value to a maximum of 750,000 visitors. Based on information provided by the local chamber of commerce, the annual visitation to South Padre Island is around 5.2 million visitors.

The recreation benefits based on both of these visitation numbers is presented in Table 14. Based on visitation of 750,000, the annual net recreation benefit (with project less without project) is \$2.6 million. Based on the total estimated visitation of 5.2 million, the annual benefit is \$18 million. If the storm damage reduction benefits can increase to a BCR of 0.5 or greater after review of the real estate costs and material placement, these recreation benefits can be added to the storm benefit for economic justification.

**Table 14. Recreation Benefits**

Annual Visitation	Recreation Benefits		Annual Net Recreation Benefit
	Without-Project (\$7.90)	With-Project (\$11.32)	
750,000	\$5,925,000	\$8,490,000	\$2,565,000
5,200,000	41,080,000	58,864,000	17,784,000

**Recommended Plan**

The combined CSRM and Recreation benefits are shown in Table 15. Using the assumption of 750,000 annual visitors, total average annual benefits are \$3.8 million. This yields \$2.4 million in annual net benefits and BCR of 2.74. Assuming 5.2 million annual visitors, annual net benefits are \$17.7 million with a BCR 13.6.

**Table 15. Combined CSRM and Recreation Benefits, (\$1,000, October 2019 Prices, 2.75% Interest Rate)**

Recreation Benefits	CSRM Net Benefits	Recreation Benefit	Total Average Annual Benefits	Average Annual Costs	Net Benefits	Benefit-to-Cost Ratio
Assuming 750,000 visitors	\$1,269	\$2,565	\$3,834	\$1,400	\$2,434	2.74
Assuming 5.2 million visitors	\$1,269	\$17,784	\$19,053	\$1,400	\$17,653	13.61

Given that the BCR is greater than 1.0 under both assumptions, the CSRM feature at South Padre Island, when combined with recreation, is economically justified and would be part of the study's overall recommended plan.