LANDSCAPE PERFORMANCE SERIES
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St. Pete Pier
Methods

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This investigation was conducted as part of the Landscape Architecture Foundation's 2023 *Case Study Investigation* (CSI) program. CSI matches faculty-student research teams with design practitioners to document the benefits of exemplary high-performing landscape projects. Teams develop methods to quantify environmental, social, and economic benefits and produce Case Study Briefs for LAF's *Landscape Performance Series*.

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The full case study can be found at: https://landscapeperformance.org/case-study-briefs/St-Pete-Pier

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Research Strategy

St. Pete Pier is a waterfront park located close to the downtown area of St. Petersburg, Florida. In this study, we evaluated St. Pete Pier's performance using longitudinal comparative analysis, which involved comparing pre-and post-performance. One exception was the microclimate study, where we utilized cross-sectional comparative analysis. To conduct the assessment, we employed a variety of methods and tools, including i-Tree, eBird, ArcGIS, Google Street View, Placer.ai, the ATMOS41W weather station, archival research, and an on-site survey.

Data for this study was collected on-site and online, and we also obtained additional data from firm liaisons. The primary data collected in this research include:

1. A comprehensive inventory of new trees added to the pier,
2. Microclimate data,
3. Feedback from park users,
4. Information on amenities of parks in the City's waterfront park system, and
5. The pedestrian network connecting parks in the waterfront park system.

In addition to primary data, we cited secondary data from existing sources or shared by the firm liaisons. These secondary data sources include:

1. The Pier Approach Drainage Report,
2. Seagrass Assessment – Tampa Bay Estuary Program,
3. Economic & Fiscal Impact Assessment Update for the St. Pete Pier,
4. eBird's species count, and
5. Placer.ai's ranking of favorite places and visits.

Specific details about the methods are outlined below along with their associated benefits. However, we would like to provide a brief overview of the survey. The survey comprised 15 questions covering topics such as Pier utilization, users' perception, social interaction, and demographic information. We also included questions to inquire about respondents' familiarity with the older pier to enable a comparison of their experiences with the old and new facilities. Two rounds of survey were conducted on June 9 and June 17, 2023, resulting in 150 responses. Below are some general findings of the survey.

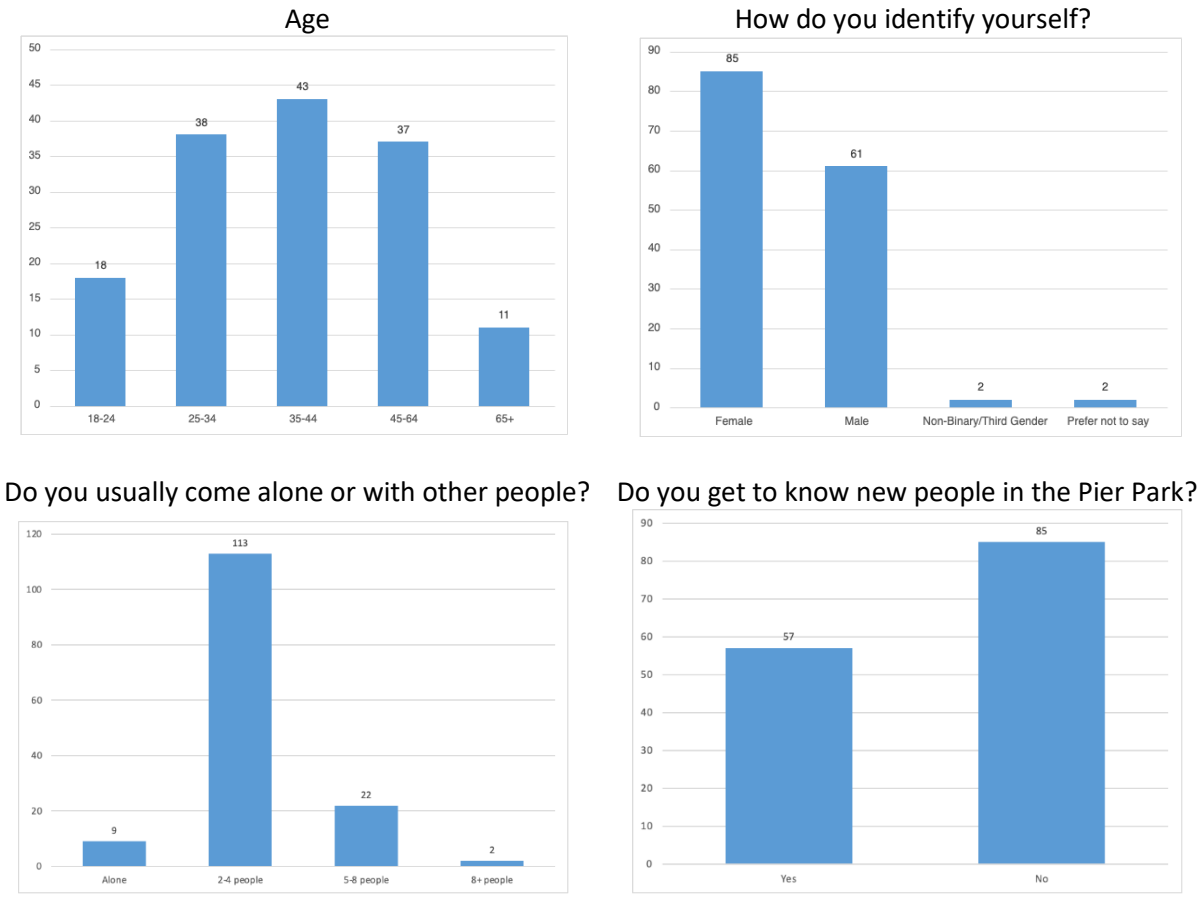


Figure 1. Summary of Part of the Survey Findings

At the end of the survey, we asked respondents to describe their experience in one word, and based on their responses, we generated this word cloud. Although it does not correspond to any specific benefits, we think it is worth sharing.

Figure 2. Word Cloud for how survey respondents described their experience

Environmental Benefits

- ***Stores and treats over 405,000 gallons of stormwater runoff annually through a network of bioswales and dry/wet ponds before releasing it into Tampa Bay and avoids an additional estimated 56,300 gallons of runoff annually with 866 newly planted trees.***

Background:

St. Pete Pier was built on the old pier. Since the redevelopment reduces the impervious area and led to a decrease in runoff, the project has been exempted from attenuation requirements for Southwest Florida Water Management District (SWFWMD) and is qualified for a waiver from treatment criteria through SWFWMD. However, the City of St. Petersburg requires that stormwater discharge from development sites must meet state water quality standards and criteria and does not allow for exemption. To meet and exceed these requirements, five dry ponds, one wet pond, and two dry swales were implemented on-site to treat runoff before it drains to the North Yacht Basin and South Yacht Basin. The Pier Approach is expected to treat ¾" of over the drainage areas discharging to dry retention ponds, and swales, and to treat 1 ½" over drainage areas discharging to the wet detention pond.

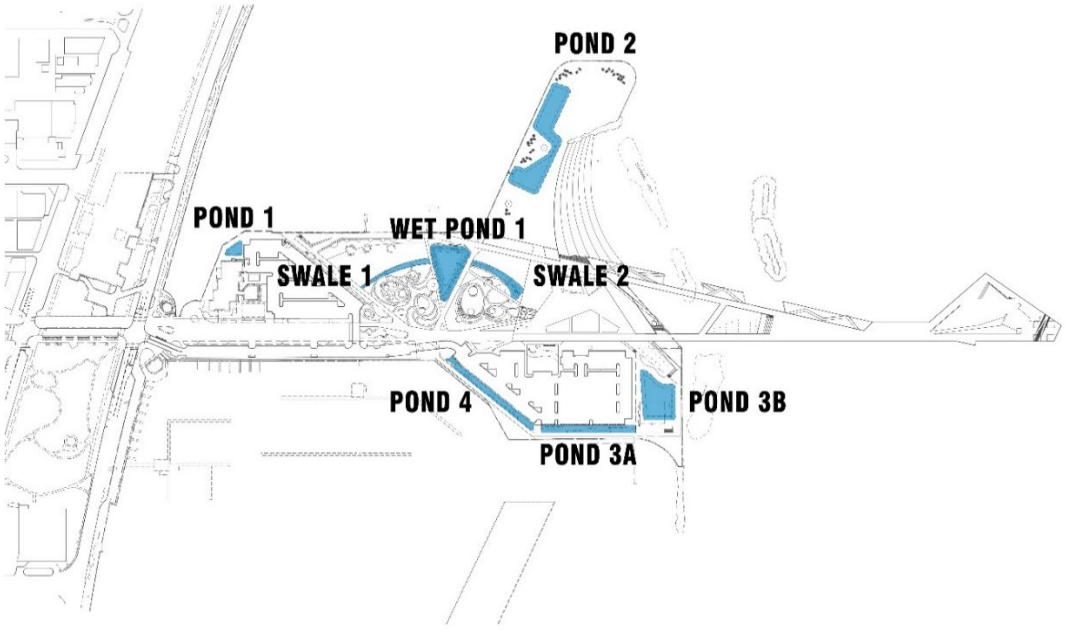


Figure 3. Pier Park Stormwater Treatment Map (Source: Developed based on Kimley-Horn's Drainage Report)

The Pier Approach is 21.64 acres, comprising 6.3 acres of the right-of-way, and 15.34 acres of areas that require stormwater treatment. The city does not require the site to treat runoff from the right-of-way. Therefore, this study focuses on the 15.34 acres not within the right-of-way. These areas were divided into five basins, each needing to meet its own treatment requirements.

Table 1. Basins, Treatment Facilities, and Treatment Requirements.

Basins	Size (AC)	Treatment Facilities	Treatment Requirements
Basin 1	0.91	Dry Pond #1	¾"
Basin 2	4.62+0.53+0.56	Wet Pond & Dry Swales	Dry Swale: ¾"; Wet Pond: 1 ½"
Basin 3	4.47	Dry Pond #3 and 3A	¾"
Basin 4	1.85	Dry Pond #4	¾"
Basin 5	2.40	Dry Pond #2	¾"

Method:

The required treatment volumes of the basins were calculated by timing each basin's area with their treatment requirements. Total runoff reduction was referred to the calculation of Kimley-Horn, using a model called Interconnected Channel and Pond Routing Model from Streamline Technologies, Inc.

For stormwater management by trees, see the carbon sequestration benefit below.

Calculations:

Required Treatment Volume

Basin 1: $0.91 \times 43560 \left(\frac{ft^2}{acre}\right) \times 0.75 \times \frac{1}{12}\left(\frac{ft}{in}\right)$ = 2,477 CF

Basin 2:

Dry swale #1: $0.53 \times 43560 \left(\frac{ft^2}{acre}\right) \times 0.75 \times \frac{1}{12}\left(\frac{ft}{in}\right)$ = 1,443 CF

Dry swale #2: $0.56 \times 43560 \left(\frac{ft^2}{acre}\right) \times 0.75 \times \frac{1}{12}\left(\frac{ft}{in}\right)$ = 1,525 CF

Wet pond: $4.62 \times 43560 \left(\frac{ft^2}{acre}\right) \times 1.5 \times \frac{1}{12}\left(\frac{ft}{in}\right)$ = 25,156 CF

Total: 1,443 + 1,525 + 25,156 = 28,124 CF

Basin 3: $4.47 \times 43560 \left(\frac{ft^2}{acre}\right) \times 0.75 \times \frac{1}{12}\left(\frac{ft}{in}\right)$ = 12,170 CF

Basin 4: $1.85 \times 43560 \left(\frac{ft^2}{acre}\right) \times 0.75 \times \frac{1}{12}\left(\frac{ft}{in}\right)$ = 5,037 CF

Basin 5: $2.40 \times 43560 \left(\frac{ft^2}{acre}\right) \times 0.75 \times \frac{1}{12}\left(\frac{ft}{in}\right)$ = 6,534 CF

Table 2. Summary of Required Treatment Volume for Each Basin.

Basin	Required Treatment Volume (CF)
1	2,477
2	28,124
3	12,170
4	5,037
5	6,534

Proposed Treatment Volume Estimation

Basin 1:

STAGE/STORAGE (Dry Retention Pond)

Top of Bank	5.00
Bottom of Pond	2.50
SHW Elevation	1.50

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
5.00	0.046	1990.7	392	3942	
4.80	0.044	1924.5	1061	3551	
4.22	0.040	1732.5	373	2490	TREATMENT ELEVATION
4.00	0.038	1659.6	788	2117	
3.50	0.034	1494.1	706	1329	
3.00	0.031	1328.6	623	623	
2.50	0.027	1163.1	0	0	

Figure 4. Dry Pond 1 Treatment Volume

2,490 > 2,477, so Dry Pond #1 has sufficient capacity to treat the entirety of Basin 1.

Basin 2:

Dry swale 1:

STAGE/STORAGE (Bio-Swales)

Swale #1

Top of Bank	4.60
Bottom of Pond	2.60
SHW Elevation	2.50

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
4.60	0.054	2365.3	852	2373	
4.20	0.043	1893.8	1037	1521	Treatment Elevation
3.50	0.025	1068.7	484	484	
2.60	0.0002	7.8	0	0	

Figure 5. Dry Swale 1 Treatment Volume

Dry swale #2:

STAGE/STORAGE (Bio-Swales)

Swale #2

Top of Bank	4.60
Bottom of Pond	3.50
SHW Elevation	3.00

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
4.60	0.064	2779.1	644	2299	
4.35	0.054	2373.1	1323	1655	Treatment Elevation
3.60	0.027	1155.0	332	332	
3.20	0.012	505.3	0	0	

Figure 6. Dry Swale 2 Treatment Volume

Wet Pond:

STAGE/STORAGE (Wet Detention Pond)

Top of Bank	4.60
Bottom of Pond	-1.00
SHW Elevation	2.50

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
4.70	0.350	15237.29	2266	29169	
4.55	0.344	14978.45	1489	26903	
4.45	0.340	14805.89	738	25414	Treatment Elevation
4.40	0.338	14719.61	2909	24676	
4.20	0.330	14374.49	2840	21766	
4.00	0.322	14029.38	6799	18926	
3.50	0.302	13166.58	6368	12127	
3.00	0.282	12303.79	5759	5759	
2.50	0.246	10733.18	0.00	0.00	Bottom of Treatment Volume / Orifice Elevation
-1.00	0.124	5401.44	0.00	0.00	

Figure 7. Wet Pond Treatment Volume

1,521 > 1,443, 1,655 > 1,525, 25,414 > 25,156, so the dry swales and wet pond have sufficient capacity to treat the entirety of Basin 2.

Basin 3:

STAGE/STORAGE (Dry Pond 3)

Pond 3

Top of Bank	4.80
Bottom of Pond	2.70
SHW Elevation	2.10

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
4.80	0.3636	15838.42	2344	25953	
4.65	0.3537	15409.13	2279	23609	
4.50	0.3439	14979.85	3656	21330	
4.25	0.3275	14264.38	3477	17675	
4.00	0.3110	13548.90	2523	14198	
3.81	0.2986	13005.14	3894	11675	TREATMENT ELEVATION
3.50	0.2782	12117.96	2940	7781	
3.25	0.2618	11402.48	2761	4841	
3.00	0.2453	10687.01	2080	2080	
2.80	0.2322	10114.63	0.00	0.00	

Figure 8. Dry Pond 3 Treatment Volume

STAGE/STORAGE (Dry Pond 3A)

Pond 3A

Top of Bank	4.70
Bottom of Pond	3.70
SHW Elevation	2.50

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
4.70	0.1157	5039.89	956	3965	
4.50	0.1037	4517.96	439	3009	
4.40	0.0977	4257.00	413	2571	
4.30	0.0917	3996.04	387	2158	
4.20	0.0857	3735.07	360	1771	
4.10	0.0798	3474.11	334	1411	
4.00	0.0738	3213.14	308	1076	
3.90	0.0678	2952.18	255	768	
3.81	0.0624	2717.31	513	513	TREATMENT ELEVATION
3.60	0.0498	2169.29	0.00	0.00	

Figure 9. Dry Pond 3A Treatment Volume

Total: 11,675 + 513 = 12,188 CF

12,188 > 12,170, so the dry ponds have sufficient capacity to treat the entirety of Basin 3.

Basin 4:

STAGE/STORAGE (Dry Pond 4)

Pond 4a

Top of Bank	4.50
Bottom of Pond	3.50
SHW Elevation	2.50

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
4.50	0.1706	7431.34	1218	5848	
4.33	0.1582	6892.98	869	4630	Treatment Elevation
4.20	0.1488	6481.29	632	3761	
4.10	0.1415	6164.61	601	3129	
4.00	0.1343	5847.93	569	2528	
3.90	0.1270	5531.25	537	1959	
3.80	0.1197	5214.57	257	1422	
3.75	0.1161	5056.23	723	1165	
3.60	0.1052	4581.21	442	442	
3.50	0.0979	4264.52	0.00	0.00	

Figure 10. Dry Pond 4 Treatment Volume

4,360 <5,037, so the dry pond does not have enough capacity to treat the entire Basin 4, and underdrain would be used.

UNDERDRAIN

10-Yr Storm		
Underdrain Outflow Rate =	0.678	cfs
Total Treatment Volume =	28,119	cf
Accumulated Treatment =	4.19	in
25-Yr Storm		
Underdrain Outflow Rate =	0.768	cfs
Total Treatment Volume =	32,917	cf
Accumulated Treatment =	4.90	in

Figure 11. Basin 4 Underdrain Volume Calculations

Basin 5:

STAGE/STORAGE (Dry Retention Pond)

Top of Bank	6.80
Bottom of Pond	5.50
SHW Elevation	4.40

Stage (NGVD)	Area (AC)	Area (SF)	Inc. Volume (CF)	Total Volume (CF)	
6.80	0.574	25003.4	1240	25369	
6.75	0.564	24581.2	5881	24130	
6.50	0.516	22470.3	5354	18248	
6.25	0.467	20359.3	6259	12895	
5.92	0.403	17572.8	2865	6636	TREATMENT ELEVATION
5.75	0.370	16137.3	3770	3770	
5.50	0.322	14026.3	0	0	

Figure 12. Dry Pond 2 Treatment Volume

6,636>6,534, so the dry pond has sufficient capacity to treat the entirety of Basin 5.

Total treatment of five dry ponds, one dry pond, and two dry swales:

$$2{,}490 + 28{,}590 + 12{,}188 + 4{,}360 + 6{,}636 = 54{,}264 \text{ CF} = 405{,}922.91 \text{ gal}$$

Sources:

- Kimley-Horn and Associates, Inc. “The Pier Approach Drainage Report.” City of St. Petersburg, FL, 2018.

Limitations:

- The stormwater volume calculation was based on modeling rather than actual measurements, so the results could be inaccurate.

- ***Contributed to a 43% increase in continuous seagrass area and turned all tidal flat areas into submerged areas.***

Background:

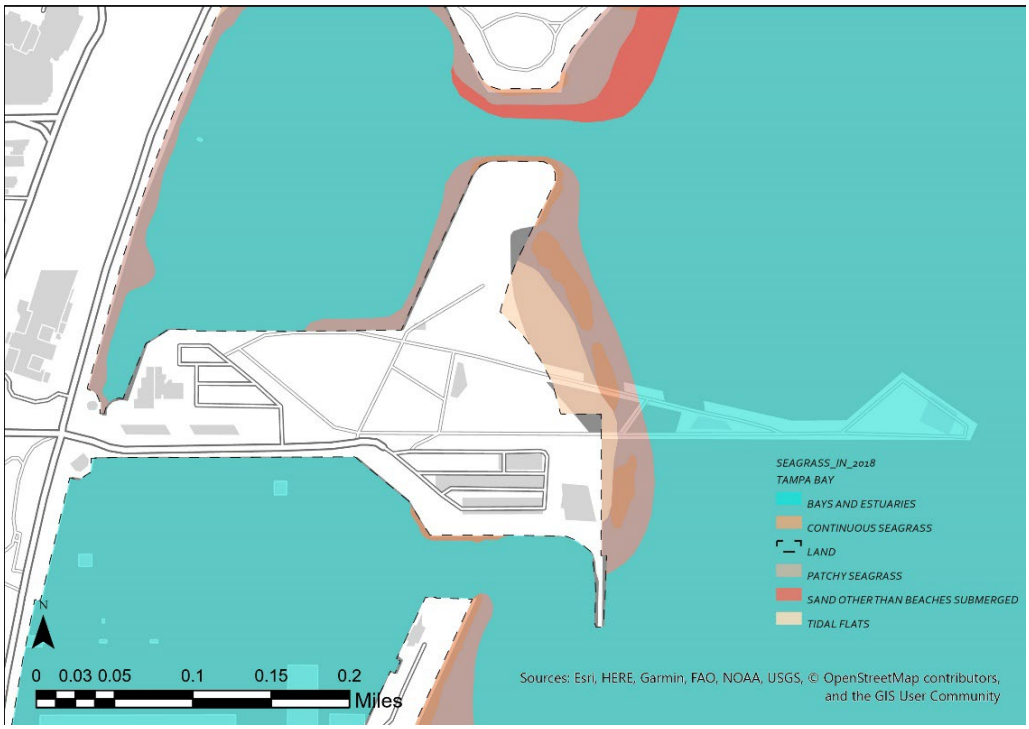
Seagrasses have long been recognized as an important coastal resource that contributes to and provides significant support for many ecosystem services. Seagrasses are underwater flowering plants found in protected bays, lagoons, and coastal waters of Florida. They require light and produce oxygen, and they are limited by water clarity. Seagrass meadows in Tampa Bay are ecological powerhouses. They serve as vital nurseries for juvenile marine species including fish,

crabs, and shrimp. Beyond providing sanctuary for these creatures, they are also essential habitats for threatened and endangered species such as the small-tooth sawfish. Many species, from the Florida Manatee and turtles to sharks, rays, and various birds, rely on seagrass beds as primary feeding grounds. These underwater meadows play a pivotal role in enhancing water quality by filtering out excess nutrients. Furthermore, they are integral to the energy and nutrient cycles of the coastal ecosystem, supporting both recreational and commercial activities in the region. The primary seagrass species in Tampa Bay are shoal grass (*Halodule wrightii*), turtle grass (Thalassia testudinum), and manatee grass (*Syringodium filliforme*).

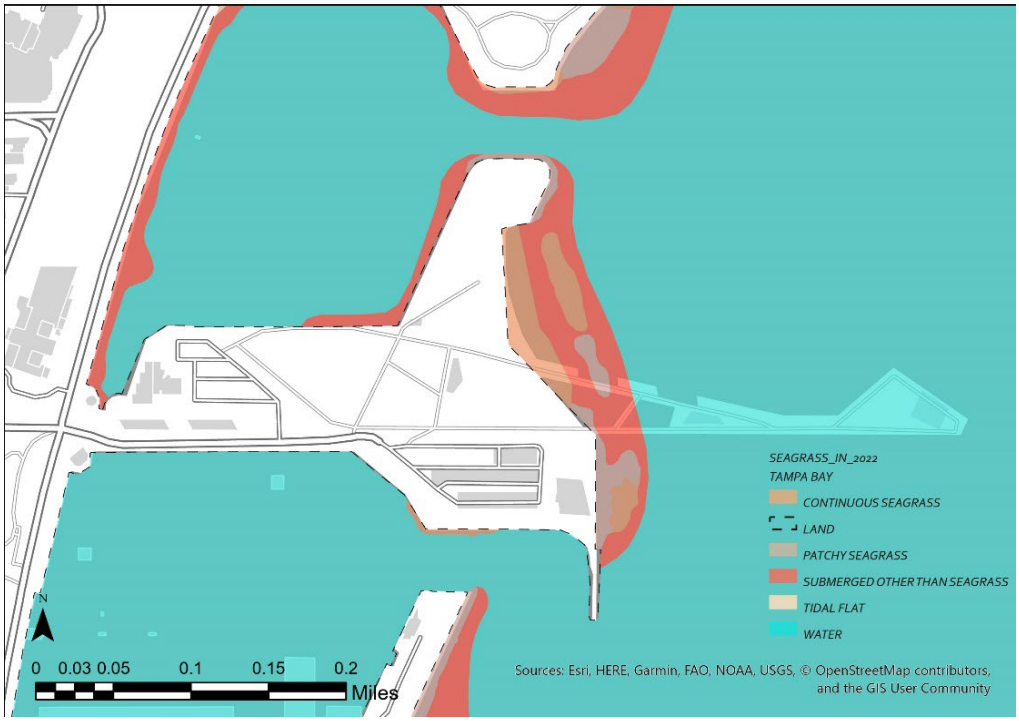
Figure 13 Shoal grass - *Halodule wrightii*, turtle grass - *Thalassia testudinum* and manatee grass - *Syringodium filiforme. (Photo@ BMMAP(The Benthic Mapping, Monitoring and Assessment Programme))*

The Tampa Bay Estuary Program is a seagrass monitoring and restoration program with the goal of restoring seagrass area coverage to 1950s levels after decades of decline. A long-term seagrass coverage mapping program was instituted in 1988 by the SWFWMD (Southwest Florida Water Management District). The Tampa Bay Estuary Program categorizes the nature of the submerged water it monitors into four categories. These are: tidal flats, submerged other than seagrass, patchy seagrass, and continuous seagrass. Tidal flats are coastal wetlands that form when mud is deposited by the tides or rivers, waves, and the wind. They are found in sheltered areas such as bays, bayous, lagoons, and estuaries. Submerged Other Than Seagrass is submerged aquatic vegetation that is not seagrass. It can include diverse types of algae and other underwater plants that are not classified as seagrasses. These plants also play a role in the aquatic ecosystem, providing habitat and food for various marine species. Patchy seagrass refers to areas where seagrass is present but not uniformly distributed. Instead, the seagrass is found in patches, with gaps of bare substrate or other types of vegetation in between. Patchy seagrass beds can be transitional zones or areas where environmental conditions are not optimal for continuous seagrass growth. Continuous Seagrass is areas where it covers most of the substrate without gaps. Continuous seagrass beds are vital for marine ecosystems, providing habitat, and food, and playing a role in sediment stabilization and nutrient cycling. Continuous seagrass is considered a more valuable habitat than patchy seagrass.

Method:



Seagrass 2018 (2 years before project completion)



Seagrass 2022 (2 years post-project completion)

Figure 14: Comparison of the Nature of Submerged Water in 2018 and 2022 (@ESRI)

The calculation of change in area for the different submerged areas is calculated based on GIS (Geographical Information Systems) Data from Southwest Florida Water Management District Geospatial Open Data Portal The GIS database contain biannual seagrass boundaries data from 1988 to 2022, we compare the data prior the park construction (2018) and after the park opened to the public (2022).

Calculations:

Table 3. Comparison of the Nature of Submerged Water in 2018 and 2022.

	Tidal Flats (sq.ft.)	Submerged Other Than Seagrass (sq.ft.)	Patchy Seagrass (sq.ft.)	Continuous Seagrass (sq.ft.)
2018	96905.9	0	159340.2	68495.1
2022	0	189062.1	52922.6	97722.4

Continuous Seagrass Increase Ratio:

$$[(Continuous\ seagrass\ 2022) - (Continuous\ seagrass 2018)] \div (Continuous\ seagrass\ 2018)$$

$$(97722.4 - 68495.1) \div 68495.1 = 42.7\%$$

Sources:

- Tampa Bay Estuary Program. "Seagrass Assessment." Accessed June 17, 2023. https://tbep.org/seagrass-assessment/.
- Tampa Bay Watch. "Seagrass Restoration." Accessed June 17, 2023. http://tampabaywatch.org/restoration/seagrass/.
- "Seagrass in 2022." SWFWMD Open Data. Accessed 20 May 2023. https://data-swfwmd.opendata.arcgis.com/maps/seagrass-in-2022/about.

Limitations:

- Seagrass beds exhibit notable fluctuations from year to year, influenced by myriad factors such as weather patterns, water quality, and intricate biological interactions. A transient surge or decline in seagrass coverage may not necessarily reflect a persistent trend, and data could occasionally present an exaggerated shift.

- There may be a temporal lag between a significant event (e.g. the park's construction) and its observable effects on seagrass ecosystems. As such, a more extensive dataset over time might be necessary to discern the true impact of the park on seagrass habitats.

- Species diversity within beds, actual health versus size, and the impact of epiphytes on photosynthesis are crucial factors. The size of the diverse surfaces might not represent the ecological value of the seagrass.

- The pier design intentionally opened the pier surface to allow sunlight to pass and added a water break to protect the pier structure and submerged nature. However, it is worth noting that the Tampa Bay Estuary Program was already in progress before the Pier was constructed, and this could have also contributed to the increase in seagrass. Therefore, the change in acreage of seagrass cannot be solely attributed to the Pier and the water break.

- ***Provides habitat for at least 90 additional observed bird species, as compared to 12 species observed during the 5 years before the new St. Pete Pier opened.***

Background:

St. Pete Pier is located near St. Petersburg's downtown. Despite being in a high-density urban environment, the Pier provides unique opportunities to explore the Tampa Bay ecosystem through the Discovery Center. In addition, it serves as an ideal spot for seabird watching, as the number of bird species has been increasing since its opening.

Method:

Utilizing data from eBird, a globally recognized platform managed by the Cornell Lab of Ornithology, we analyzed bird sightings from July 2015 to the present. Our findings revealed 102 bird species spotted at the location. Interestingly, from July 2015 to July 2020, the 5 years prior to the new pier's inauguration, only 12 distinct species were recorded. Post-establishment, however, there was a marked increase in avian diversity, with an additional 90 species observed. This data underscores the park's role in bolstering local biodiversity, providing a testament to the transformative power of urban green spaces in fostering environmental conservation.

The table below highlights a compilation of 102 distinct bird species identified at St. Pete Pier Park in St. Petersburg, Florida, as reported by community contributors on eBird from 2005 to 2023. For a detailed description of each species, the names are hyperlinked to their respective eBird profiles.

Table 4. Bird Species Observed on Site from 2005 to 2023.

ID	Species Name	Date	ID	Species Name	Date
1	Eurasian Collared-Dove	2023/7/22	52	Common Loon	2023/3/6
2	Laughing Gull	2023/7/22	53	Monk Parakeet	2023/3/1
3	Double-crested Cormorant	2023/7/22	54	American White Pelican	2023/2/12
4	Brown Pelican	2023/7/22	55	Bald Eagle	2023/2/11
5	Little Blue Heron	2023/7/22	56	Turkey Vulture	2023/1/29
6	Green Heron	2023/7/22	57	Lesser Scaup	2023/1/26
7	White Ibis	2023/7/22	58	Blue-gray Gnatcatcher	2023/1/26
8	Nanday Parakeet	2023/7/22	59	Least Sandpiper	2023/1/23
9	Blue Jay	2023/7/22	60	Brown-headed Cowbird	2023/1/23
10	Northern Mockingbird	2023/7/22	61	Northern Cardinal	2023/1/16

11	House Sparrow	2023/7/22	62	Caspian Tern	2023/1/6
12	Boat-tailed Grackle	2023/7/22	63	Forster's Tern	2023/1/6
13	Mallard	2023/6/22	64	Black Vulture	2023/1/6
14	Loggerhead Shrike	2023/6/22	65	Herring Gull	2022/11/26
15	Fish Crow	2023/6/22	66	Sedge Wren	2022/11/24
16	European Starling	2023/6/22	67	Lesser Black-backed Gull	2022/10/20
17	Rock Pigeon	2023/6/6	68	Sandwich Tern	2022/10/20
18	Common Grackle	2023/6/6	69	Cattle Egret	2022/10/20
19	Mourning Dove	2023/6/6	70	Belted Kingfisher	2022/10/20
20	Purple Martin	2023/6/6	71	Killdeer	2022/10/19
21	Chimney Swift	2023/6/5	72	Downy Woodpecker	2022/10/16
22	Anhinga	2023/6/5	73	Common Tern	2022/10/7
23	Great Blue Heron	2023/6/5	74	Least Tern	2022/9/17
24	Great Egret	2023/6/5	75	Magnificent Frigatebird	2022/7/2
25	Snowy Egret	2023/6/5	76	Barn Swallow	2022/4/17
26	Tricolored Heron	2023/6/5	77	Red-breasted Merganser	2022/3/22
27	Black-crowned Night-Heron	2023/6/5	78	Common Ground Dove	2022/2/28
28	Yellow-crowned Night-Heron	2023/6/5	79	Bonaparte's Gull	2022/2/28
29	Osprey	2023/5/26	80	Short-billed Dowitcher	2021/11/11
30	Dunlin	2023/5/15	81	Semipalmated Sandpiper	2021/10/29
31	Red-bellied Woodpecker	2023/5/15	82	Gray Catbird	2021/9/23
32	Black-bellied Plover	2023/5/11	83	Swallow-tailed Kite	2021/6/13
33	American Oystercatcher	2023/5/1	84	Reddish Egret	2021/6/4
34	Gray Kingbird	2023/5/1	85	Black-necked Stilt	2021/4/21
35	Spotted Sandpiper	2023/4/26	86	Tree Swallow	2021/4/21
36	Black Skimmer	2023/4/6	87	Red Knot	2021/4/20
37	Northern Rough-winged Swallow	2023/4/6	88	Eastern Kingbird	2021/4/19
38	Brown Thrasher	2023/4/6	89	Pied-billed Grebe	2021/1/12
39	Ring-necked Duck	2023/3/12	90	Red-winged Blackbird	2020/7/9
40	Royal Tern	2023/3/12	91	Western Sandpiper	2018/3/29
41	Willet	2023/3/12	92	Prairie Warbler	2015/12/4
42	Roseate Spoonbill	2023/3/12	93	White-winged Dove	2014/5/27
43	Marbled Godwit	2023/3/10	94	Red-tailed Hawk	2014/5/11
44	Ruddy Turnstone	2023/3/10	95	American Goldfinch	2014/1/23
45	Ring-billed Gull	2023/3/10	96	Mottled Duck	2013/4/16
46	Yellow-rumped Warbler	2023/3/10	97	American Kestrel	2012/1/22
47	Wilson's Plover	2023/3/9	98	Cooper's Hawk	2011/6/7
48	Semipalmated Plover	2023/3/7	99	House Finch	2011/6/7
49	Sanderling	2023/3/7	100	Wood Stork	2005/7/7
50	Common Gallinule	2023/3/6	101	Red-shouldered Hawk	2005/7/7
51	Palm Warbler	2023/3/6	102	Blue-crowned Parakeet	2014/10/5

Calculations:

(Bird species observed from July 2005 to Present) - (Bird species observed prior July 2020)

$$102-12=90$$

Sources:

- eBird. "St. Pete Pier Hotspot." Accessed August 1, 2023. https://ebird.org/hotspot/L388222.

Limitations:

- The data available on eBird are not exhaustive and do not include all birds that may be present in the field. Results are determined by an individual's ability to access the eBird platform, the frequency of site visits, their ability to identify species, and their willingness and ability to report species. During construction no observations were made.

- ***Generates 195,000 kWh of energy per year through solar panels, saving an estimated $31,200 in annual energy costs.***

Background:

The approach marketplace features two canopies equipped with solar panels that offer shade while producing clean and renewable solar energy. The energy generated from the solar panels is used to serve the site.

Method:

Each canopy has 221 Florida-manufactured SolarTech Universal solar panels, with each panel producing approximately 305 watts of power. The total amount of power generated was calculated by multiplication described below.

Calculations:

(Unit power generated per panel per hour) * (number of solar panels) * (St. Petersburg average annual solar hours) * (St. Petersburg average annual energy price)

$$0.305\text{kW}\times442\times1446.5\text{h}\times0.16\$/\text{kWh}=\$31,200$$

Sources:

- Brilliant Harvest. "Solar Canopies at St. Pete Pier." Accessed 20 Jun 2023. https://www.brilliantharvest.com/projects/solar-canopies-st-pete-pier/.
- Solar Power World. "Duke Energy Gets Approval for Solar Carport at St. Petersburg Pier." May 2018. Accessed 20 Jun 2023. https://www.solarpowerworldonline.com/2018/05/duke-energy-gets-approval-solar-carport-st-petersburg-pier/.
- Tampa Bay Times. "Council Approves Solar Canopy for Parking at St. Pete Pier District." 17 May 2018. Accessed 20 Jun 2023. https://www.tampabay.com/blogs/baybuzz/2018/05/17/council-approves-solar-canopy-for-parking-at-st-pete-pier-district/.
- Skanska. "St. Pete Pier." Accessed 20 Jun 2023. https://www.usa.skanska.com/who-we-are/our-impact/climate/sustainability/projects/st.-pete-pier/.

Limitations:

- Sunlight Variability: The actual energy production can vary based on the number of sunny days, which can be influenced by seasonal changes and unexpected weather patterns.
- Maintenance: The efficiency of solar panels can decrease over time and may require regular maintenance to achieve optimal energy production.
- Public Usage: The actual reduction in carbon footprint also depends on how the public utilizes the facilities, such as the frequency of electric vehicle charging.
- One parking lot on site also has solar panels that provide shade and generate power. However, these panels were installed and managed by the energy company directly, and the City and park managers do not possess detailed information about them, so we were not able to estimate their productivity and usage.

- ***Improves thermal comfort by providing shade, with the energy budget of a park visitor seated in the shade measured at 50 watts per sq meter (W/m^2) on average, as compared to a visitor seated in the sun measured at 196 W/m^2. An average individual's energy budget is considered safe when under 65 W/m^2, and extreme caution is advised when it reaches over 121 W/m^2.***

Background:

St. Petersburg is located in southwestern Florida, which can be extremely hot and uncomfortable in summer. However, the St. Pete Pier is one of the most popular destinations in Florida in the summer. The landscape structures and buildings on the Pier intentionally extended roofs to provide more shade, and more trees were added to the Pier to mitigate the heat.

Method:

The ATMOS41 W Wireless All-In-One Weather Station was utilized to document microclimate conditions during two visits on June 9 and June 17, 2023. We collected three sets of data as follows: 1) from 9:20 am to 10:50 am on June 9, 2) from 3:00 pm to 5:15 pm on June 9, and 3) from 4:20 to 7:20 pm on June 17. These timeframes allowed us to capture the microclimate condition throughout a typical summery day.

The ATMOS41 W takes measurements every 3-10 seconds and uploads averaged readings every 5 minutes. While it provides data for more than ten different parameters, we focused on solar radiation, air temperature, wind speed, and relative humidity which are essential for estimating thermal conditions for humans.

The map below displays the measurement location. Initially, nine locations were selected for morning measurements on June 9. However, upon observing several other areas where people ended up gathering in the afternoon, we included eight additional measuring locations.

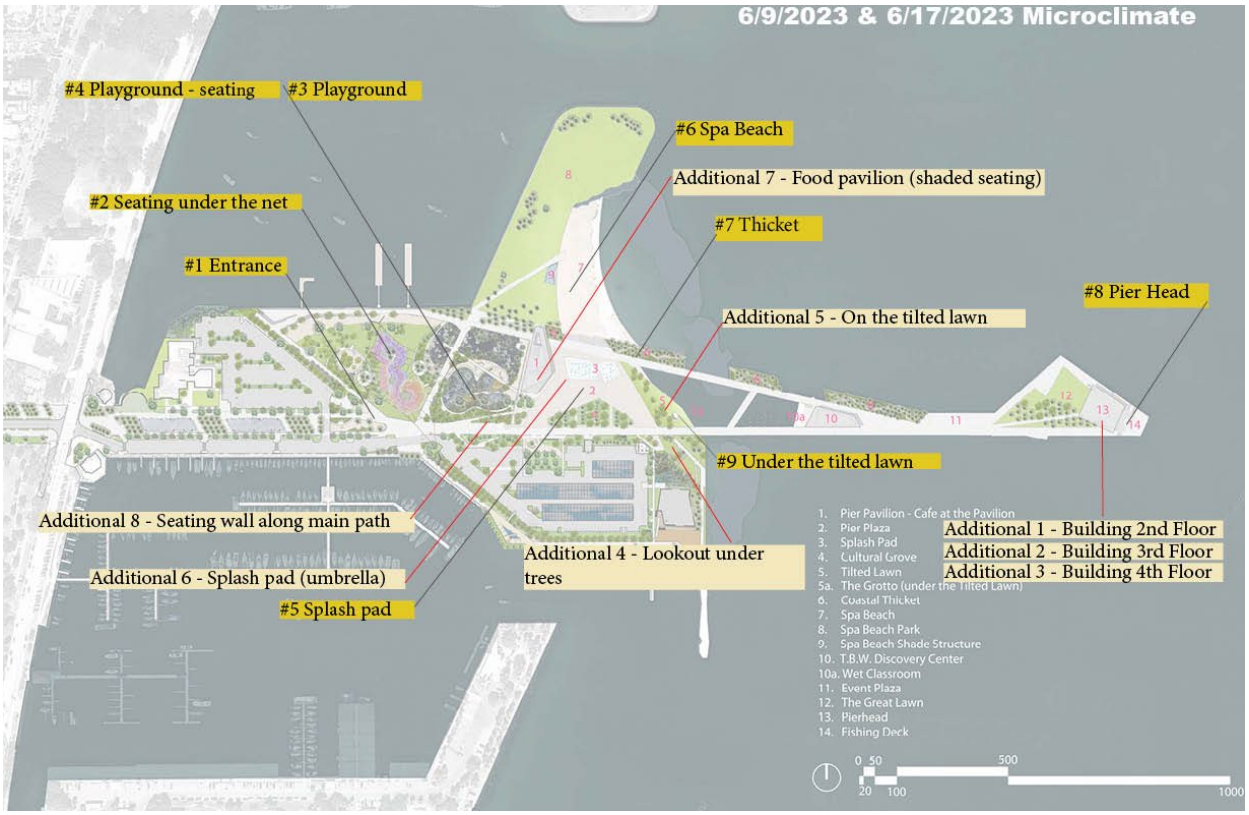


Figure 17: Microclimate Measurement Location Map (Source: Developed with the Base map provided by Ken Smith)

Table 5. Summary of Microclimate Data.

Location	Description	Clock Time	Solar Time (-92 min)	Solar Radiation W/m²	Air Temp °C	Wind Speed m/s	Relative Humidity %	Solar Elevation
June 9 Morning								
1	Entrance (Sun/shade)	9:25	7:53	133	28.4	2.58	75.67	15.36
2	Seating under the net (Sun)	9:35	8:03	141.5	28.3	2.47	77.31	17.46
3	Playground (Sun)	9:50	8:18	632.9	30.4	2.35	71.52	20.63
4	Playground (Shaded seating)	9:55	8:23	442.4	30.0	1.89	73.03	21.69
5	Splash pad (Sun)	10:05	8:33	780.5	30.5	2.58	69.84	23.83
6	Spa beach (Sun)	10:10	8:38	491.6	30.6	2.19	71.83	24.90
7	Thicket (Shade/shade)	10:15	8:43	151.7	29.4	1.89	76.37	25.97
8	Pier head (sun)	10:30	8:58	537.5	30.0	2.00	72.32	29.20
9	Under the tilt lawn (Shade)	10:45	9:13	54.7	30.0	2.09	69.63	32.45
June 9 Afternoon								
1	Entrance (Sun/shade)	15:05	13:33	949.4	33.5	1.67	52.80	85.13
2	Seating under the net (Sun)	15:15	13:43	711.05	32.7	1.72	54.86	84.34
3	Playground (Sun)	15:20	13:48	630.8	33.6	1.47	50.08	83.67
4	Playground (Shaded seating)	15:30	13:58	741.55	35.05	1.44	47.40	82.02
5	Splash pad (Sun)	15:35	14:03	743.6	34.2	2.12	49.73	81.10
6	Spa beach (Sun)	15:40	14:08	683.5	33.3	2.09	51.61	80.13
7	Thicket (Sun/shade)	15:50	14:18	512	34.8	1.53	49.15	78.11
8	Pier head (Shaded in the afternoon)	16:00	14:28	37.2	33.2	1.49	55.72	76.02
Add 1	2nd Floor terrace (Shade)	16:10	14:38	15.6	30.5	2.12	60.42	73.88
Add 2	3rd Floor terrace (Shade)	16:15	14:43	17.6	29.8	3.29	60.54	72.81
Add 3	4th Floor terrace (Sun)	16:25	14:53	719.5	30.1	2.75	57.18	70.64
9	Under the tilted lawn (Shade)	16:35	15:03	228.1	30.6	2.35	58.61	68.45
Add 4	Look out under shaded trees (Shade)	16:40	15:08	129.3	31.1	2.59	57.92	67.35
Add 5	On the tilted lawn (Umbrella)	16:50	15:18	65.6	30.4	1.92	62.51	65.15
Add 6	Splash pad (Umbrella)	16:55	15:23	99.8	30.7	2.05	60.63	64.05
Add 7	Food Pavilion (Shaded seating)	17:00	15:28	91.3	30.8	2.43	58.23	62.95
Add 8	Seating wall along main path (Tree shade)	17:10	15:38	60	30.6	2.48	60.80	60.74
June 17 Evening								
1	Entrance (Sun/shade)	17:45	16:12	376.9	31.8	1.62	78.32	53.71
2	Seating under the net (Sun)	17:40	16:07	263	31.4	1.62	79.89	54.82
3	Playground (Sun)	18:05	16:32	133.6	31.8	1.58	80.15	49.30
4	Playground (Shaded seating)	18:00	16:27	113	31.6	1.51	80.17	50.40
5	Splash pad (Sun)	18:35	17:02	181.7	31.7	1.23	81.30	42.70

6	Spa beach (Sun)							
7	Thicket (Sun/shade)	19:00	17:27	44.1	30.8	2.89	86.42	37.23
8	Pier head (Shaded in the afternoon)	16:30	14:57	237.3	30.8	2.45	75.72	70.26
Add 1	2nd Floor terrace (Shade)	16:25	14:52	12	31	2.01	74.97	71.35
Add 2	3rd Floor terrace (Shade)	16:40	15:07	495.2	30.8	1.68	77.70	68.07
Add 3	4th Floor terrace (Sun)	16:45	15:12	310.7	30.4	2.33	79.20	66.97
9	Under the tilted lawn (Shade)	18:50	17:17	49.7	31.4	1.72	83.98	39.42
Add 4	Look out under shaded trees (Shade)	19:15	17:42	57.5	30.4	2.11	88.24	33.97
Add 5	On the tilted lawn (Umbrella)							
Add 6	Splash pad (Umbrella)	18:30	16:57	167.1	31.6	1.41	81.72	43.80
Add 7	Food Pavilion (Shaded seating)							
Add 8	Seating wall along main path (Tree shade)	18:15	16:42	107.4	31.8	1.68	80.02	47.10

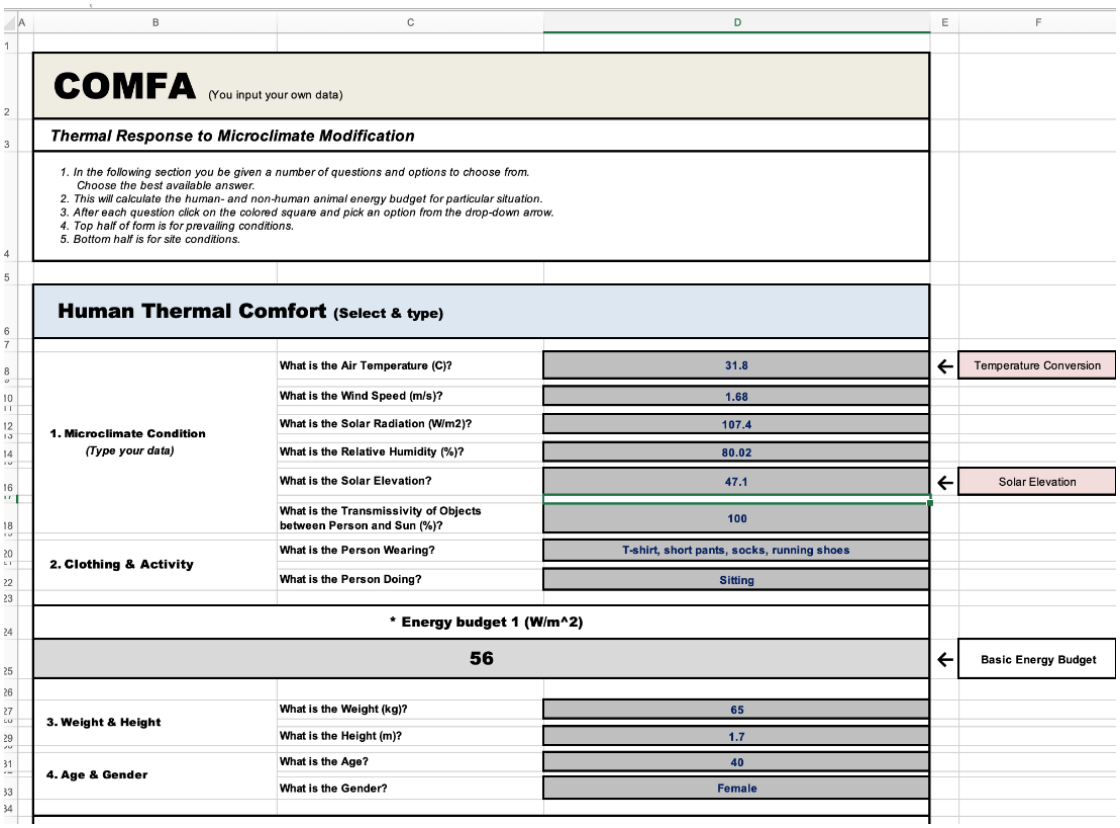
Calculations:

The data measured by the ATMOS 41W, along with solar elevation calculated using NOAA's Solar Position Calculator, were inputted into the COMFA model adjusted and updated based on Brown and Gillespie's 1987 version. This model enables us to estimate the energy budget and predict human thermal comfort in Pier Park.

Below is a snapshot illustrating the utilization of the COMFA model to estimate the energy budget. The energy budgets calculated by the model were compared against the standards associated with the model to assess the thermal comfort of individuals on site.

The model considers factors such as age, height, weight, and gender. To simplify the calculation and make the estimation feasible, we focused on two specific types of individuals. The first type is a 40-year-old female, weighing about 65 kg and standing at an eight of 1.7 m. This type was used to estimate the thermal comfort of most areas in the park. The second type is a 5-year-old male, weighing 20kg and standing at a height of 1.1m. This type was used to estimate the thermal comfort of children in the playground.

These two types were selected based on our survey findings, which indicated that most respondents were female aged 35-44 (see Research Strategy above), and the observed children in the playground were between the ages of 2-7.



COMFA (You input your own data)

Thermal Response to Microclimate Modification

1. In the following section you be given a number of questions and options to choose from.
Choose the best available answer.
2. This will calculate the human- and non-human animal energy budget for particular situation.
3. After each question click on the colored square and pick an option from the drop-down arrow.
4. Top half of form is for prevailing conditions.
5. Bottom half is for site conditions.

Human Thermal Comfort (Select & type)

1. Microclimate Condition *(Type your data)*	What is the Air Temperature (C)?	31.8	← Temperature Conversion
	What is the Wind Speed (m/s)?	1.68	
	What is the Solar Radiation (W/m2)?	107.4	
	What is the Relative Humidity (%)?	80.02	
	What is the Solar Elevation?	47.1	← Solar Elevation
	What is the Transmissivity of Objects between Person and Sun (%)?	100	
2. Clothing & Activity	What is the Person Wearing?	T-shirt, short pants, socks, running shoes	
	What is the Person Doing?	Sitting	

*** Energy budget 1 (W/m^2)**

56 ← Basic Energy Budget

3. Weight & Height	What is the Weight (kg)?	65
	What is the Height (m)?	1.7
4. Age & Gender	What is the Age?	40
	What is the Gender?	Female

Figure 18. Snapshot of COMFA Model Interface

1. What the Budget Values mean for a Standing Adult	
< -150	Would prefer to be much warmer
-150 to -50	Would prefer to be warmer
-50 to 50	No change
50 - 150	Would prefer to be cooler
> 150	Would prefer to be much cooler

2. What the Budget Values Mean for an Active Athlete	
< 120	Safety
121-200	Caution
201 - 340	Dangerous
> 341	Extremely Dangerous

3. What the Budget Values Mean for the Heat Health of an Adult	
65 - 120	Caution
121-200	Extreme Caution
201 - 340	Dangerous
> 341	Extremely Dangerous

Figure 19. Snapshot of COMFA Model Standards

Table 6. Summary of the Energy Budget Calculation

Location	Description	Energy Budget W/m²					
June 9 Morning							
		Sitting	Standing	Walking (moderate)	Bicycling (16-19.2 km/hr)	Running (8.4 km/hr)	Roller blading
1	Entrance (Sun/shade)	84	104	133	247	389	341
2	Seating under the net (Sun)	79	99	129			
3	Playground (Sun)	330	352	384	504	649	601
4	Playground (Shaded seating)	224	246	278			
5	Splash pad (Sun)	360	381	413	529	674	626
6	Spa beach (Sun)	227	248	280		550	
7	Thicket (Shade/shade)		94	125			
8	Pier head (sun)	213	234	266	390	536	487
9	Under the tilt lawn (Shade)	32	53	84	204		301
June 9 Afternoon							
1	Entrance (Sun/shade)	162	184	220	340	489	440
2	Seating under the net (Sun)	134	156	191			
3	Playground (Sun)	125	148	184	305	454	404
4	Playground (Shaded seating)	154	178	215			
5	Splash pad (Sun)	149	172	208	319	593	422
6	Spa beach (Sun)	135	157	192	303	451	402
7	Thicket (Sun/shade)		150	187			
8	Pier head (Shaded in the afternoon)	46	68	104	230	380	330
Add 1	2nd Floor terrace (Shade)	19	40				
Add 2	3rd Floor terrace (Shade)	12	32				
Add 3	4th Floor terrace (Sun)	130	151				
9	Under the tilted lawn (Shade)	56	77	109	215		311
Add 4	Look out under shaded trees (Shade)	43					
Add 5	On the tilted lawn (Umbrella)	28					
Add 6	Splash pad (Umbrella)	37					
Add 7	Food Pavilion (Shaded seating)	36					
Add 8	Seating wall along main path (Tree shade)	29					
June 17 Evening							
1	Entrance (Sun/shade)	112	135	180	313	463	413
2	Seating under the net (Sun)	83	105	150			
3	Playground (Sun)	61	84	131	265	415	365

4	Playground (Shaded seating)	54	77	124			
5	Splash pad (Sun)	79	101	154	288	441	390
6	Spa beach (Sun)						
7	Thicket (Sun/shade)		54	94			
8	Pier head (Shaded in the afternoon)	58	80	112	239	385	336
Add 1	2nd Floor terrace (Shade)	24	45				
Add 2	3rd Floor terrace (Shade)	106	128				
Add 3	4th Floor terrace (Sun)	71	92				
9	Under the tilted lawn (Shade)	41	63	111	243		344
Add 4	Look out under shaded trees (Shade)	36					
Add 5	On the tilted lawn (Umbrella)						
Add 6	Splash pad (Umbrella)	73					
Add 7	Food Pavilion (Shaded seating)						
Add 8	Seating wall along main path (Tree shade)	56					

Table Legend:

For Sitting or Standing Adult
No change
Would prefer to be cooler
Would prefer to be much cooler
For an Active Athlete
Safety
Caution
Dangerous
Extremely Dangerous
Heat Health for an Adult
Safe
Caution
Extreme Caution
Dangerous
Extremely Dangerous

As shown in the table above, it is important to note that while Pier Park offers various activities, engaging in active exercises such as running, rollerblading, bicycling can pose risks due to excessive heat in the summer of Florida. During our visits, we observed a few people (15-20) participating in these activities in the morning. However, in the afternoon, these activities were less prevalent. Instead, the most popular activities were sitting, scenic viewing, and walking.

In the morning, we selected nine locations to measure, six of which are suitable for sitting. These locations are the entrance, seating under the net, the playground, Spa Beach, the Pier head, and the area under the tilted lawn. The energy budgets reveal that one of these six locations was comfortable for people, with no need for changes, two locations were tolerable, but people might prefer a cooler environment, and in the remaining three locations, people would prefer to be much cooler.

In the afternoon, due to the additional locations we measured, there were 14 locations suitable for sitting. Among these locations, eight were comfortable for people with no need for change, and the remaining six locations were deemed tolerable in terms of thermal comfort.

To understand to what extent the trees and shade structures improve people's thermal comfort, we compare the average energy budget for people sitting under the shades and people sitting under the sun. Since the splash pad was in the sun the entire day, we selected it to be compared to the shaded seating. The result shows that the shade structures and trees on the pier Improve thermal comfort for visitors in hot summer, with the energy budget of a person sitting in shaded areas being an average of 50 W/m2, which is more comfortable/safer compared to that of a person who sitting in the sun on the Pier (196 W/m2). According to the standards, when the energy budget is less than 65 W/m2, people are considered safe in terms of heat health, but when the energy budget is between 121-200 W/m2, people should be extremely cautious.

Table 7. Human Thermal Comfort Comparison between Sun and Shade.

	Sun (splash pad)	Shade	
Jun. 9 morning	360	32	Under the tilted lawn
		224	Playground seating
Jun. 9 afternoon	149	46	Pier head
		19	2nd floor
		12	3rd floor
		56	Under the tilted lawn
		43	Look out area
		28	On the tilted lawn (umbrella)
		37	Splash pad umbrella
		36	Food pavilion
		29	Seating wall
Jun. 17 evening	79	58	Pier head
		24	2nd floor
		41	Under the tilted lawn
		36	Look out area
		73	Splash pad umbrella
		56	Seating wall
Average	196	50	

Sources:

- Brown, Robert, Terry Gillespie, Natasha Kenny, Jennifer Vanos, Wenwen Cheng, and Kanghyun Lee. "COMFA Model." Accessed June 20, 2023. https://research.arch.tamu.edu/microclimatic-design/COMFA/index.html .
- Cornwall, Chris, Aaron Horiuchi, and Chris Lehman. "Solar Position Calculator." Last updated August 1, 2023. https://gml.noaa.gov/grad/solcalc/azel.html

Limitations:

- The standards associated with the COMFA model may not account for tropical climates, therefore, some visitors might be more tolerant of hot weather conditions.
- Due to the size of the site, it takes more than two hours to measure all locations. In this period, microclimate could change, therefore, the measurements did not reflect the microclimate condition of the entire site at one point of time.
- The findings are also limited by ATMOS41 W's accuracy. The device's accuracy varies for different parameters, with the following specifications: solar radiation ±5%, relative humidity ±1.5%, air temperature ±0.6°C, and wind speed 3% of measurement.

- ***Sequesters an estimated 5 tons of atmospheric carbon annually and stores an estimated 47.3 tons of carbon in 866 newly planted trees.***

Background:

St. Pete Pier in St. Petersburg, Florida, exemplifies the harmonious integration of urban design and ecological conservation through its addition of 866 newly planted trees. The tree species include Cabbage palmetto (*Sable Palmetto*), accounting for 33.5%, Southern live oak (*Quercus virginiana)* At 16.4%, and Pond cypress (*Taxodium ascendens*) at 6.6%. To assess the environmental impact and benefits of these trees, we utilized the i-Tree Eco v6 software. This application, part of a comprehensive suite developed by the USDA (US Department of Agriculture) Forest Service, estimates the ecosystem services and structural attributes of both rural and urban forests using standardized sampling, data collection protocols, and automated processing. The final reports generated elucidate metrics such as carbon sequestration in tons, carbon storage in pounds, and avoided runoff in cubic feet, providing a holistic understanding of the environmental and economic advantages trees confer in urban settings.

Method:

Carbon storge and rainwater runoff interception was calculated using i-Tree Eco v6. i-Tree requires the species and number of trees on the site as well as the DBH, all of which were measured from the on-site tree inventory in conjunction with Kimley-Horn and Ken Smith's construction documents. For each species, we took measurements from 3-5 trees and then used their average DBH for our computations.

Table 8. Tree Species inventory.

TREE SPECIES COMMON NAME	TREE SPECIES SCIENTIFIC NAME	Count of TREES	% of trees
Cabbage Palmetto	Sabal palmetto	290	0.335
Southern Live Oak	Quercus virginiana	142	0.164
Pond Cypress	Taxodium ascendens	57	0.066
Silver Bismarck Palm	Bismarckia nobilis	54	0.062
South Florida Slash Pine	Pinus elliottii var. densa	52	0.060
Royal Palm	Roystonea regia	44	0.051
Jacaranda	Jacaranda mimosifolia	29	0.033
Green Bottom Wood	Conocarpus erectus	28	0.032
Pink Tabebuia	Tabebuia heterophylla	24	0.028
Bald Cypress	Taxodium distichum	21	0.024
Crape Myrtle	Lagerstroemia indica	21	0.024
Trumpet tree	Tabebuia rosea	17	0.020
Wax Myrtle	Myrica cerifera	15	0.017
Sea Grape	Coccoloba uvifera	14	0.016
Yellow Poinciana	Peltophorum pterocarpum	10	0.012
Balsam Apple	Momordica balsamina	9	0.010
Yellow Trumpet tree	Handroanthus chrysotrichus	9	0.010
Orange Geiger tree	Cordia sebestena	7	0.008
Silver Buttonwood	Conocarpus erectus var. sericeus	7	0.008
Royal Poinciana	Delonix regia	5	0.006
Hongkong Orchid	Bauhinia blakeana	4	0.005
Florida Flame Red Maple	Acer rubrum 'Florida Flame'	3	0.003
South Live Oak	Quercus virginiana	2	0.002
Golden Trumpet Tree	Handroanthus chrysanthus	2	0.002
Grand Total		866	

Calculations:

The i-Tree database attributes specific values to each tree species and size category. Through its proprietary calculations, the software determines the amount of CO2 each tree sequesters, measured in kilograms. Additionally, the estimation of avoided runoff is derived from local weather data sourced from the closest weather station. Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon annually sequestered is increased with the size and health of the trees. The gross sequestration of St Pete Pier trees is about 4.973 tons of carbon per year with an associated value of $848.

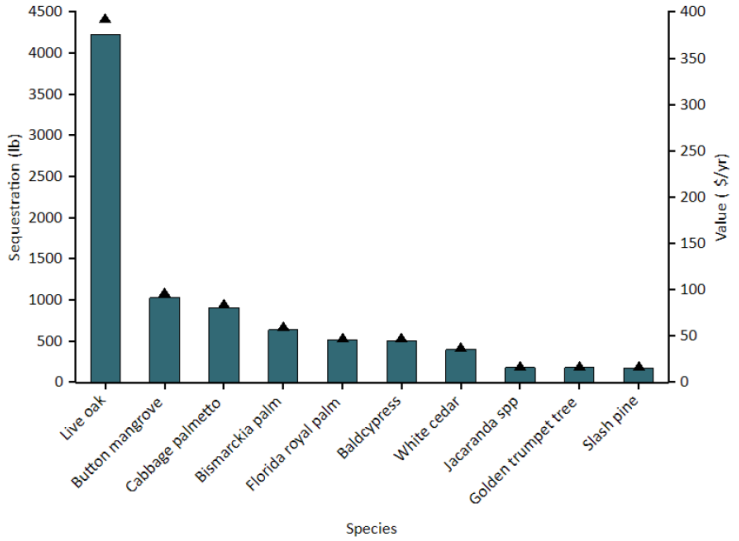


Figure 15. Annual Gross Carbon Sequestration

The trees in St. Pete Pier are estimated to have stored a commendable 47.3 tons of carbon, valued at approximately $8,070. Among the diverse species present, the Cabbage palmetto stands out, accounting for 29.5% of the total carbon storage. Meanwhile, the Live oak is notable for its carbon sequestration prowess, contributing to around 44.3% of the overall carbon sequestered.

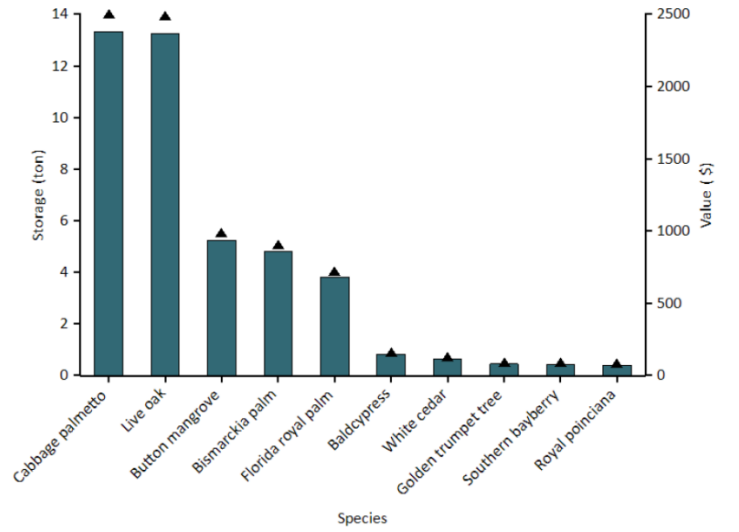


Figure 16. Carbon Storage and Values

In St. Pete Pier, trees and shrubs play a pivotal role in managing precipitation. Their canopy intercepts rainfall, while their extensive root systems facilitate soil infiltration and storage. As a result, these green assets help mitigate runoff by an estimated 56.3 thousand gallons annually, translating to a monetary value of $500. This avoided runoff estimation is derived from local weather data, with the park recording a total annual precipitation of 46.9 inches in 2020.

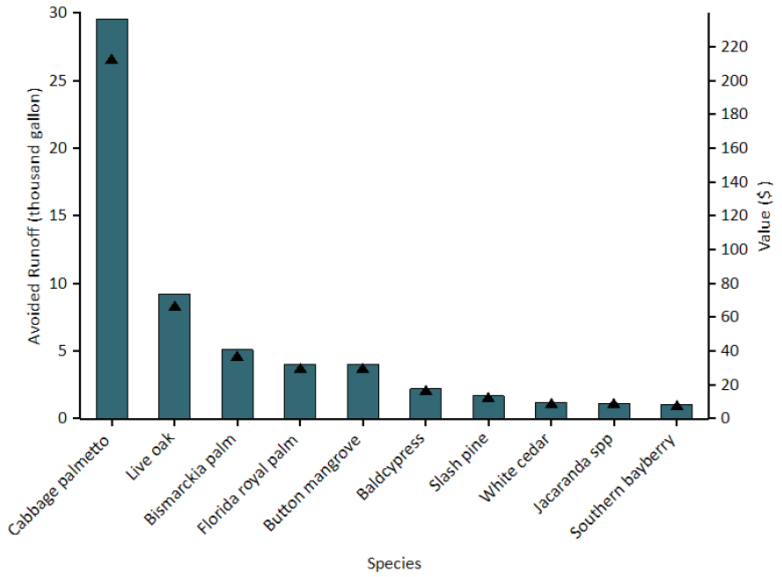


Figure 17. Avoided Runoff and Value

Sources:

- "i-Tree Eco v6." Accessed July 15, 2023. https://www.itreetools.org/tools/i-tree-eco.
- On site tree inventory conducted on June 7.

Limitations:

- The i-Tree database attributes specific values to each tree species and size category. Due to the database's limitation, some trees on-site are not included in the database and must be replaced with similar trees.
- For our calculations, we utilized the average diameter at breast height (DBH) of each species rather than the DBH of every individual tree. This approach means that our results are approximations and not precise values.
- i-Tree's estimation focused on new trees and did not fully consider types of vegetation, like groundcover and shrubs, which can also play a significant role in carbon sequestration and stormwater retention.

Social Benefits

- ***Attracts approximately 2.3 million annual visitors and serves both locals and tourists. On average, visitors stay for about 70 minutes.***

Background:

After a significant redevelopment project, the pier was officially reopened in July 2020, known as the new St. Pete Pier. Since then, it has emerged as a popular destination, drawing both locals and tourists alike.

Figure 20. Examples of uses observed at on-site visits: cycling with family, scootering, walking dogs, reading, eating & socializing, taking photos, wheelchair and baby stroller rolling, interacting with art that facilitates views, chilling on the lodge, taking a sunbath, playing in the water.

Method:

Two methods were implemented to complement each other. We used Placer.ai to calculate the visits between May 1, 2021, to April 30, 2022. Data from an on-site survey conducted in July 2023 as complement to further substantiate the appeal of the Pier.

Placer.ai is a location analytics company that documents individual person/traffic movement using cellular phone metadata and geo-fencing technology that only first became available in 2018. It can not only distinguish traffic movement among residents, workers, and visitors within a specific area, but also provides analytical data for visit frequency, journey to/from specific destinations, and dwell time (and further detailed in the following sections). The data of Placer.ai was from the Economic and Fiscal Impact Assessment developed by Lambert Advisory for the City of St. Petersburg.

An on-site survey was conducted at St. Pete Pier Park pertaining to visitation. The survey encompassed inquires such as "How close do you live to St. Pete Pier Park?" "How long do you typically stay at the Park?" "Do you consider the Park a must-see place?" "How often do you visit the Park?"

Calculations:

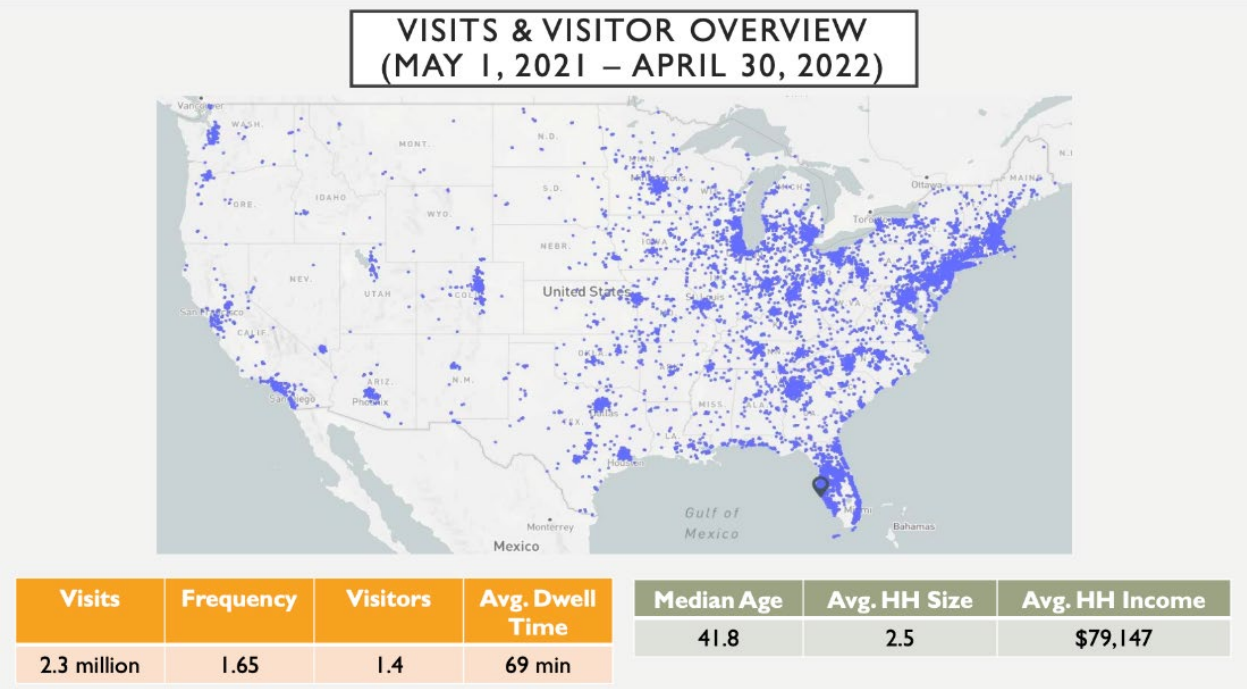


Figure 21. Placer.ai Data of Visits & Visitor overview

Table 9. Visits & Visitor overview (May 1, 2021 – April 30, 2022).

	Visits	Frequency	Visitors	Avg. Dwell Time
0-10 Miles	746,700	2.98	250,300	69 min
11-50 Miles	601,200	1.55	386,300	70 min
51-100 Miles	89,700	1.33	67,200	71 min

100+ Miles	882,800	1.3	676,300	69 min
Total	2.3 million	1.65	1.4 million	69 min

Visitors from outside of 100 miles

882800 (number of visits) ÷2.3 million (total visit) = 38.38%

Visitors from 51-100 miles:

89700 (number of visits) ÷2.3 million (total visit) = 3.9%

Visitors from 11-50 miles:

601200 (number of visits) ÷2.3 million (total visit) = 26.13%

Visitors from 10miles:

746700 (number of visits) ÷2.3 million (total visit) = 32.47%

Average dwell time:

$$(69 + 70 + 71 + 69 + 69) \div 5 = 69.8 \text{ min}$$

During the 12-month period from May 1, 2021, to April 30, 2022, St. Pete Pier had approximately 2.3 million visits, surpassing the estimated 1.7 million visits from the original 2017 study based upon benchmarking other piers and attractions. Of the total visits, approximately 40% (882,800 visits) were from visitors arriving from areas 100+ miles, with an average frequency of 1.3 visits per year. 33% (746,700 visits) came from St. Petersburg and/or the proximate surrounding area (within 10 miles) with an average frequency of 3.0 visits per year. The Pier serves as both a major tourist attraction and a regular destination for locals.

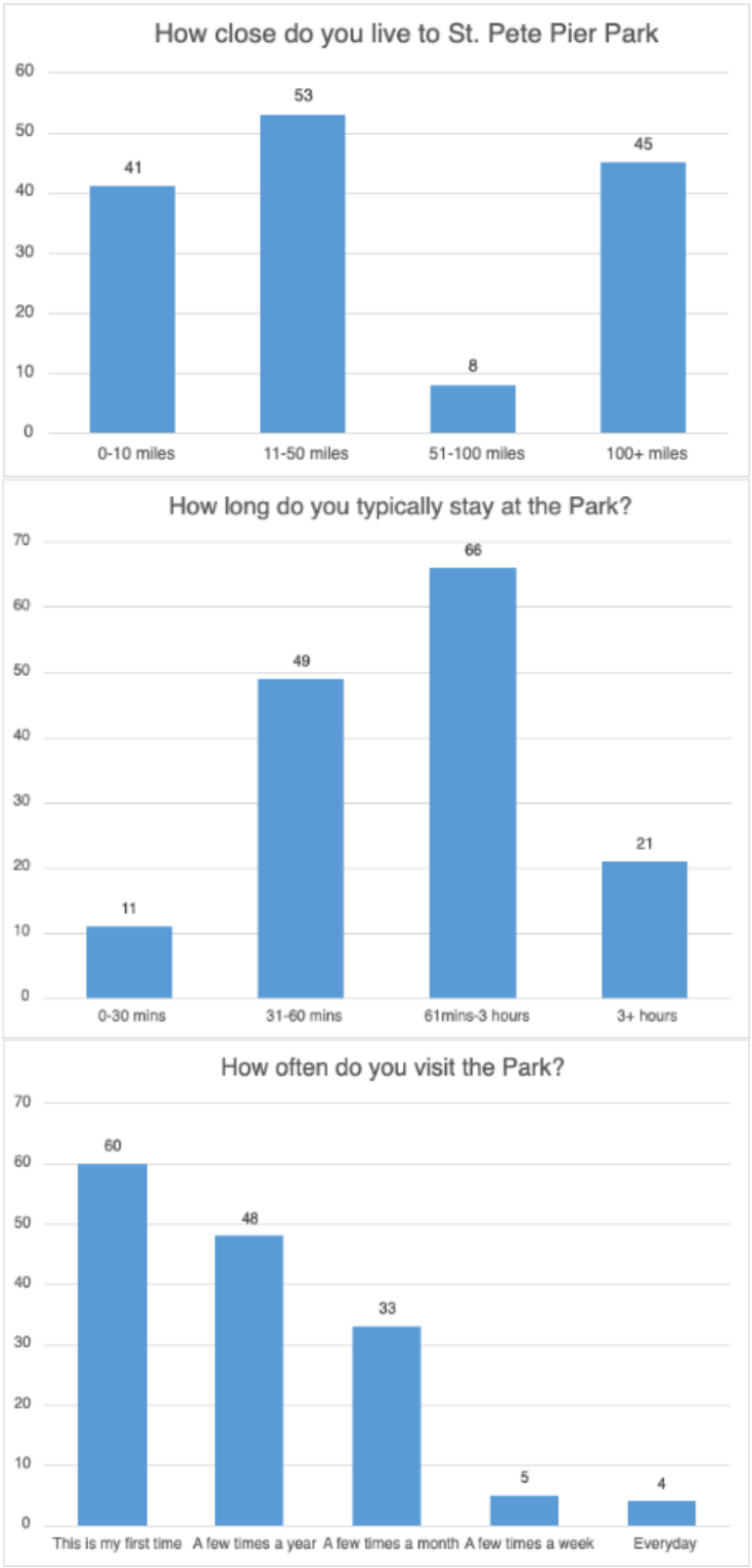


Figure 22. Summary of Part of the Survey Findings

Percentage of first visit:

60 (number of first visitors) ÷150 (total number of visitors) = 40%

Percentage of visitors live over 100miles:

45 ÷ 147 (total number of people who answered this question) =30.6%

Percentage of visitors live 51-100 miles:

8 ÷ 147 (total number of people who answered this question) =5.4%

Percentage of visitors live 11-50 miles:

53 ÷ 147 (total number of people who answered this question) =36.1%

Percentage of visitors live within 10 miles:

41 ÷ 147 (total number of people who answered this question) =27.9%

According to our survey results, out of the 150 respondents, 40% are first-time attendees, and the average stay duration during each visit is between 1 to 3 hours. The Pier's appeal extends far beyond the local community, attracting visitors from across the nation. Specifically, 30.6% of surveyed respondents lived more than 100 miles away, 5.4% were from 51-100 miles, 36.1% were from 10-50 miles, and 27.9% were from within 10 miles. These results align with the data from Placer.ai data cited in the Economic and Fiscal Impact Assessment, so we reported the results from the Assessment as it covers a longer time period.

Sources:

Lambert Advisory. "St. Pete Pier Economic & Fiscal Impact Assessment Update." Report, City of St. Petersburg, 2022.

Placer.ai. "St. Pete Pier." Accessed June 2022. https://www.placer.ai/?name=st+pete+pier

On-site survey conducted on June 9 and June 17, 2023.

Limitations:

- The total visitation count of 2.3 million between May 1, 2021, and April 30, 2022, is undoubtedly an impressive statistic. However, due to the lack of prior data or benchmarks for comparison, its significance and performance relative to historical trends or standards remain uncertain.

- ***Enhances the recreational amenities offered by St. Petersburg's waterfront park system by adding 8 new recreational functions, representing a 40% increase in the number of amenity types offered throughout the park system across 13 parks.***

Background:

The St. Pete Pier is closely aligned with the City of St. Petersburg Waterfront Master plan, which requires the new design to integrate the Pier into the fabric of the City's downtown waterfront park system. This system is supported by the Downtown Waterfront Parks Foundation of St. Petersburg, which aims to preserve and enhance the historic waterfront parks of the city, ensuring the enjoyment of residents and visitors for years to come. The Waterfront Parks in St. Petersburg stretch along Tampa Bay from Coffee Pot Park (1st Street and 30th Ave. NE) to the north to Lassing Park (Beach Drive and 22nd Ave. SE) in the south. The Pier plays an essential role in enriching the activity opportunities within the waterfront park system.

Method:

Programming Complement

The downtown St. Petersburg Waterfront Park System comprises 12 parks, excluding the Pier Park. To assess the programming complement of the Pier, we compiled a list of all the recreational amenities present in these parks to determine the number of new recreational amenities added to the Waterfront Park System. The amenity data for each waterfront park was obtained from the Waterfront Parks Foundation, and the amenities of the Pier were identified from the design documents provided by the firm liaisons.

Calculation:

Table 10. Amenities in Each Park of the St. Petersburg Waterfront Park System.

	Coffee Pot Park	*Flora Wylie Park*	*Elva Rouse Park*	*North Shore Park*	*Vinoy Park*	*North Straub Park*	*South Straub Park*	*Pioneer Park*	*Demes Landing Park*	*Albert Whitted Park*	*Poynter Park*	*Lassing Park*	*St. Pete Pier Park*
Category	Waterfront	Water front	Waterfront	Waterfront	Waterfront	Water front	Water front	Waterfront/ Historic	Waterfront	Waterfront	Waterfront	Water front	Waterfront
Acreage	1.2	11.4	o.6	33.2	11.6	4.8	7.3	1.8	14.7	4.78	2.1	14.2	26
Open Green Space	✓	✓		✓	✓		✓		✓		✓	✓	✓
Playground	✓			✓					✓	✓		✓	✓
Picnic Shelter	✓								✓				
Boat Ramp	✓								✓				

Kayak Ramp	✓												
Beach				✓								✓	✓
Trail		✓	✓			✓	✓						
Bench Swing		✓											
Sundial		✓											
Wilderness Area			✓					✓					
Arboretum			✓										
Dog Park				✓									
Restroom				✓					✓	✓			✓
Aquatic Complex				✓									
Sports Complex (Tennis,volleyball, softball)				✓									
Performance Stage						✓							
Water Fountain							✓						
Picnic tables										✓			
Restaurant													✓
Artistic features					✓	✓	✓	✓			✓		✓
Museum													✓
Splash Pad													✓
Monument								✓					✓
Discovery Center													✓
Fishing Deck													✓
Market Place													✓
Plaza													✓
Parking lot													✓
Total	5	4	3	7	2	3	4	3	5	3	2	3	14

Amenities increase ratio:

$$(Number\ of\ new\ amenities) \div (Number\ of existing\ amenities\ in\ the\ system)$$

$$8 \div 20 = 40\%$$

The results table shows that the number of amenities in the existing waterfront park system varies from 2 to 7. In comparison, the Pier Park stands out with 14 amenities offered. Notably, the Pier has 8 new features that are unique and not present in the other parks, which is a 40% increase on the original number of types of features across the park system. These amenities

include restaurants, a museum, a splash pad, a discovery center, a fishing deck, marketplace, a plaza, and parking lots, which make St. Petersburg's waterfront park system a more versatile and multi-functional urban greenspace.

Sources:

- Waterfront Parks Foundation. "Downtown St. Petersburg's Waterfront Parks." Accessed August 2023. https://waterfrontparksfoundation.org/parks

Limitations:

- The current programming calculation solely focuses on the quantitative aspects, and we have not conducted a comparative evaluation of the quality of the amenities.
- There are other factors that could potentially influence the integration of the Pier into the waterfront park system, such as walkability and visitors' experiences, but we were not able to include them due to the availability of data.

- ***Increases the recreational value of the pier, with 98% of 64 surveyed visitors who were familiar with the old pier agreeing that the new pier provides more recreational opportunities.***
- ***Honors the history of St. Petersburg, with 60% of 150 surveyed visitors agreeing that St. Pete Pier raises their awareness of local history and culture.***
- ***Increases sense of safety, with 84% of 64 surveyed visitors who were familiar with the old pier agreeing that the new pier is safer to walk.***

Background:

The old pier (1973-2013) consisted of a long concrete driveway and a building at the pier head that housed restaurants, snack bars, shops, etc. The renovated St. Pete Pier aims to transform the entire pier into a public park, extending the urban and recreational features of St. Petersburg downtown into the bay and honoring the history and culture of the city. In addition, to make the park safer and more relaxing for visitors, designers advocated for a pedestrian-oriented park while reducing parking spaces.

Method:

To evaluate the pier's safety, we used the survey to gauge visitors' perception. Questions related to the three benefits above are:

- **Does the park raise your awareness of St. Petersburg's history and culture?**
  Yes No

In response to this question, 90 respondents selected "Yes", 55 selected "No", and five did not provide an answer. It is worth noting that 40% of respondents surveyed visited the pier for the first time, which could contribute to their unfamiliarity with the history and culture of the city.

- **Are you familiar with the old St. Pete Pier (1973-2013 Inverted Pyramid)?**
  Yes No

In response to this question, 64 respondents selected "Yes", indicating that they were familiar with the older pier.

If yes,

- **Do you think Pier Park is safer to walk in than the old one?**
  Yes No

Among the 64 respondents who were familiar with the old pier, 54 selected "Yes", indicating that the new pier was perceived as safer to walk in than the old one.

- **Does Pier Park provide more recreational opportunities than the old one?**
  Yes No

Among the 64 respondents who were familiar with the old pier, 63 selected "Yes", indicating that the new pier provides more recreational opportunities than the old one.

Calculations:

Awareness of History and Culture

$$90 \div 150 \times 100\% = 60\%$$

Safety of the Pier

$$54 \div 64 \times 100\% = 84\%$$

Recreational Opportunities

$$63 \div 64 \times 100\% = 98\%$$

Sources:

- On-site survey conducted on June 9 and June 17, 2023.

Limitations:

- The reliability of the results might be influenced by the fact that we only visited the site twice. In addition, we observed that people walking on the pier in hot weather were less inclined to respond to survey compared to our previous survey experiences. Therefore, the findings might not reflect all visitors' experiences.
- Pier safety can include other aspects such as crime prevention. However, the metrics we selected centered on evaluating the achievements of the original design goals, so the findings do not reflect the pier's performance on crime reduction, which is likely to be promising, based on the lighting design and usage at night.

- ***Allows people of different buying capacities to enjoy the pier, with 19% of 150 surveyed visitors reporting that they typically spend less than $10, 36% spending $11-30, 20% spending $31-60, and 21% spending over $60.***

Background:

The City of St. Petersburg and designers of St. Pete Pier endeavored to create an inclusive park that welcomes visitors of all ages, income levels, etc. A key slogan of St. Pete Pier is to ensure individuals with just 5 cents and those with $50 can equally enjoy the park's offerings.

Method:

As described above, we used an in-person survey to learn about visitors' experience and perception of the Pier. Considering that questions about income are sensitive, we asked the following question instead.

How much do you usually spend during your visits?

The result shows that out of 150 respondents, 29 selected "$0-10", 54 selected "$11-30", 30 selected "31-60", and 32 selected ">$60"

Calculations:

$0-10 $29 \div 150 \times 100\% = 19.3\%$

$11-30 $54 \div 150 \times 100\% = 36\%$

$31-60 $30 \div 150 \times 100\% = 20\%$

> $60 $32 \div 150 \times 100\% = 21.3\%$

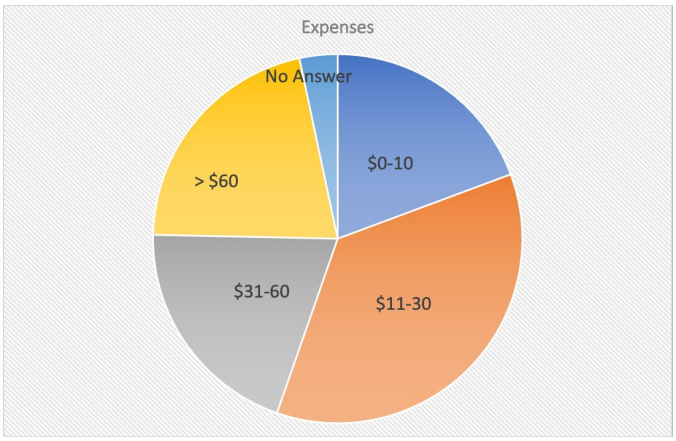


Figure 23. Visitors' Expense Composition

Sources:

- On-site survey conducted on June 9 and June 17, 2023.

Limitations:

- The reliability of the results might be influenced by the fact that we only visited the site twice.
- The amount spent by individuals in the park may not reflect visitors' income levels.

Additional Social:

- ***Is the number one most visited place in St. Petersburg. Among 150 surveyed visitors, 69% agreed that the Pier is a must-see place in St. Petersburg, and 13% agreed it was a must-see place in Florida.***

Background:

The St. Pete Pier competitions held by the city called for creating a new iconic pier as a focal point of the St. Petersburg waterfront. Throughout history, the pier and the city have shared a deep-rooted connection, evoking a strong sense of image, identity, and civic pride. The new design is anticipated to be an inviting and symbolic landmark, one that will resonate with visitors and residents.

Method:

When evaluating social benefits, both on-site surveys and big data have limitations. On-site surveys can only capture the perception of people who visited the site during the survey, while big data can only represent people who actively post on social platforms or use smartphones. To assess the achievement of the design goal – create a new landmark for St. Petersburg as a destination for both city residents and visitors - we opted for a combination of on-site survey and

big data to complement each other. This approach allows us to gather a more comprehensive understanding of the project's overall impact.

Big data: Currently, a growing number of platforms such as SafeGraph, Olvin, and Advan offer a new way of understanding the world. They utilize big data, such as foot traffic across different sectors, proximity of public transit stops, and demographic information, to generate insights on various aspects, such as crime, point of interest, and visit trends. Although most of these platforms require paid subscriptions, some offer free features and discounts to support academic research.

One such data platform is Placer. ai, which offers an intelligence platform that provides information about the environment. While their primary target customers are industries like shopping centers and real estate, they also offer a few free datasets, including information on the most visited places in a given geographic area.

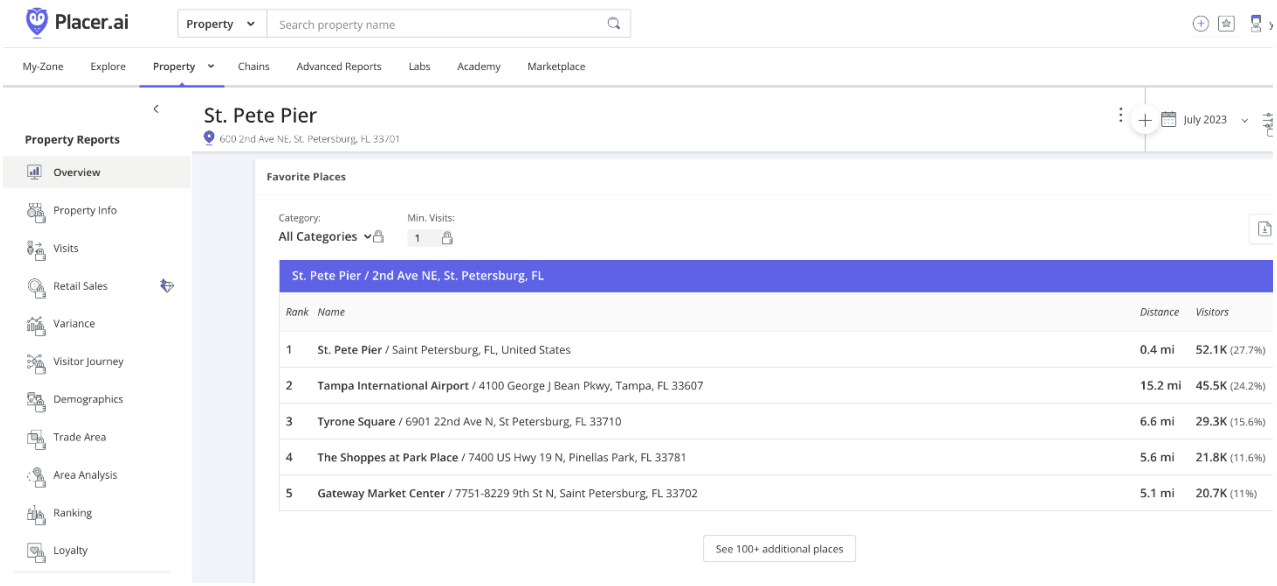


Figure 25. Snapshot of the Most Favorite Places in St. Petersburg

Survey: we conducted an in-person survey on June 9 and June 17, 2023, to learn about visitors' experiences and perceptions of the Pier. Question related to this benefit is:

Is the park a must-see place?

- No
- In St. Petersburg
- In Florida
- In the US

The results indicate that out of 150 respondents, 103 agreed that Pier Park was a must-see place in St. Petersburg, 20 agreed it was a must-see in Florida, two believed it was a must-see in the US, and 4 thought it was not a must-see place.

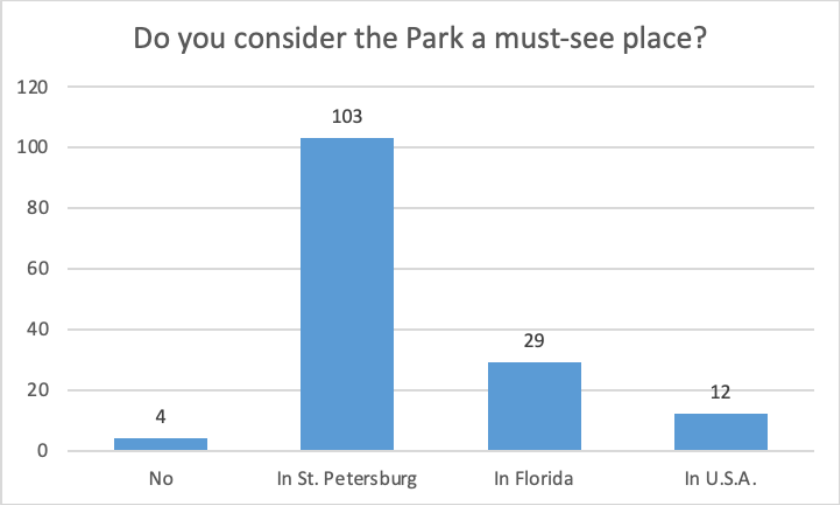


Figure 26. Summary of Part of the Survey Findings

Calculations:

$$103 \div 150 \times 100\% = 68.7\%$$

$$20 \div 150 \times 100\% = 13.3\%$$

$$2 \div 150 \times 100\% = 1.3\%$$

Sources:

"St. Pete Pier." Placer.ai. Accessed June 23, 2023. https://www.placer.ai/?name=st+pete+pier

On-site survey conducted on June 9 and June 17, 2023.

Limitations:

- The small number of survey respondents (n=150) might influence the reliability of the findings.

Economic Benefits

- ***Created an estimated 1,184 direct and induced jobs in the city, county, and region from May 2022 to April 2022.***

Background:

St. Pete Pier in St. Petersburg, Florida is a prominent waterfront destination that has contributed significantly to the regional economy. Since the opening of the Pier, the availability of actual visitor data, visitor expenditure information, and facility operating data has improved the evaluation of the on-going economic impact and benefits to the City and County. This enhanced data has made the assessment more defined and measurable compared to the situation in 2017. In 2017, during the pre-construction phase of the St. Pete Pier, Lambert Advisory was commissioned by the City of St. Petersburg to conduct an economic and fiscal impact analysis of the future Pier on the local economy. At that time, although there was an estimate of construction costs available, there was a need to estimate other key factors such as visitation, expenditure, employment, and operating aspects of the Pier, which would generate economic activity for the local economy. Without any historic data, they made estimates based upon the performance of other attractions in the City and benchmarked the Pier in relation to other well-established significant piers throughout the United States and the UK.

Method:

The job creation at St. Pete Pier was calculated at three levels using the same method called IMPLAN, by comparing the estimation of the 2017 model with the data generated between 05/01/2021 and 04/30/2022. IMPLAN (Economic Impact Analysis for Planning) is one of the most recognized economic impact modeling systems in the US, providing complete and extremely detailed Social Accounting Matrices (SAM) and Multiplier Models of local economies. It is a modeling system that uses annual, regional data to map these buy-sell relationships and predict how specific economic changes will impact a given regional economy or estimate the effect of past or existing economic activity.

The job creation data in 2017 utilized a benchmark assessment of other existing major Piers in the U.S. (i.e., Santa Monica Pier and Navy Pier) which was gathered through literature review of the broader economic and social benefits of park systems, open spaces, and recreation activities have on local economies. Since 2017, the Pier has opened and the new Jobs and Operations data from 05/01/2021 and 04/30/2022 is provided by Pier Operations and Employment Data from the City of St. Petersburg.

The job creation aspects are:

1. The Jobs and operation of St. Pete Pier (Direct, Indirect/ Induced).
2. The St. Pete Pier out-of-area hotel jobs creation.
3. The Restaurants off-pier jobs creation.

Calculations:

Table 11. The Jobs and operation of St. Pete Pier (Direct, Indirect/ Induced).

Impact	Employment
Direct	548
Indirect	112
Induced	111
Total	**771**

Table 12. The St. Pete Pier Out-of-Area Hotel Jobs Creation.

Impact	Employment
Direct	127
Indirect	31
Induced	33
Total	**192**

Table 13. The Restaurants Off-Pier Jobs Creation.

Impact	Employment
Direct	166
Indirect	26
Induced	27
Total	**220**

Sources:

- Lambert Advisory. "St. Pete Pier Economic & Fiscal Impact Assessment Update." Report, City of St. Petersburg, 2022.
- IMPLAN. IMPLAN Group, LLC. IMPLAN [Application]. Huntersville, NC. IMPLAN.com.

Limitations:

- The collection of information utilizes data and economic impact models provided by third-party/independent providers. The accuracy of the material obtained has not been independently verified.

- The dataset comprises only one year's worth of data, thereby lacking sufficient information for conducting comprehensive comparisons.

- ***Generated approximately $4.5 million in adjusted total revenue for the City of St. Petersburg in 2021.***

Background:

The City of St. Petersburg has provided a detailed statement of revenue (All Revenue Line Items Amended Budget) and expenses for the Fiscal Year (FY) 2021 and FY 2022 (year-to-date, YTD) covering the period of October through April. Both revenue and expense operating statements are itemized by City department. Additionally, the city has provided gross sales revenue for selecting tenants for FY 2021 and YTD FY 2022.

Method:

For the revenue increment, the IMPLAN model is used for calculation.

Calculations:

	FY 2021	YTD 2022	'22 - *Annualized*
Revenue			
4445000 Transportation (Parking)	$19,515	$51,350	*$88,029*
4445100 Services (Pier Parking -Meters)	$0		
4451000 Services (Pier Parking -Meters)	$2,343,170	$1,083,407	*$1,857,269*
4451000 Services (Street -Meters)	$483,290	$142,891	*$244,956*
4475800 Naming Rights (Tropicana Field)	$0	$0	*$0*
4461100 Investment Earnings (City)	$16,153		
4461100 Investment Earnings (Discount)	($6,653)		
4461200 Investment Earnings (Overnight)	$3,483		
4461300 Unrealized Gain, (Loss)	($37)		
4620000 Rents & Royalties (Rent)	$460,941	$345,067	*$591,543*
4620000 Rents & Royalties (CAM)	$198,729	$103,083	*$176,714*
4620000 Rents & Royalties (Other)		$7,092	*$12,158*
4620000 Rents & Royalties (Rent Percent)	$759,351	$405,597	*$695,309*
4621000 Operating Leases, Licenses - Rent)	$127,563		
4660100 Contributions (Private Source)	$750,000		
4660100 Contributions (Business)	$20,047	$397,105	*$680,751*
4660100 Contributions (Business)	$596,390		
4693000 Miscellaneous	$135,738	$116,123	*$199,068*
4697000 Uncollectbile charges	($687)		
4697000 Transfer in, (General Fund)	$1,997,000	$1,997,000	*$1,997,000*
TOTAL	**$7,903,993**	**$4,648,715**	**$6,542,797**
less: Investment Earnings	$12,983	$0	*$0*
less: Unrealized Gains/Loss	($37)	$0	*$0*
less: Contributions	$1,366,437	$397,105	*$680,751*
less: Transfer in, General Fund	$1,997,000	$1,997,000	*$1,997,000*
Adjusted TOTAL	**$4,527,610**	**$2,254,610**	***$3,865,046***

Figure 27. FY 2021 Adjusted total revenue to City from the Pier and FY 2022 Estimation

Table 14. Other Revenue Data.

Total Economic Output	$125 million

NPV (Net Present Value) Aggregated Taxes to County	$23 million
Pier expenditures to Local Contractors	$6.4 million
Four restaurants on Pier gross sale	$36 million

Sources:

- IMPLAN. IMPLAN Group, LLC. IMPLAN [Application]. Huntersville, NC. IMPLAN.com.
- Lambert Advisory. "St. Pete Pier Economic & Fiscal Impact Assessment Update." Report, City of St. Petersburg, 2022.

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