





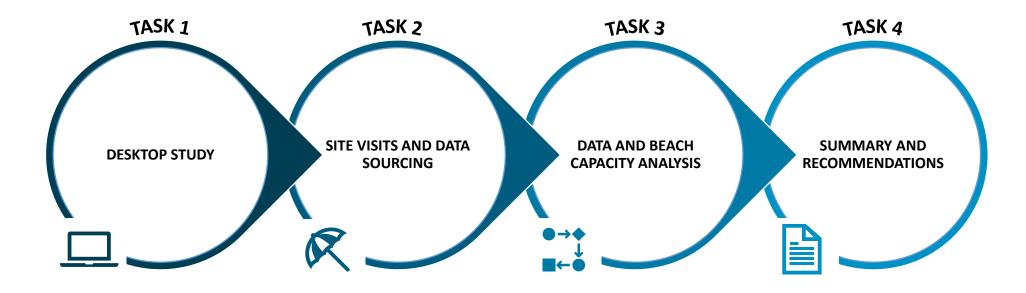
Objective

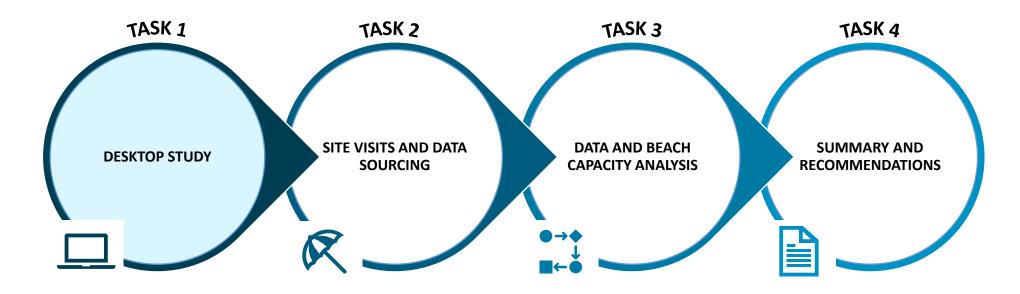
- Conduct a multi-parameter carrying capacity study
- Provide recommendations for beach operations and management that will enhance the experience of beach visitors and create a safe and resilient beach



Outline

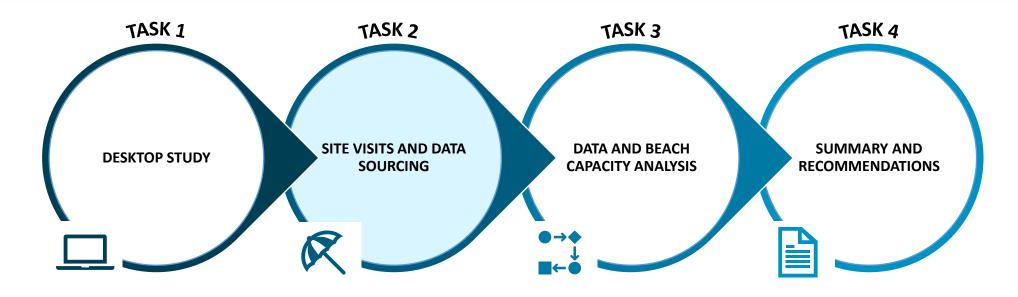
- Introduction
- Study Objectives and Methodology
- Beach Morphology- past, present, and future conditions
- Beach Usage
 - > Policies, parking sales, pass sales, daily admissions, revenue, water usage
- Survey Results
- Carrying Capacity
- Recommendations
- Summary





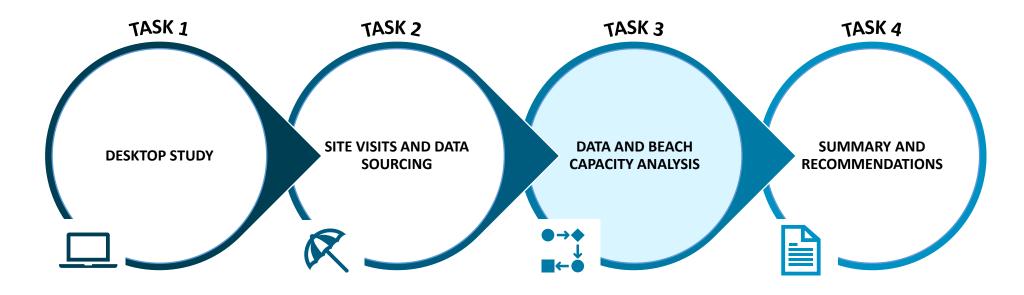
- Previous studies
- Placement history
- Topographic and bathymetric data
- Aerial imagery

- Water level history
- SLR projections
- Beach usage
 - Policies, parking, pass data, admissions, revenue, water usage

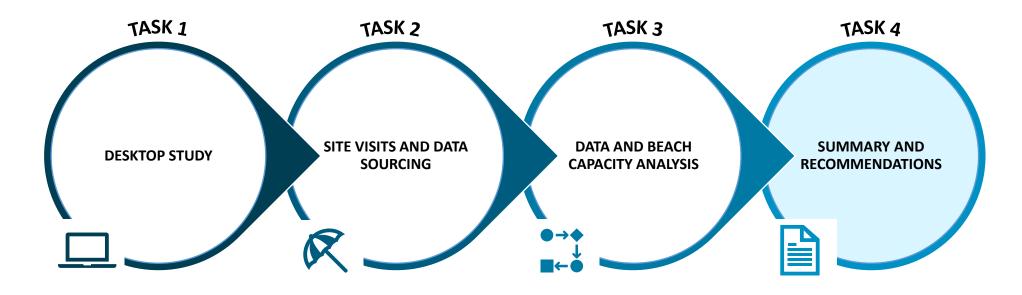


- Site visits
 - > 4 site visits— August 2023
 - > UAS photogrammetry— number of beach goers and beach conditions
 - > Ecological analysis

- Beach user and employee survey
 - Online survey
 - User survey generated nearly 1,000 responses!



- Process information collected in tasks 1 & 2
- Analyze the current and future physical condition of the beach
- Summarize user trends and survey
 Conduct the capacity analyses results



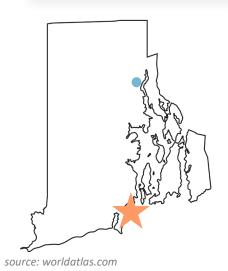
- Provide recommendations for beach operations and management
 - > Include examples from locations where such actions or policies are used

Reporting

Project Location



Project Location









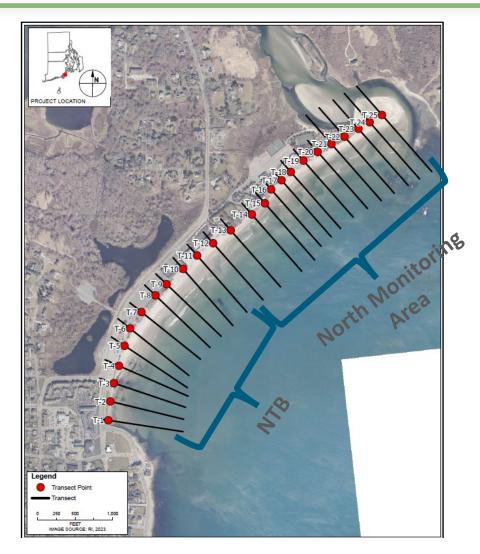
Beach Morphology

- Analysis of topographic and bathymetric data to determine beach evolution through four evolution parameters

 - Shoreline position— tracks the beach's seaward limits
- Beach width— provides insight on the beach's protective buffer and available recreation space
- Volume quantify erosion or accretion patterns
- Analyze alongshore and across shore

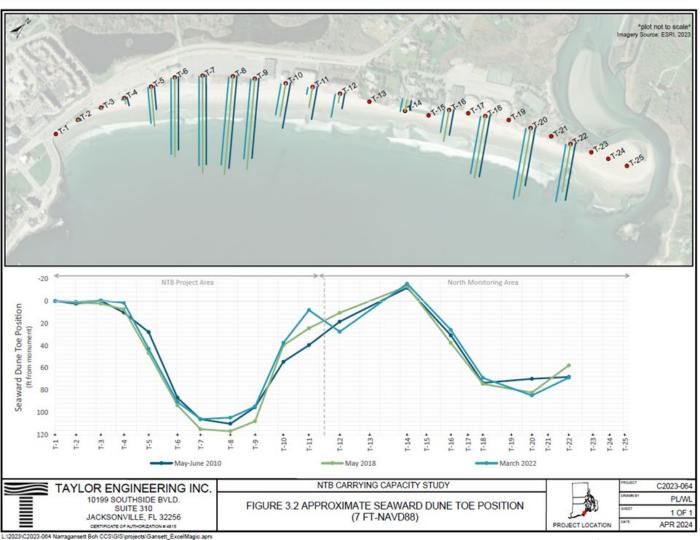


- Establish transects
- Select surveys— 17 available
 - Date/extent
 - May-June 2010, May 2018, & March 2022
 - > Long-term vs. near-term
 - "Longer" term- pre-Sandy conditions
- Position of beach features defined by a range (distance) from a transect
 - > Often relates to an elevation



Dune Position

- Dune present T-5 to T-22
 - Vegetated dune T-5 to T-9, T-12, T-17 to T-22
- Approximate dune toe elevation: +7 ft-NAVD88



Dune Position

2010-2022

- Average landward movement of 6 ft
- Seaward movement near South Pavilion (T-5 & T-6)
- Largest landward movement occurred where dunes are not well vegetated near the North Beach Clubhouse and Cabanas
- Mixed movement to the north; average 2 ft seaward movement

- Average landward movement of 8 ft
- Landward movement at <u>all</u> transects
- Largest landward movement occurred the North Pavilion Parking Lot and the Cabanas
- Mixed movement to the north;
 average 2 ft seaward movement

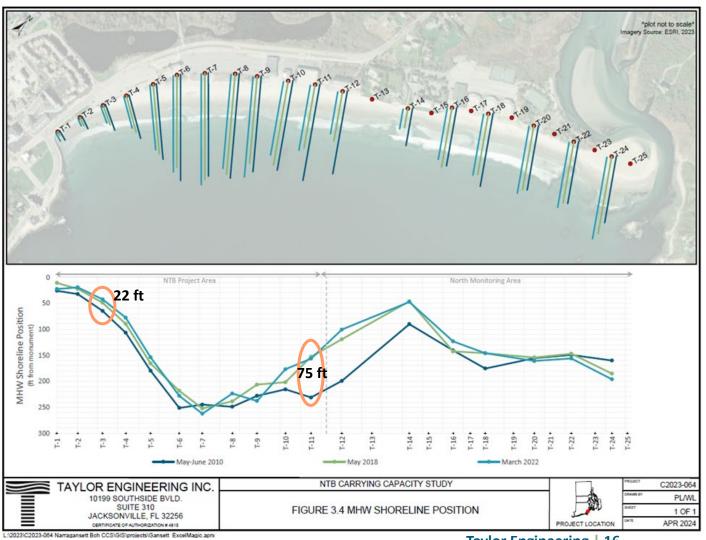
Shoreline Position

MHW elevation: +1.57 ft-NAVD88

LONG-TERM CHANGES 2010-2022

- Average shoreline recession of 21 ft
- Significant landward movement near cabanas (controlling)
- North control- average retreat of 18 ft

- Average shoreline retreat of 1 ft
- Largest retreat occurred at T-10 (Cabanas)
- North control- average retreat of 1 ft



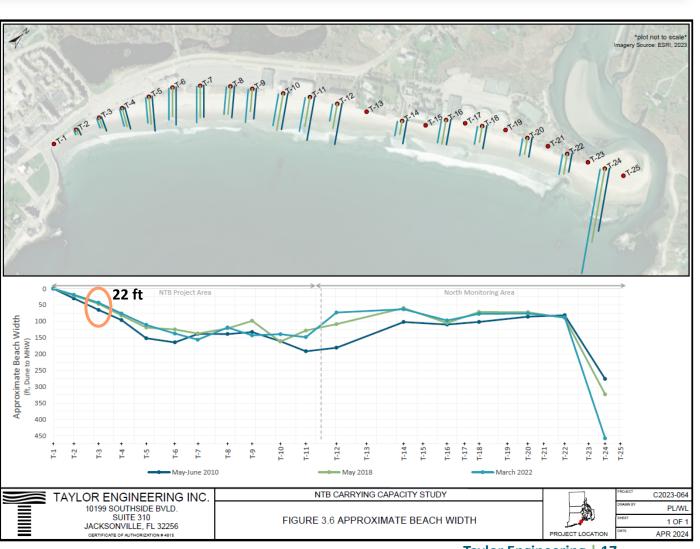
Beach Width

 Based on dune position and MHW position

LONG-TERM CHANGES 2010-2022

• <u>Decrease</u> in width of 17 ft on average

- Increase in width of 5 ft on average
 - > Attributed to dune recession

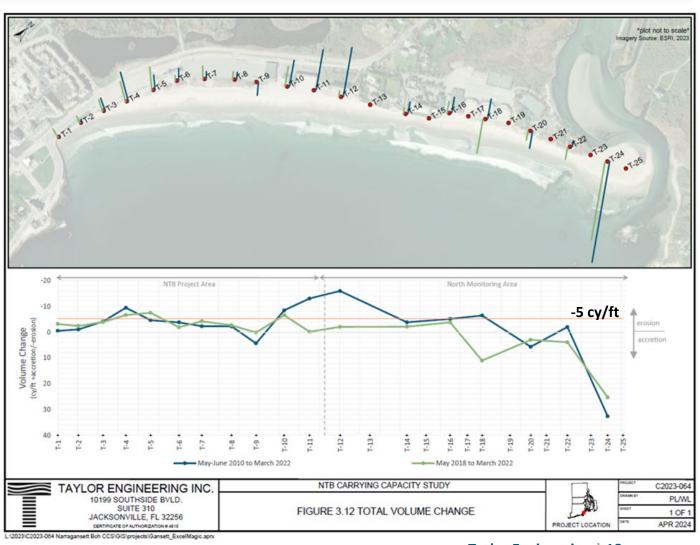


Volume Change

2010-2022

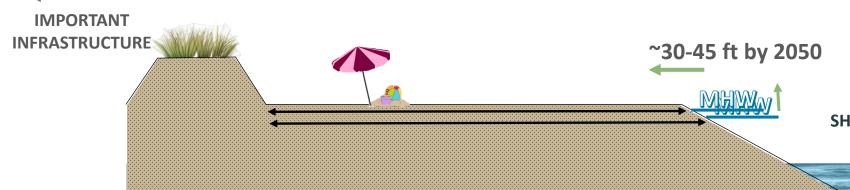
- Erosion controls; average of -4.3 cy/ft
- North monitoring area experienced <u>accretion</u> averaging 2.5 cy/ft with increases primarily below MHW

- Erosion controls; average of -3.5 cy/ft
- North monitoring area experienced <u>accretion</u> averaging 6.0 cy/ft with increases primarily below MHW



Beach Changes due to SLR





SHOCKS & STRESSORS: EROSION FROM SEA LEVEL RISE & STORMS

M	W	V	V
	A- 4- 8		

2022 NOAA SLR Curve	Period	Predicted SLR (ft)	Approx. Shoreline Recession Due to SLR (ft)	Approx. Erosion Due to SLR (cy/ft)
Intermediate	2020 – 2050	0.9	32	24
	2020 – 2100	3.4	130	95
High*	2020 – 2050	1.2	45	33
	2020 – 2100	6.0	230	168

*RI CRMC recommended

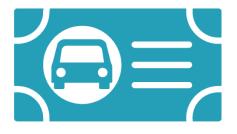
Beach Morphology- Summary

- Dunes provide increased resilience to the beach; native vegetation enhances their function
 - > The dunes at NTB are retreating
- Long-term trends indicate a decrease in beach width while recent data indicates a slight increase (due to dune retreat)
- Volume analyses indicate significant sediment accumulation near the Narrow River
- Most significant changes occur just north of the Cabanas
- With increased SLR there will likely be increased impacts to the beach morphology



Beach Usage- Data Analyzed









Parking Sales

Pass Sales





Daily Admission

Revenue

Parking

- Parking availability
- Lot closures *Data limited
 - Closures typically occur between 11 AM and 1 PM
 - Closed for ~2 hours
 - ~60% occur on weekends
 - West lot closes first
 - Decline in lot closures between 2021 and 2023

Location	Available Spaces	Restriction
NTB Cabana Lot	99	Cabana pass holder
NTB North Lot	457	Resident pass holder
NTB South Lot	246	Resident pass holder; paid fee after 1 PM weekdays
NTB West Lot	184	Paid fee, (\$10 weekday, \$15 weekend)
Narragansett Local Roads*- limited duration	244	Variable restrictions, commonly 2- 3 hr parking
Narragansett Local Roads*- permit only	178	Resident permit required
Pier Marketplace	392	Shopping, no beach parking

986 parking spots within town lots

Parking

- Lot closures *Data limited
 - Closures typically occur between 11 AM and 1 PM
 - Closed for ~2 hours
 - ~60% occur on weekends
 - West lot closes first
 - Decline in lot closures between 2021 and 2023







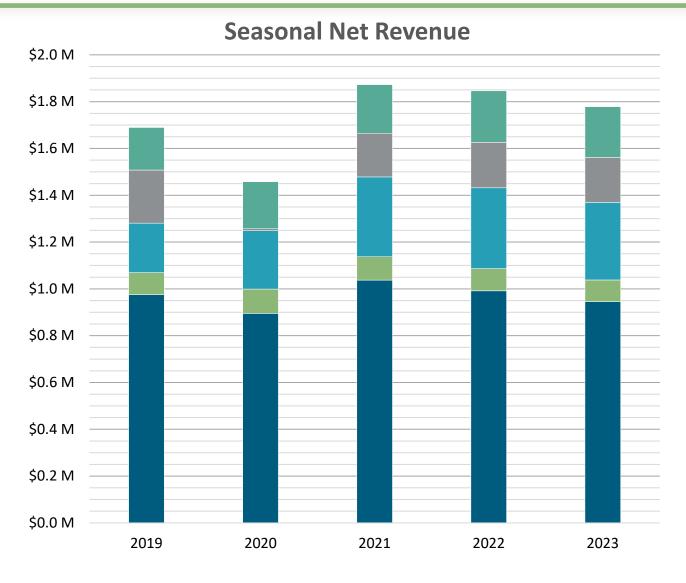
Beach Admissions

- Logs include- date, weather conditions, attendance, revenue from admissions and parking, and notes detailing lot closures or other significant events
 - Dependent on those logging the data and clicker counts
- 20% of the days more than 4,000 admitted
 - > 8 days with more than 6,000 (2.3%)
- Weekends are most popular with ~3,000 people/day
- Weekdays attract ~2,000 people/day

Admissions	2020	2021	2022	2023
Average	1,940	2,556	2,663	2,041
Maximum	5,017	6,275	8,228	7,412
Memorial Day	-	-	6,100	2,325
July 4 th	5,014	2,200	8,228	1,699
V-J Day	2,353	1,200	3,067	2,324
Labor Day	2,198	2,010	-	7,412



Beach Revenue



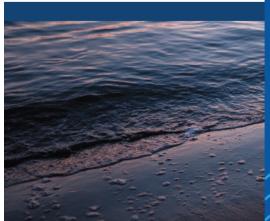
- 2019-2023 beach season revenue— \$8.65 million (~\$1.7 million/year)
 - Season fees for cabanas, lockers, and changing rooms are not included (>\$0.5 million)
- The largest contributor to revenue: daily admissions charges for entry and parking—65% of revenue
 - Visitors who do not hold a taxpayer/resident season pass are a significant contributor to the NTB revenue
- Seasonal Parking (12%); \$50
- **Daily Parking** (9%); \$10-15
- Seasonal Passes, transferable (17%); \$100-200
- Seasonal Passes, non-transferable (6%); \$0-25
- **Daily Admissions** (56%); \$12



Beach User Survey

- Active July 28-October 2, 2023
- Generated nearly 1,000 responses!
- Series of multiple choice/ranking questions and open-ended prompts
- Survey consisted of questions regarding:
 - > Length of the user's trip
 - > Where they are from
 - Group size
 - > Activities they participate in while visiting the beach
 - What times they visit the beach
 - > How much they spend
 - > Facility usage
 - > Safety perception
 - > Concerns





2023 **BEACH USER SURVEY**

This survey will inform local Narragansett policymakers about the quality of your beach experience and the impact beach activities have on the Town, such as economic benefits due to increased tourism and parking availability. The data collected in this survey is intended to enhance your future beach experience and help ensure a safe, resilient beach. The corresponding study will also evaluate historic beach morphology, the impacts of future sea level rise, and the health of the beach's dune system, providing data on how these parameters may affect the beach ecosystem and potentially impact beach visitors' experience. Survey data and the corresponding beach study will inform recommendations for beach operations, management, sustainability, and restoration.



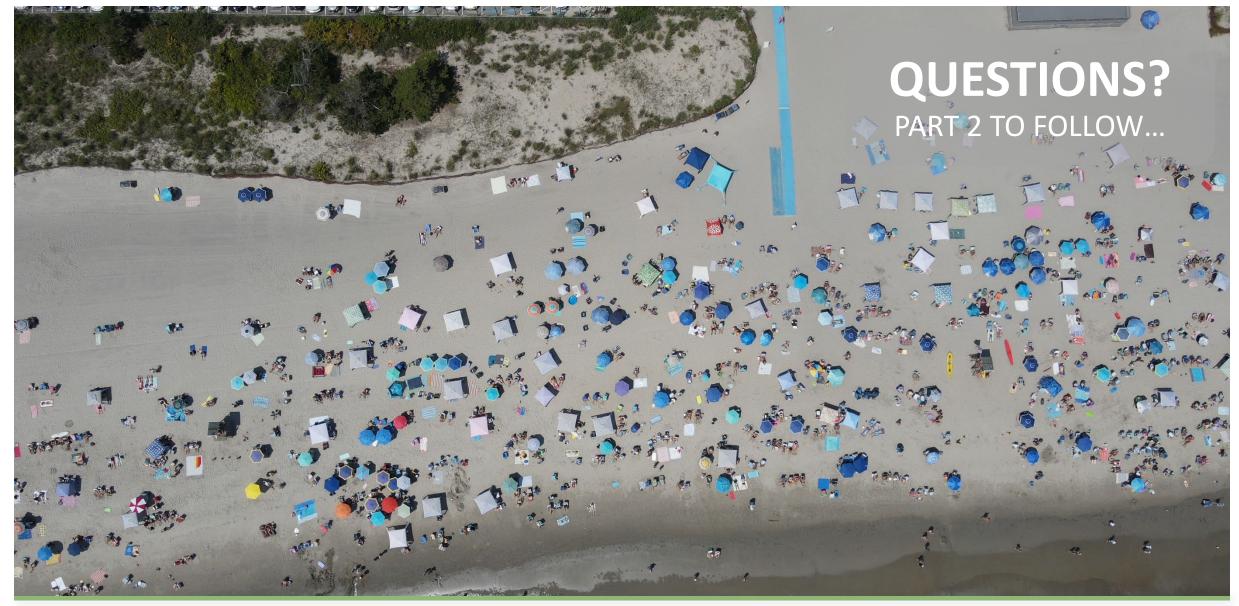
Each person is asked to submit only one survey response based on their beach going experience.

Beach User Survey

- Majority of beach users attend NTB for 2-4 hours with family and friends.
 - Primarily visit between the hours of 11 AM and 3 PM
- The most used facility is the restrooms, and the beach is primarily used for sunbathing, swimming, and exercising

 <u>Users</u> are 	most concerned about	least concerned about	Employees are	most concerned about
	overcrowding	beach safety		inappropriate behaviors
	parking	cleanliness of facilities		crowds
	beach erosion	noise		parking
	ecosystem health	trash/sanitation		staffing levels

- There is high satisfaction with visits
 - > 95% of respondents ranked their experience as a 3 (good) or higher, 78% as 4 (very good) or higher, and 37% as a perfect 5 (excellent)!
- Respondents noted common complaints about: difficulty of parking, need for enforcement, crowding, and the cost
- The staff was praised by residents and visitors for their friendly nature and hard work and people enjoy the natural environment/beauty of the beach



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Objective

- Conduct a multi-parameter carrying capacity study
- Provide recommendations for beach operations and management that will enhance the experience of beach visitors and create a safe and resilient beach



Outline

- Introduction
- Study Objectives and Methodology
- Beach Morphology- past, present, and future conditions
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Carrying Capacity

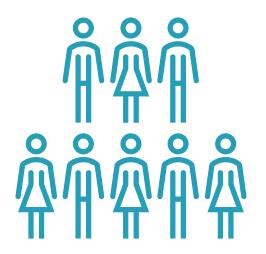
SOCIAL CARRYING CAPACITY

SCC is defined as the maximum beach user density at which beach users "feel comfortable and uncrowded" (Cumberbatch and Moses, 2011)



PHYSICAL CARRYING CAPACITY

PCC relates to the **limitations on the number of beach users** "who
can **use the area at any given time**for different purposes" (Clark, 1996)



Social Carrying Capacity Analysis

- Easy to assume higher densities = less quality experiences
 - > Difficult to illustrate based on field observations and surveys





- SCC also depends on and requires assessment of factors such as:
 - distance to nearby urban areas
 - > beach accessibility
 - > parking availability
 - > the conditions of beach accesses and facilities
 - > the presence of lifeguards
 - > the presence of restaurants/concessions (da Silva, 2002)



















Social Carrying Capacity Results

Conflicting results from beach user survey

SURVEY QUESTION:

Select your top three issues/concerns related to NTB

- #1 Lack of Personal Space
- #2 Parking

Concern	Top Concern	Second Concern	Third Concern	Summated Count
Lack of Personal Space	363	149	58	570
Cost	145	97	58	300
Dirty	24	70	76	170
Noise Levels	43	157	124	324
Not Enough Amenities	30	27	35	92
Safety	45	49	77	171
Parking	192	131	70	393
I Would Not Change Anything	123	86	114	323
No Response	23	222	376	621

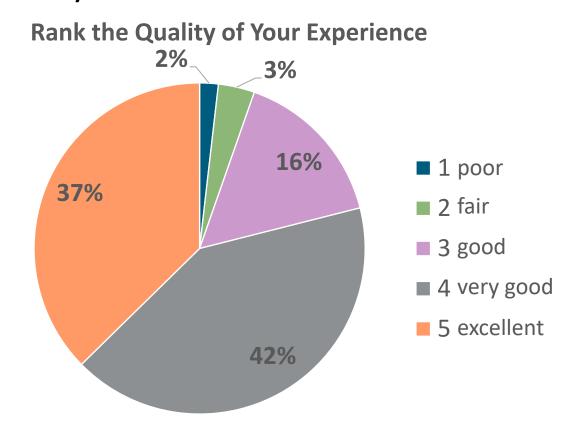
Social Carrying Capacity Results

Conflicting results from beach user survey

SURVEY QUESTION:

Rank the quality of your experience

78% of respondents rated the overall quality of their experience as excellent (5/5) or very good (4/5)



Social Carrying Capacity Results

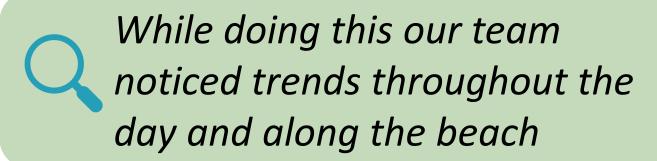
- Conflicting results from beach user survey
 - > Social capacity has been met for some on high-entry days
 - > People are highly pleased with their beach experience



Physical Carrying Capacity Methodology

To assess the PCC, Taylor Engineering:

- 1-Counted the number of people, umbrellas, tents, and empty chairs from the August 2023 field work
- 2-Applied a multiplier to approximate the number of people on the beach during each UAS survey





A Person

Tent

Empty Chair

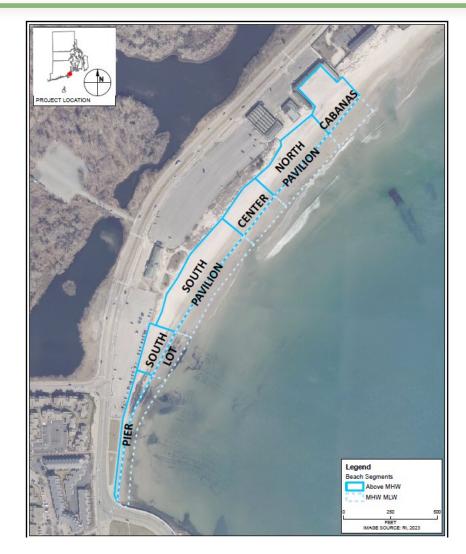
♦ Large Tent

Umbrella

Physical Carrying Capacity Methodology

To assess the PCC, Taylor Engineering:

- 3-Analyzed the distribution of people throughout the day and within different beach segments
- 4-Approximated the space needed per visitor using a sample of 30 groups throughout the beach segments



Physical Carrying Capacity Results

How do admissions fluctuate throughout the day?

- UAS Flight Analysis
- - Busiest flight day/time: August 6th at 1 PM
 - > Daily peak hours: between 11 AM to 3 PM
 - On average, 51-57% of the people admitted to the beach are present during peak hours

Date	Time	Count Total*	Total Admissions	Percent of Total Admissions
Saturday 8/5/2023	9:00 AM	1,063		24%
Saturday 8/5/2023	11:00 AM	2,190	4 401	49%
Saturday 8/5/2023	1:00 PM	2,579	4,491	57%
Saturday 8/5/2023	3:00 PM	2,460		55%
Sunday 8/6/2023	11:00 AM	2,383	F 627	42%
Sunday 8/6/2023	1:00 PM	2,847	5,627	51%
Saturday 8/12/2023	9:00 AM	555		11%
Saturday 8/12/2023	11:00 AM	2,001	F 1 4 7	39%
Saturday 8/12/2023	1:00 PM	2,757	5,147	54%
Saturday 8/12/2023	3:00 PM	1,645		32%
Monday 8/14/2023	11:00 AM	736	2 224	32%
Monday 8/14/2023	1:00 PM	1,332	2,324	57%

^{*}Based on assumptions of Person = 1; Empty Chair = 0.5; Umbrella = 2; Tent = 2; Large Tent = 4

Physical Carrying Capacity Results

UAS Flight Analysis



- > Busiest flight day/time: August 6th at 1 PM
- > Daily peak hours: between 11 AM to 3 PM
 - On average, 51-57% of the people admitted to the beach are present during peak hours



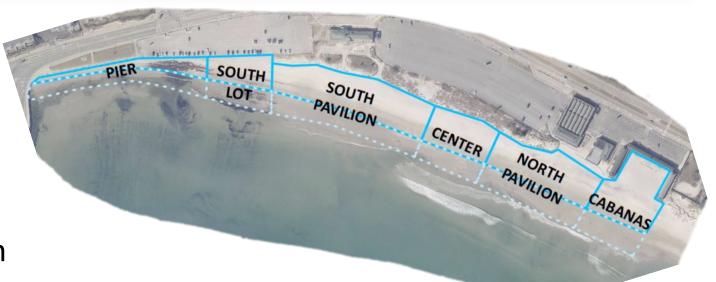
Results align with beach user survey results:

- Most respondents indicated they visit between 11 AM - 1 PM, followed by 1 - 3 PM
- 60% of respondents indicated they attend the beach for less than 4 hours

Physical Carrying Capacity Results Spatial Distribution of Users

 Recreational beach area = "usable beach area"

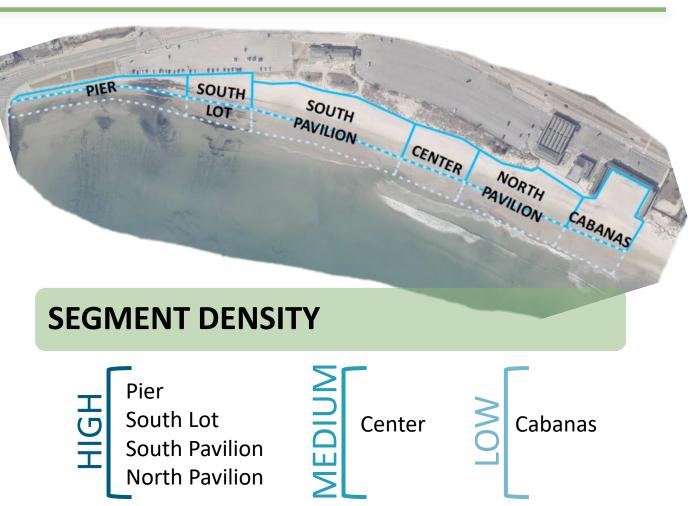
- First, we found the area:
 - > Above MHW- area between dune toe and MHW position
 - > Above MLW- area between dune toe and MLW position



Beach Segment	Recreational Area Above MHW (sq ft)*	Recreational Area Above MLW (sq ft)*	
Pier	25,900	67,100	
South Lot	29,700	50,500	
South Pavilion	92,700	137,400	
Center	40,800	61,100	
North Pavilion	63,900	101,100	
Cabanas	58,800	83,100 —	

Physical Carrying Capacity Results Spatial Distribution of Users

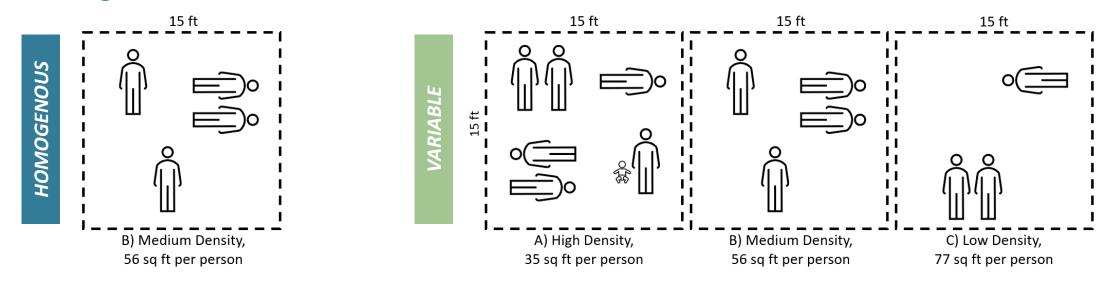
- Similar to findings from da Silva (2002), results showed the density of users on the beach is **not homogenous**
 - > People tend to sit nearest to:
 - Entrances/exits
 - Amenities
 - Water



Physical Carrying Capacity Methodology

To assess the PCC, Taylor Engineering:

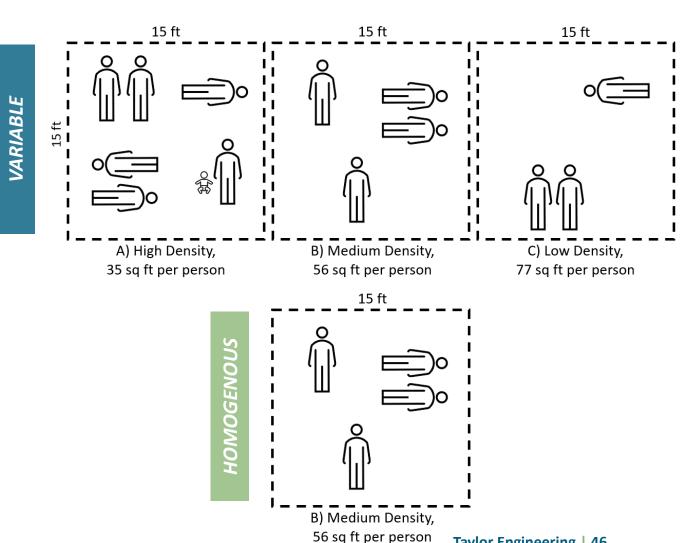
5- Divided the area into segments by the space needed per visitor for both homogenous and variable distributions



- 6- Repeated for multiple current/future scenarios: Homogenous and Variable distribution
 - Current (2023) conditions
 - > Future conditions- 2050 and 2100
 - With emergency lanes

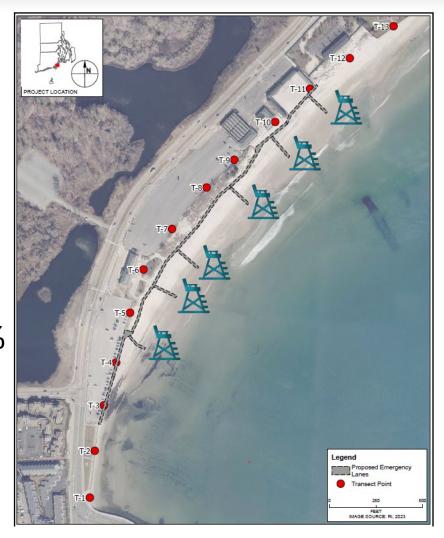
Physical Carrying Capacity Results Current (2023) Conditions

- Variable (high/medium/low) density distribution:
 - > 7,600 people when analyzing above MHW
 - > 10,100 people when analyzing above MLW
- Homogenous density distribution:
 - > 5,600 people when analyzing above MHW
 - > 9,000 people when analyzing above MLW

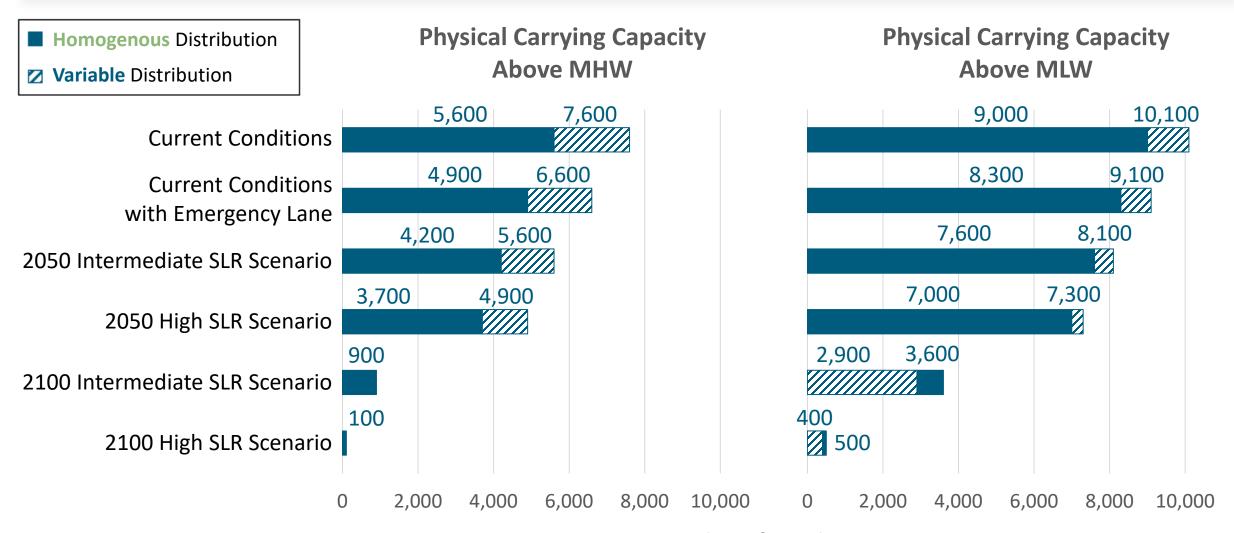


Physical Carrying Capacity Results Emergency Lanes

- Emergency lanes will decrease available beach space
 - > Lanes are recommended to improve response time and ease of accessibility
 - > Crucial as the number of people on the beach increases
- Emergency lanes (as outlined) will:
 - Decrease available area above MHW by 13%
 - Variable (high/medium/low) density: Reduction of ~1,000 people
 - Homogenous density: Reduction of ~700 people



Summary of Physical Carrying Capacities



Summary of Physical Carrying Capacities Parking Limitations

Parking Implications on Physical Carrying Capacity



> NTB is primarily accessed by vehicle (92% based on user survey)

Beach User
Survey indicated
that 90% of
respondents
attend the
beach as a group
of 4 people or
less

3.5

people per vehicle

(Silva and Ferreira, 2013)

X

986

~3,500

total spaces within
4 main lots

capacity based on NTB parking lot availability

*Parking availability is a factor limiting the beach from reaching its physical capacity

Summary of Physical Carrying Capacities Facilities Usage

 Facilities Implications on Physical Carrying Capacity



- > Based on field observations and survey results:
 - Facilities often at capacity with lines and additional cleaning needs
- > Based on monthly water usage:
 - ~3.2 gallons of water per visitor





Month/Year	Water Usage (Gallons)	Admissions	Use per Visitor (Gallons/Person)
June 2020	124,168	46,382	2.7
July 2020	268,532	69,073	3.9
August 2020	198,220	50,666	3.9
June 2021	94,996	43,924	2.2
July 2021	213,928	74,603	2.9
August 2021	266,288	87,777	3.0
June 2022	118,932	36,129	3.3
July 2022	303,688	95,206	3.2
August 2022	220,660	68,736	3.2
June 2023	60,250	17,133	3.5
July 2023	142,000	84,147	1.7
August 2023	342,250	64,226	5.3

*limited distribution of water usage data available



Recommendations on Beach Management Strategies and Policies

- Final report lists 39 recommendations with examples of implementation
- Split into the following categories
- Presenting some of our top recommendations for each category



Beach Data Collection and Management



Direct Human-Induced Threats and Social Concerns



Sustainability



Invasive Species and Bio-Diversity



Vehicular Issues



Recommendations on Beach Management Strategies and Policies

Data Collection and Management

Increase volume of sand placement to widen the beach and enhance

the protective dune; implement RSM strategies



Direct Human Induced Threats and Social Concerns

- Install a livestream camera of the beach
- Increase staffing on weekends and holidays
- Designate a safety lane on the beach





Recommendations on Beach Management Strategies and Policies



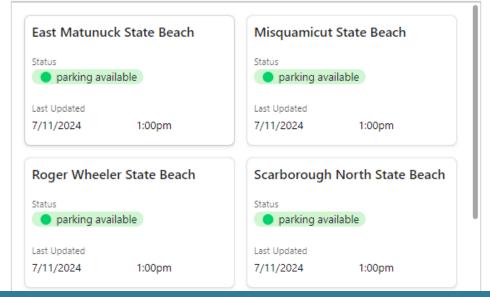
Sustainability; Invasive Species and Bio-Diversity

 Conduct strategic planting of dune grass in less vegetated and low elevation areas



State Beach Parking

Check here for the near real-time status of parking lots at our busiest state beaches.



Vehicular Issues



- Allow for increased revenue through nonresident parking in resident lots on days with lower admissions
- Provide a parking availability count online or livestream footage of parking lots

Recommendations on Beach Management Strategies and Policies

Accessibility

Assist with accessibility through additional blue mats or a gator service





Long Beach Township, NJ "Gator" System to Assist with Beach Access (pc-Daily Times, 2024)



Summary of Major Findings- Data Collection

Users generally attend the beach for

2-4 hours between 11 AM and 3 PM

Survey results, UAS data, and parking closure logs align

 Beach goers are not evenly distributed along the beach

> The most popular areas are near the entrance points and along the water



The addition of entrance locations for all visitors and increased accessibility options would likely change the distribution along the beach

Summary of Major Findings—Current (2023) Conditions

- NTB is an economic driver with revenue approximating ~\$1.7 million/year for the beach alone (2019-2023)
 - ➤ Visitors who do not hold a taxpayer/resident season entry and parking passes to NTB are a significant source of revenue—65% of revenue (2019-2023)
- ~3,000 visitors/day on weekends and ~2,000 visitors/day on weekdays
- ~60% of lot closures occur on the weekends; the West Lot is the most frequent to close
- Daily pass sales have decreased by 20% (2019-2023)
 - ➤ Majority are sold at the South Pavilion or Seawall entrances
- Resident pass sales average ~10,000 passes/season
 - > Decrease in revenue due to introduction of the adult free pass
 - In 2023 3,586 adult passes (\$25) and 3,015 adult free passes

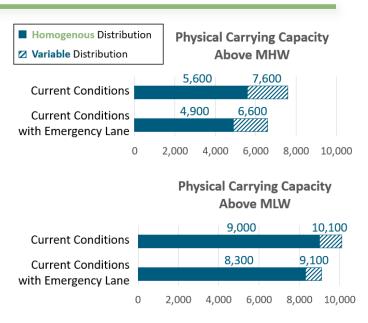
Summary of Major Findings—Current (2023) Conditions

- Beach almost doubles in size at low tide
- Long term morphometric analyses yield: Dune toe retreat; landward shift in MHW position; decrease in beach width; significant sediment accumulation near the Narrow River
- Erosion > sand placement events
- Anticipate increased impacts to the beach system with increasing SLR— 30-45 ft shoreline recession predicted by 2050
- Dune planting and invasive species removal is recommended



Conclusions

- Limiting beach capacity is not necessary at this time
 - Comparison of the PCC analyses, aerial imagery, admissions data, and survey results indicate NTB has additional space for users to recreate *PCC values do not include turnover
 - Social impacts, facilities, and available parking likely restrict the beach from reaching the physical capacity level
 - Taylor Engineering does not recommend limiting beach access without a thorough assessment of the value of tourism on the economy for Narragansett
- Additional beach management strategies are encouraged to maintain NTB's reputation and family-friendly atmosphere
 - Enforcement of policies; real-time parking and use status; increased staffing and emergency lanes on high-use days
- Increased physical monitoring and future use planning, including larger scale sand placement events, are advised
 - Without action, SLR and storm induced erosion will significantly impact the available space for beach users to recreate





"Similar to many other popular beach destinations, some level of crowding at NTB is inevitable, especially at the height of the tourist season on weekends and holidays. The data indicates consistent admissions in recent years with an increase in seasonal beach passes and a decrease in daily beach passes since 2019. With proper management, including a focus on data collection to understand beach and user trends, the Town can manage the high use periods to maintain beach conditions that allow for enjoyable experiences by beach users. A lack of active beach management could lead to beach users experiencing reduced recreational enjoyment, declining tourist arrivals, and a loss of economic benefits."



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