COASTAL

FRONTIERS

Beach Nourishment at San Clemente near T Street, Transect SC-1660 – May 1, 2024

CITY OF SAN CLEMENTE
BEACH MONITORING PROGRAM
SPRING 2024 BEACH PROFILE SURVEY REPORT

Prepared for:

City of San Clemente

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CITY OF SAN CLEMENTE
BEACH MONITORING PROGRAM

SPRING 2024 BEACH PROFILE SURVEY REPORT

1. INTRODUCTION

This report presents the methods and results of the City of San Clemente Spring 2024 Beach Profile Survey. The sections that follow provide an overview of the Monitoring Program, describe the Spring 2024 survey, and present the results. Beach profile plots accompany the report in Appendix A, while Mean High Water (MHW) beach widths are provided in Appendix B. Appendix C provides synopsis plates for each transect.

The vertical datum employed throughout this report is National Ocean Service (NOS) Mean Lower Low Water (MLLW) for the 1983-2001 Epoch. The horizontal datum is California State Plane Zone 6 relative to the North American Datum of 1983 (NAD83(2011) 2010.00 epoch), with units of U.S. Survey Feet.

It should be noted that the landward limit of the beach used to calculate beach widths was revised in Fall 2023 for Transects SC-1680, SC-1645, and SC-1623 based on input from community stakeholders. Beach widths at these sites were recalculated for all surveys on record. These revisions are reflected herein.

2. SEDIMENT MANAGEMENT ACTIVITIES

Accounts of opportunistic beach nourishment in the study area date back to 1928, with reports of waste material from development of Doheny Palisades placed on the beach near San Juan Creek (Shaw, 1980). Wiegel (1994) and Shaw (1980) report that more than 2 million cubic yards (cy) of sand was placed on Doheny State Beach and Capistrano Beach from 1966 to 1970, owing mostly to San Juan Creek flood control measures and hauling of sand from terrace deposits at Camp Pendleton.

More recently, the City of San Clemente conducted opportunistic nourishment at North Beach with sand derived from the Santa Ana River (5,000 cy in 2005 and 12,000 cy in 2016; City of San Clemente, 2021). A much larger opportunistic nourishment project (anticipated to yield approximately 50,000 cy) is planned for North Beach in mid -2024 (City of San Clemente, 2024a).

Orange County Parks placed 45,000 cy of sand sourced from the Santa Ana River at Doheny State Beach and Capistrano Beach between June and September 2023 (OC Parks, 2023). An additional 20,000 cy will be placed at Capistrano Beach between July and September 2024 (Brodeur, 2024).

The San Clemente Shore Protection Project commenced in December 2023. The 50-year federal beach nourishment project provides sand to the region near the San Clemente Pier and is administered by the US Army Corps of Engineers, with the City of San Clemente as the local sponsor. The initial planned placement volume is 251,000 yr (USACE, 2023). Subsequent renourishments are planned at intervals of five to six years. The project was suspended in January 2024 due to undesirable material and difficult dredging conditions at the borrow site (located near Oceanside Harbor), and a minimal amount of material was delivered to the beaches at this time. The project resumed in April 2024 using an alternative borrow site near Surfside-Sunset, and about half of the planned nourishment volume was placed on the beach (City of San Clemente, 2024b). Current plans call for the balance of the material to be placed in late-2024.

3. PROGRAM OVERVIEW

The general objective of the monitoring program is to document changes in the condition of the active coastal zone between Dana Point Harbor and San Mateo Point, thereby providing a basis for evaluating the impacts of both natural events and beach replenishment operations. The program includes semi-annual beach profile surveys at 12 representative coastal sites.

Shoreline monitoring programs within the study area have been conducted intermittently since 1983. Ten surveys were performed by the U.S. Army Corps of Engineers (USACE) between November 1983 and December 1989 under the auspices of the Coast of California Storm and Tidal Waves Study – San Diego Region (CCSTWS-SD; USACE, 1991). Between October 2001 and May 2007, eleven surveys were conducted on behalf of the City's Beach Monitoring Program (Coastal Frontiers, 2007). Four additional wading-depth surveys were later performed between November 2016 and November 2017 exclusively at North Beach to document the placement of opportunistic nourishment. The City's Beach Monitoring Program, consisting of all twelve sites within the study area, was resumed in October 2022 following a nearly 16-year hiatus after the May 2007 survey. The May 2024 survey marks the fourth survey performed under the recently resumed Monitoring Program.

The twelve shore-perpendicular beach profile transects within the study area are shown in Figure 1 and listed in Table 1. Five of these were established specifically for the Beach Monitoring Program and were surveyed for the first time in Fall 2001 (Coastal Frontiers, 2001). Six transects had been established previously by the USACE and were included in the CCSTWS-SD (USACE, 1991). An additional transect (SC-1702, North Beach) was established in May 2005 to monitor the fate of approximately 5,000 cy of sand nourishment material placed at the site (Coastal Frontiers, 2005).

Publicly available LiDAR data of the above-water beach were used to supplement the beach profile data and reduce temporal gaps in data coverage between the aforementioned monitoring programs. Data from ten LiDAR surveys were retrieved for analysis using NOAA's online Data Access Viewer (NOAA, 2024a) including the years 1997, 1998, 2007, 2008, 2009, 2014, 2016, and 2018. The data were acquired by a variety of entities, including the United States Geological Survey, the USACE's National Coastal Mapping Program, and Scripps Institution of Oceanography. Full spatial coverage of the study area was not available from every LiDAR survey.

Table 2 summarizes the beach data utilized for the monitoring program. As indicated above, the LiDAR data are limited to the above-water beach.

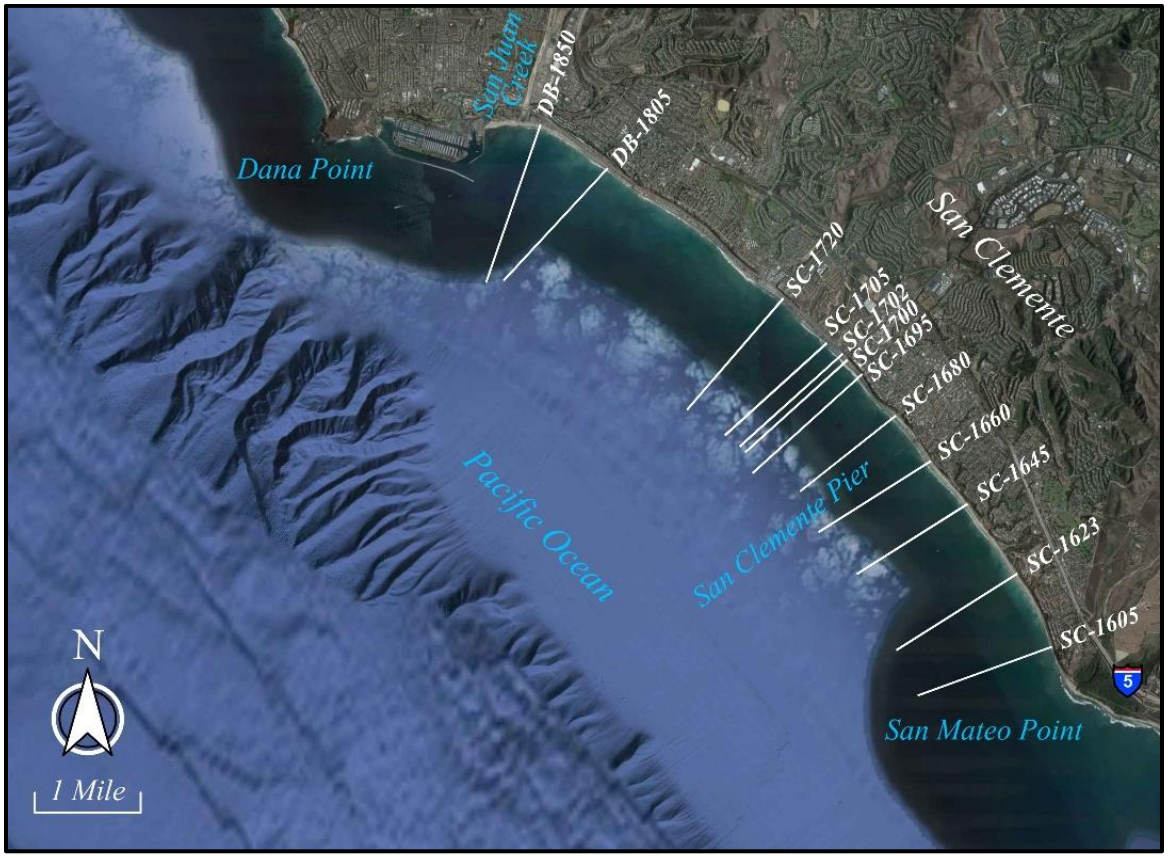


Figure 1. Transect Location Map

Table 1. San Clemente Area Beach Profile Transects

Transect Designation	Location	Origin
DB-1850	North Doheny State Beach	Historical (CCSTWS)
DB-1805	South Doheny State Beach	Historical (CCSTWS)
SC-1720	Shorecliffs	Historical (CCSTWS)
SC-1705	Capistrano Shores MHC (manufactured home community)	Established Oct. 2001
SC-1702	North Beach	Established May 2005
SC-1700	North Beach	Established Oct. 2001
SC-1695	Dije Court	Established Oct. 2001
SC-1680	Linda Lane	Historical (CCSTWS)
SC-1660	T Street	Historical (CCSTWS)
SC-1645	Lost Winds	Established Oct. 2001
SC-1623	San Clemente State Beach	Historical (CCSTWS)
SC-1605	Cottons Point	Established Oct. 2001

Table 2. Beach Profile and LiDAR Data for the San Clemente Area

Date	Transect											
	DB-1850	DB-1805	SC-1720	SC-1705	SC-1702	SC-1700	SC-1695	SC-1680	SC-1660	SC-1645	SC-1623	SC-1605
Dec. 1983	✓	✓	✓						✓		✓	
Jul. 1984	✓	✓	✓					✓	✓		✓	
Dec. 1984	✓	✓	✓					✓	✓		✓	
Jun. 1985	✓	✓	✓					✓	✓		✓	
Apr. 1986	✓	✓	✓					✓	✓		✓	
Oct. 1986	✓	✓	✓					✓	✓		✓	
Apr. 1987	✓	✓	✓					✓	✓		✓	
Oct. 1987	✓	✓	✓					✓	✓		✓	
Jan. 1988	✓		✓						✓			
Dec. 1989		✓	✓					✓	✓		✓	
Oct. 1997		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Apr. 1998	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oct. 2001	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
May 2002	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Oct. 2002	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
May 2003	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Oct. 2003	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
May 2004	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Oct. 2004	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
May 2005	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Oct. 2005	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oct. 2006	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
May 2007	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nov. 2007	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Apr. 2008	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sept. 2008	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mar. 2009	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oct. 2009	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sept. 2014										✓	✓	✓
May 2016	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nov. 2016				✓	✓	✓	✓					
Dec. 2016				✓	✓	✓	✓					
May 2017				✓	✓	✓	✓					
Nov. 2017				✓	✓	✓	✓					
Aug. 2018	✓	✓	✓	✓	✓		✓	✓			✓	
Oct. 2022	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
May 2024	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oct. 2023	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
May 2024	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: CCSTWS
LiDAR
City Monitoring Program

4. SPRING 2024 BEACH PROFILE SURVEY

4.1 Field Activities

The Spring 2024 beach profile survey was conducted on May 1 and 2 in good conditions, with light winds and wave heights generally less than 2 ft. The wading and bathymetric portions of the survey were performed concurrently by two separate crews. Data were acquired along each transect from the back beach to either the 45 ft isobath (MLLW), or a distance of 6,000 ft seaward of the transect origin (whichever was first reached when proceeding offshore).

The above-water beach and surf zone were surveyed using an electronic total station and a survey rodperson. The total station was used to determine the position and elevation of the beach at each location occupied by the rodperson. Each transect was surveyed from the back beach seaward through the surf zone until the survey rod no longer protruded above the water surface when held vertically. This location, typically in a water depth of 10 to 12 ft below MLLW, provided overlap with the landward portion of the bathymetric survey.

Bathymetric data were collected with a digital acoustic echo sounder operated from a shallow-draft survey vessel. Vessel motion was recorded using an integrated GNSS/ Inertial Navigation System (INS). A dual antenna Global Navigation Satellite System (GNSS) receiver was used to determine the vessel heading and the position of each sounding. To improve the position accuracy, differential corrections (DGNSS) transmitted in real-time from the Wide Area Augmentation System (WAAS) were used. All systems were interfaced to a laptop computer using the Hypack Survey software package.

The survey vessel transited from the offshore terminus to the surf zone guided by DGNSS navigation. The sounding and vessel motion data were acquired on a continuous basis. Positions were recorded at 2 Hz, with interpolated values assigned to the soundings acquired between position fixes.

The calibration of the echo sounder was checked at the beginning and end of the survey using a standard “bar check” procedure. Additionally, the speed of sound in sea water was obtained at the offshore end of each transect using a device that measures conductivity, temperature, and depth (CTD) along a vertical profile within the water column.

4.2 Data Reduction

Data from the wading portion of the survey were processed using software developed by Spectra Precision. The raw total station data were read by the software, and the coordinates and elevation of each data point were calculated and subsequently verified in a surface modelling utility (Trimble Terramodel).

The raw data from the bathymetric portion of the survey consisted of Hypack files containing the position data and motion-compensated soundings. The raw soundings were corrected based on the speed-of-sound profiles obtained at the offshore end of each transect. The soundings then were adjusted to the MLLW datum using water level measurements made by NOAA at La Jolla (Station ID 9410230). To provide a more accurate representation of local tide conditions, the water levels recorded at La Jolla were adjusted using the time and height differences for San Clemente published by NOAA.

The adjusted soundings were edited for outliers using the Hypack Single Beam Editor processing module. The integrated GNSS/Inertial Navigation System (INS) utilized during the survey removed the majority of the wave contamination from the record in real time.

The processed bathymetric data were thinned to a nominal interval of 10 ft to produce a file suitable for developing beach profile plots. The resulting x, y, z data (easting, northing, and elevation) were inserted into the surface modelling utility containing the wading data. As indicated above, the field work was conducted in such a manner as to provide overlap between the wading and bathymetric portions of the survey. The data were examined in this region to ensure that the two data sets were compatible. Once this confirmatory inspection had been completed, only the more detailed data in the region of overlap were retained (typically the bathymetric data). The less detailed data were purged, after which the wading and bathymetric data were merged to create a digital beach profile data file (*.bpd) unique to each transect and containing range and elevation pairs for each data point along the transect alignment.

Based on experience, the vertical accuracy of the processed soundings is approximately ±0.5 ft. According to the Hemisphere GNSS equipment specifications, the root mean square (RMS) accuracy of the horizontal positions obtained in the manner described above is approximately 2.0 ft (95% confidence). The electronic total station used to conduct the survey is capable of measuring ranges to within ±0.5 ft and elevation differences to within ±0.1 ft. However, because the rodman was subjected to waves and currents in the surf zone, the horizontal distance perpendicular to each transect (parallel to the shoreline) may vary by approximately ±15 ft.

5. RESULTS

5.1 Data Products

Beach profile plots developed from the May 2024 survey data accompany the report in Appendix A. To place the survey results into historical context, each profile is plotted in concert with the envelope of profiles measured during the roughly 5.5-year period that comprises the prior phase of the Monitoring Program (Fall 2001 to Spring 2007). In addition, the profiles from the April 1986, May 2002, May 2007, May 2023, and October 2023 surveys are shown, where such data are available. The horizontal range on each profile plot represents the distance, in feet, seaward of the transect origin measured along the transect alignment. The elevation is given in feet relative to MLLW for the 1983-2001 National Tidal Datum Epoch.

In 2003, NOAA implemented the current National Tidal Datum Epoch (1983-2001) to account for changes in sea level along the coast (NOAA, 2003). While historical surveys conducted prior to 2003 by the City and the USACE referenced the previous epoch (1960-1978), all data presented in this report have been updated to the current epoch to facilitate direct comparison.

Notwithstanding the use of MLLW as the elevation reference for the profile data, MHW was adopted as the beach width reference elevation in belief that is provide a more accurate indicator of changes in beach condition and to facilitate usage of the limited spatial coverage from the LiDAR data. MHW beach widths may be used to generally characterize "towel space." While Mean Sea Level (MSL) beach widths were reported in prior reports, only MHW beach widths are presented herein because many of the LiDAR surveys do not extend to MSL.

MHW beach widths are presented in Appendix B and were measured at each of the twelve sites using both the profile and LiDAR datasets. The beach width was computed as the horizontal distance, in feet, between the landward limit of the beach and the point at which the beach intersected the plane of the MHW tidal datum (Figure 2). MHW is located 4.60 ft above MLLW, based on the published tidal datum elevations at La Jolla, CA (Station ID 9410230; NOAA, 2024b). As indicated above, the 0 ft range on the beach profile plots corresponds to the transect origin. The horizontal offset between the transect origin and the landward limit of the beach is provided for each site in Appendix B.

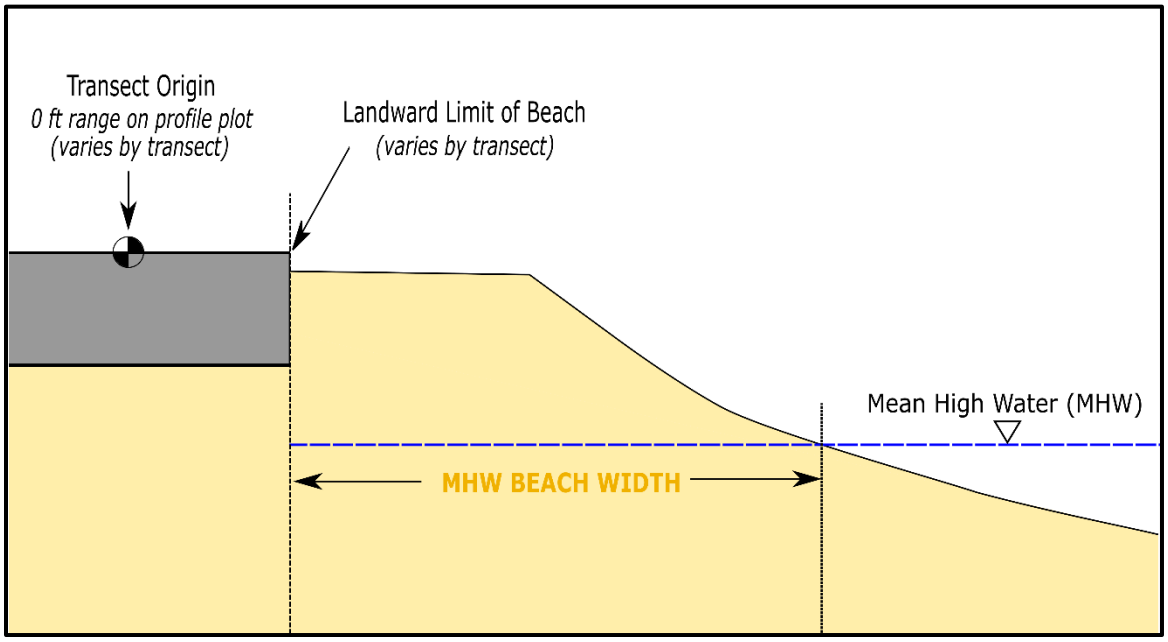


Figure 2. Illustration of Mean High Water Beach Width

In Fall 2022, the location of the landward terminus of the beach was measured at each of the twelve sites (Appendix B). Based on input from community stakeholders, three sites were revised in Fall 2023 (Transects SC-1680, SC-1645, and SC-1623). MHW beach widths were subsequently recomputed in Fall 2023 for all surveys on record to reflect these changes. ***The beach widths provided herein supersede those provided prior to the Fall 2023 report.***

The Spring 2024 Beach Profile Survey data are included in a compressed (*.zip) folder attached to the electronic submittal of this report. The *.zip folder contains ASCII files of: (1) range and elevation pairs for each profile (*.bpd), and (2) northing, easting, and elevation triplets (*.nez) for the entire survey. The beach profile data files (*.bpd) were derived from the georeferenced data (*.nez) and were used to generate the profile plots attached in Appendix A. In the case of the georeferenced data (*.nez), the horizontal positions reference California State Plane Zone 6, NAD83(2011)2010.00 epoch, expressed in U.S. Survey Feet, while elevations are provided relative to National Ocean Service Mean Lower Low Water for the 1983-2001 National Tidal Datum Epoch (NOS MLLW 83-01), expressed in feet. The files can be opened using a text editor, such as Notepad, and header within each file provides relevant metadata, including date, location, and datums.

5.2 Observations

A detailed analysis of the state of the City's beaches exceeds the present Scope of Work. General observations are offered, however, based on the profile plots and MHW beach widths provided in Appendices A, B, and C. For clarity, the term "beach width" discussed herein refers to MHW beach width. It should be noted that the Spring 2024 survey was conducted prior to beach nourishment at Capistrano Beach, North Beach, and the USACE project near San Clemente Pier (Section 2).

Beach Widths and Shoreline Changes

1. **MHW Beach Widths (Appendix B, Figure 3):** MHW beach widths at the time of the Spring 2024 survey are illustrated in Figure 3. The envelope of historical Spring beach widths is provided for context (comprised of all surveys conducted during the months of April through July between 1984 and 2023). Spring 2024 beach widths ranged from 15 ft at ***Capistrano Shores (Transect SC-1705)*** to 176 ft at ***Lost Winds (SC-1645)***. Historical minimum values were recorded at ***North Beach (SC-1700)*** and ***Capistrano Shores (SC-1705)***. The Spring 2024 beach widths fell near, or below, the lower bound of the historical range throughout most of the study area. Exceptions occurred at ***Shorecliffs (SC-1720), T-Street (SC-1660)*** and ***Lost Winds (SC-1645)***, where beach widths fell near the middle or upper end of the historical range.

2. **Beach Width Trends (Appendix C):** Time series plots provided in Appendix C illustrate the beach widths measured at each site over the period of record. At ***North Doheny State Beach (DB-1850)***, beach widths have fluctuated appreciably over the period of record in comparison to the other eleven sites in the study area. Punctuated large increases in beach width at the site, such as in 2005, resulted from sediment delivery to the coast from San Juan Creek during periods of high rainfall. The comparatively wide beaches that prevailed in 1983 and 1998 are likely attributable to the heavy precipitation during the 1992-83 and 1997-98 El Niño winters. A trend of decreasing beach widths has prevailed at ***North Doheny State Beach***, and the Spring 2024 survey was among the narrowest recorded.

   Beach widths at ***South Doheny State Beach (DB-1805)*** have been steadily declining over the period of record, decreasing from 300 ft in 1983 to around 100 ft in recent surveys (110 ft at the time of the Spring 2024 survey).

   Shorecliffs (SC-1720) is characterized by a narrow range of beach widths that have remained fairly stable over the period of record. The beach width at the time of the Spring 2024 survey fell near the middle of the historical range.

At ***Capistrano Shores (SC-1705) and Dije Court (SC-1695)***, beach widths have been consistently narrow. At the time of the Spring 2024 survey, both monitoring locations were at or near the narrowest recorded Spring beach width.

A modest trend of shoreline retreat has prevailed at ***North Beach (Transects SC-1702 and SC-1700)*** over the period of record. At the time of the Spring 2024 survey, beach widths at both North Beach monitoring locations were at or near historical minimums.

A trend of increasing beach widths has prevailed from ***Linda Lane (SC-1680)*** to ***San Clemente State Beach (SC-1623)*** since October 2001. Despite seasonal losses, beach widths at these four monitoring locations were near the middle to upper portion of the respective historical Spring range.

The most pronounced beach width change in the study area occurred at ***Cotton's Point (SC-1605)***, where the beach eroded back to the revetment sometime between 2016 and 2022. Recent beach widths have remained less than 20 ft.

3. **Winter Seasonal Beach Width Changes – Oct. 2023 to May 2024 (Tbl. 3, Fig. 4):** Shoreline retreat predominated in the study area over the most recent winter season (October 2023 to May 2024). The greatest losses were concentrated in the region between ***Linda Lane (SC-1680)*** and ***San Clemente State Beach (SC-1623)***. Gains were confined to three sites ***(Shorecliffs, SC-1720; Capistrano Shores, SC-1705; and Dije Court, SC-1695)***. The greatest loss measured 75 ft ***(SC-1680)***, while the greatest gain measured 19 ft ***(SC-1695)***.

4. **Long-Term Beach Width Changes – Apr. 1986 to May 2024 (Table 3, Fig 5):** When the 38-yr period between the April 1986 and May 2024 surveys is considered, shoreline losses predominated in the study area. Shoreline retreat at the ***Doheny State Beach*** sites ***(DB-1850 and DB-1805)*** exceeded 150 ft. Long-term changes were more modest in the rest of the study area. The shoreline retreated 15 ft at ***San Clemente State Beach (SC-1623)***, and was essentially unchanged at ***Shorecliffs (SC-1720)*** and ***Linda Lane (SC-1680)***. Shoreline advance occurred only at ***T-Street (SC-1660)*** - a gain of 12 ft.

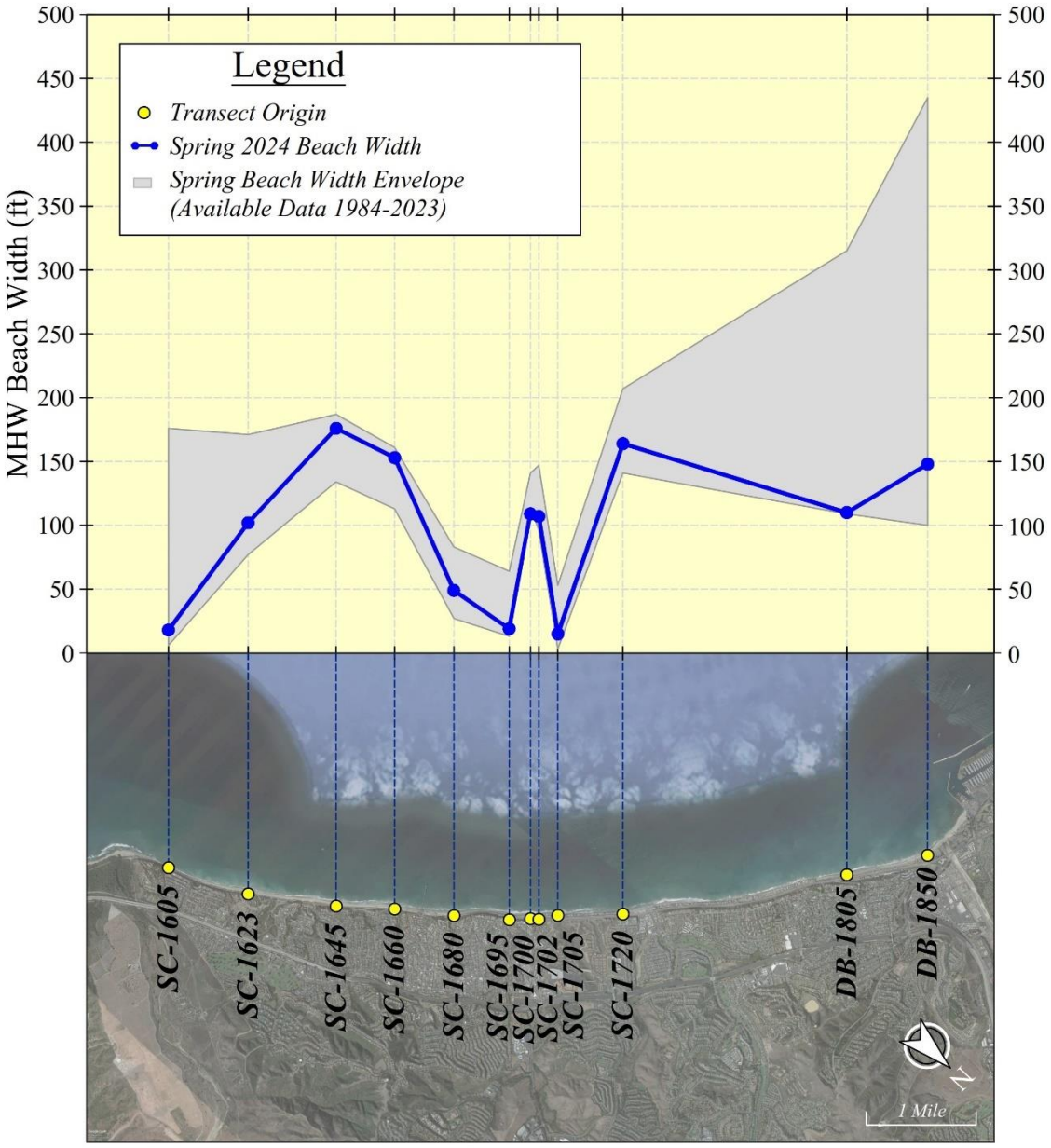
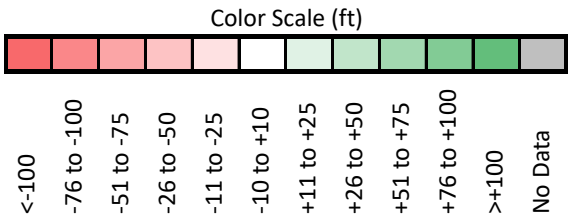


Figure 3. Spring 2024 MHW Beach Widths
Relative to 1984-2023 Historical Spring Beach Width Envelope

Table 3. MHW Beach Width Changes at San Clemente Area Transects

Transect	Location	MHW Beach Width Change (ft)	
		Winter Seasonal Oct 2023 – May 2024 (~7 Months)	Long-Term Apr 1986 – May 2024 (38 Years)
DB-1850	N. Doheny SB	-33	-153
DB-1805	S. Doheny SB	-6	-174
SC-1720	Shorecliffs	15	-10
SC-1705	Capistrano Shores MHC	13	--
SC-1702	North Beach	-36	--
SC-1700	North Beach	-23	--
SC-1695	Dije Court	19	--
SC-1680	Linda Lane	-75	0
SC-1660	T-Street	-56	12
SC-1645	Lost Winds	-3	--
SC-1623	San Clemente SB	-35	-15
SC-1605	Cottons Point	6	--



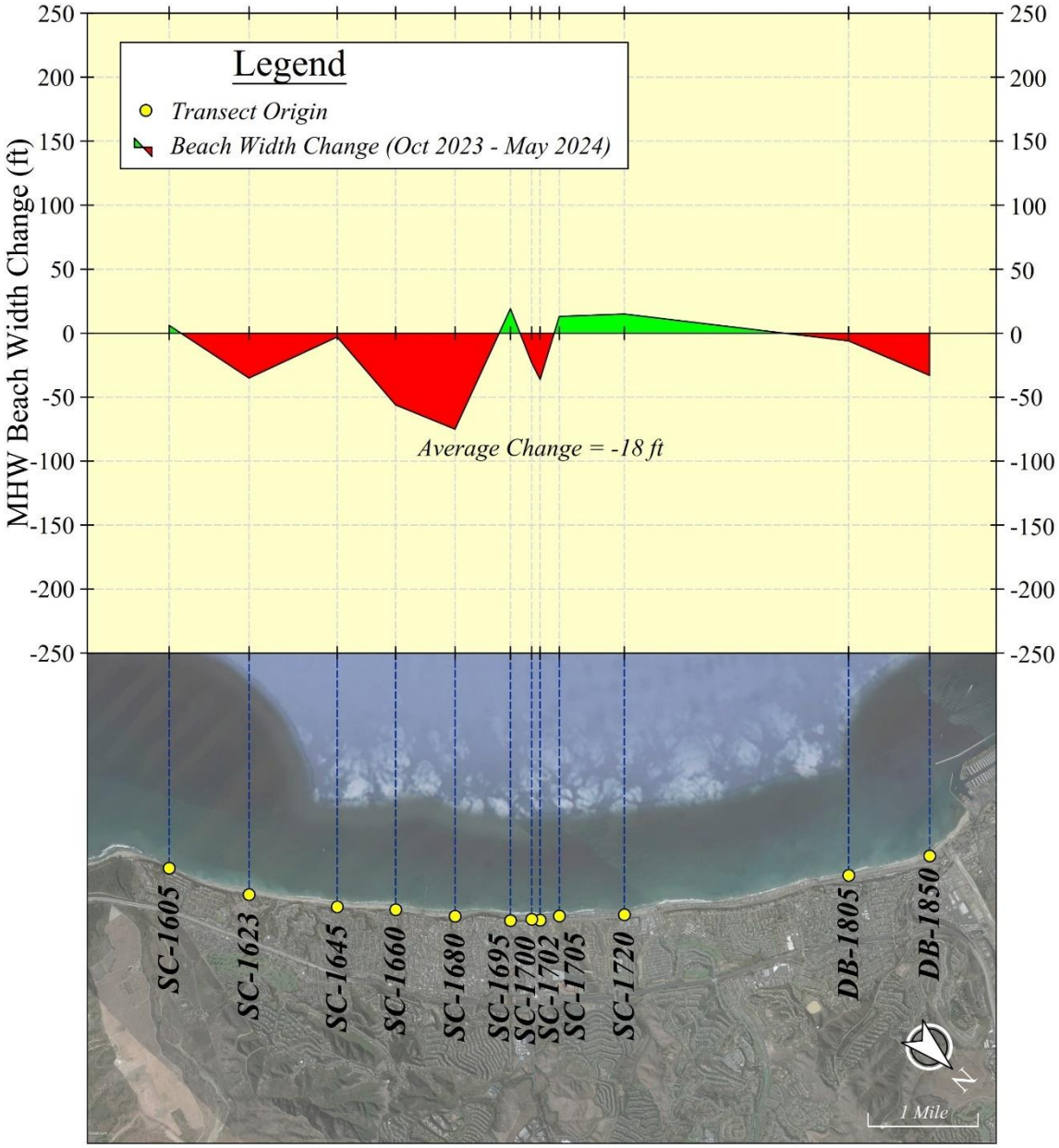


Figure 4. Winter Seasonal Beach Width Changes, October 2023 to May 2024

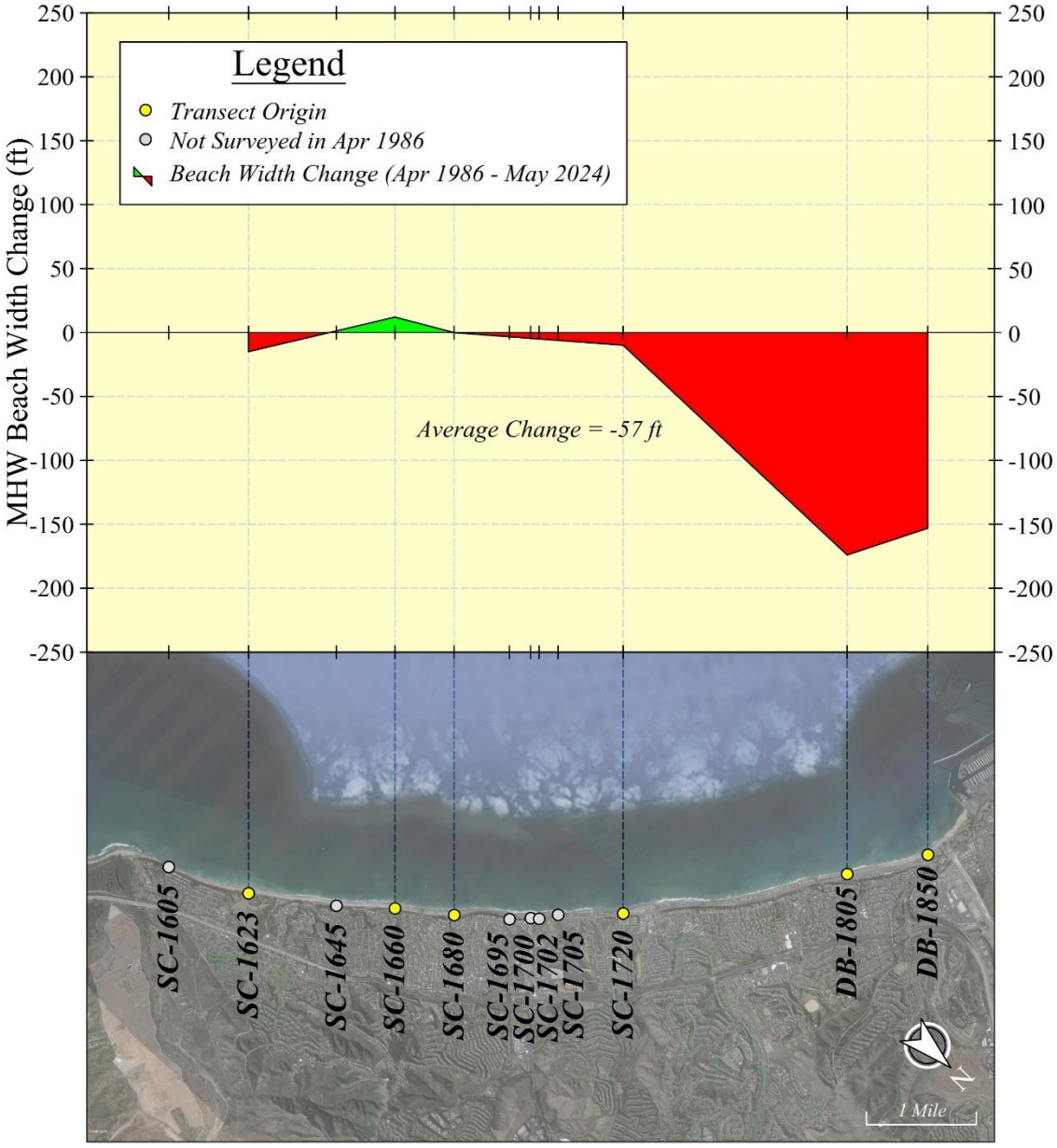


Figure 5. Long Term Beach Width Changes, April 1986 to May 2024

Profile Changes

From 1999 to 2020, Southern California Edison constructed the 376-acre artificial Wheeler North Reef (WNR) offshore of the San Clemente shoreline during three phases. While the Phase 1 Experimental Reef (22.4 acres) was installed in 1999 prior to the 2001-2007 Beach Monitoring Program, the majority of the reef was constructed after the May 2007 Survey as Phase 2 (152 acres, June to September 2008; Coastal Environments, 2018) and Phase 3 (202 acres, July 2019 to July 2020; SCE, 2020). At Transects SC-1720 through SC-1605, profile changes between recent and historical surveys in depths greater than about 40 ft are believed to be artifacts of the WNR.

1. **Doheny State Beach:** Over the most recent winter season (October 2023 to May 2024) profile erosion occurred at North Doheny State Beach (Transects DB-1850) from the berm to about -10 ft MLLW. Profile changes at South Doheny State Beach were modest during the same period, and consisted of minor losses near the berm. Both Doheny State Beach sites are significantly eroded when compared to the April 1986 baseline as well as the historical envelope encompassing the Fall 2001 and Spring 2007 surveys.

2. **Shorecliffs:** Winter seasonal profile changes at Shorecliffs (SC-1720) were mild. Minor subaerial gains were accompanied by losses at the nearshore bar. The May 2024 profile was among the most eroded conditions on record, falling well below the historical envelope.

3. **Capistrano Shores manufactured home community:** Winter seasonal profile changes at Capistrano Shores (SC-1705), were confined to the relatively small region from the revetment to just below MLLW. Modest accretion occurred in front of the revetment, with losses prevailing just below water. Further offshore, the profile was generally unchanged. The May 2024 profile falls near the lower boundary of the historical envelope.

4. **North Beach:** Modest above-water losses occurred at the two North Beach transects (SC-1702 and SC-1700) over the recent winter season. Below-water changes were negligible at SC-1702, while the below-water changes at SC-1700 consisted of reconfiguration of the nearshore bar. The May 2024 profile at both sites was among the most eroded on record.

5. **Dije Court:** Winter seasonal profile changes at Dije Court (SC-1695) were similar to the revetment-backed beach at Capistrano Shores (SC-1705). Isolated gains occurred

in front of the revetment, while a mix of erosion and accretion occurred between MLLW and a depth of about 10 ft.

6. **Linda Lane to San Clemente State Beach:** Winter seasonal profile changes in the region between Linda Lane (SC-1680) and San Clemente State Beach (SC-1623) were generally characterized by above-water erosion accompanied by gains in the nearshore bar. This pattern is most pronounced at the northernmost sites (Linda Lane, SC-1680 and T-Street, SC-1660). The May 2024 profiles at T-Street (SC-1660) and Lost Winds (SC-1645) exceed the historical envelope in the above-water region.

7. **Cottons Point:** At Cottons Point (SC-1605), modest profile gains occurred from the back beach to a depth of about 15 ft during the most recent winter season. However, the May 2024 profile falls well below the historical envelope and is among the most eroded conditions on record.

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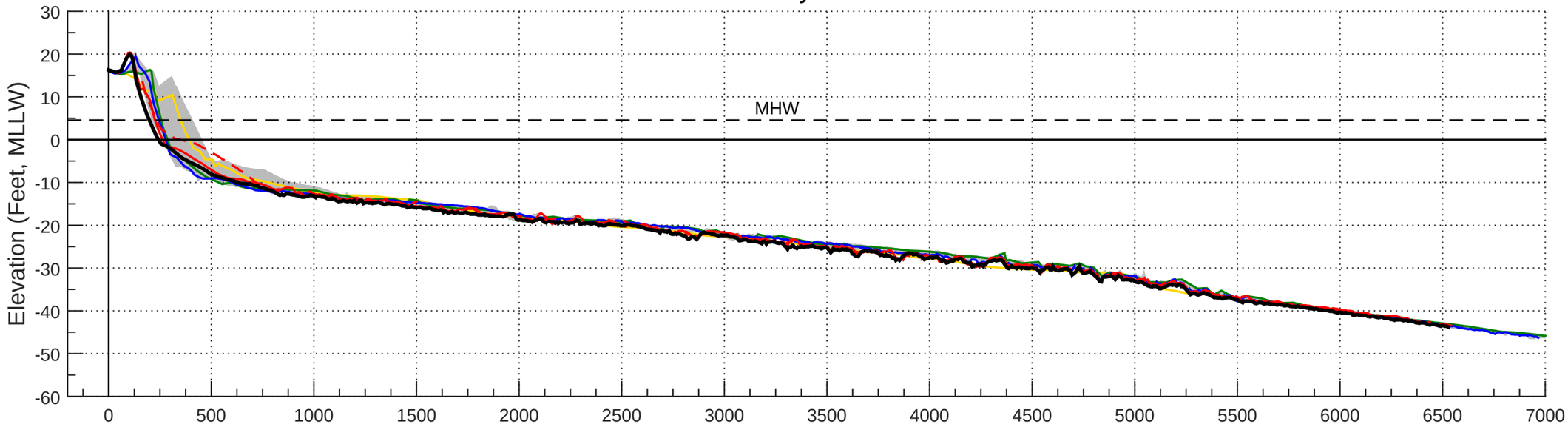
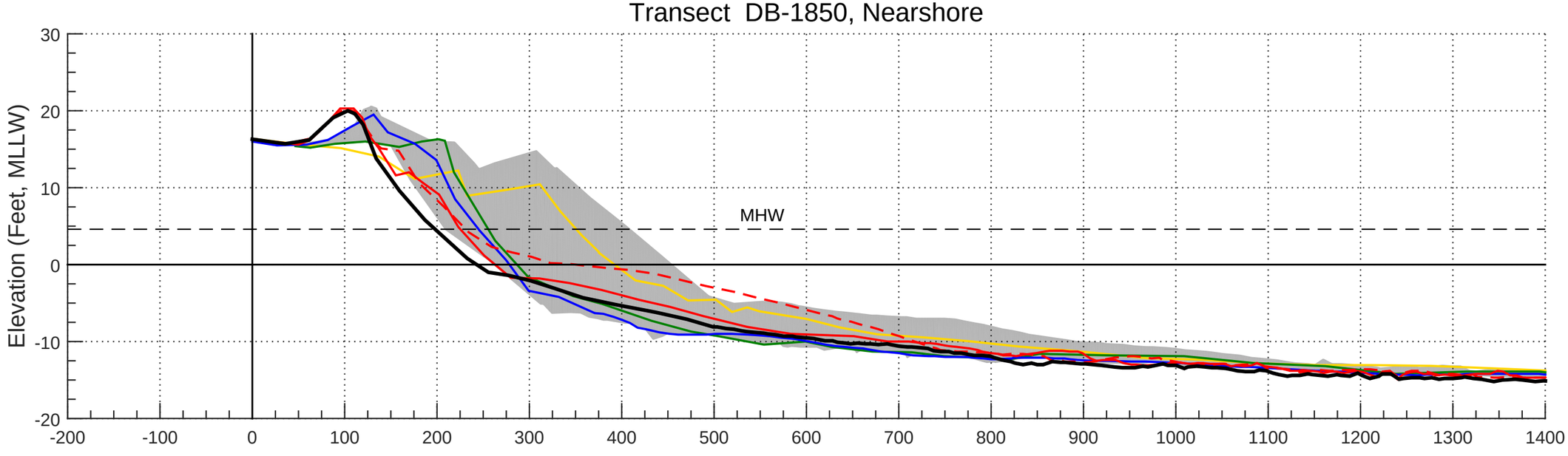
APPENDIX A

BEACH PROFILE PLOTS

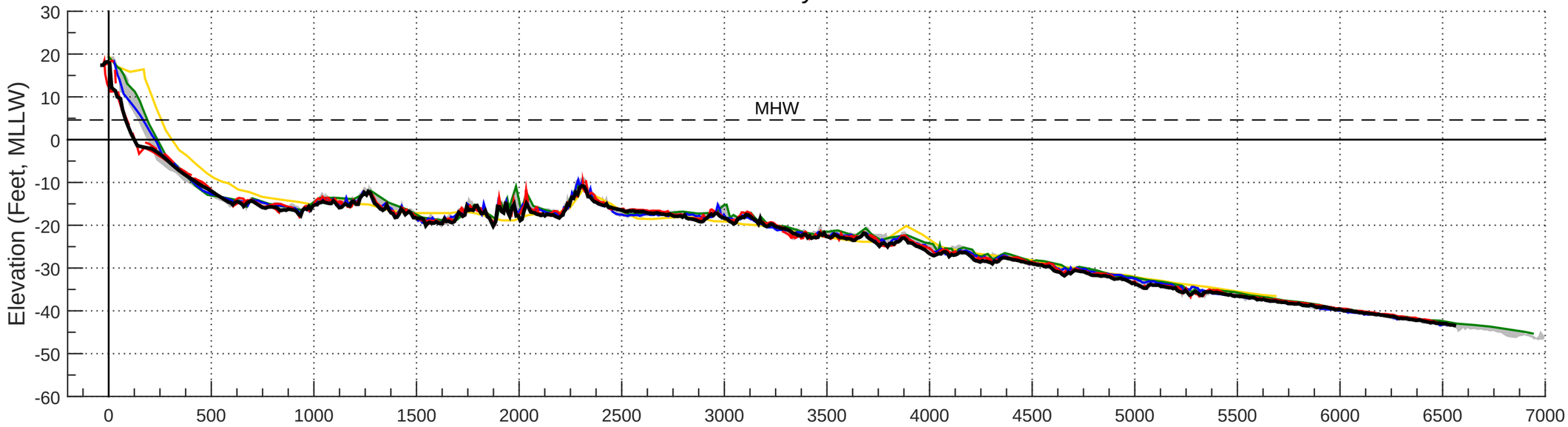
Transect DB-1850
North Doheny State Beach



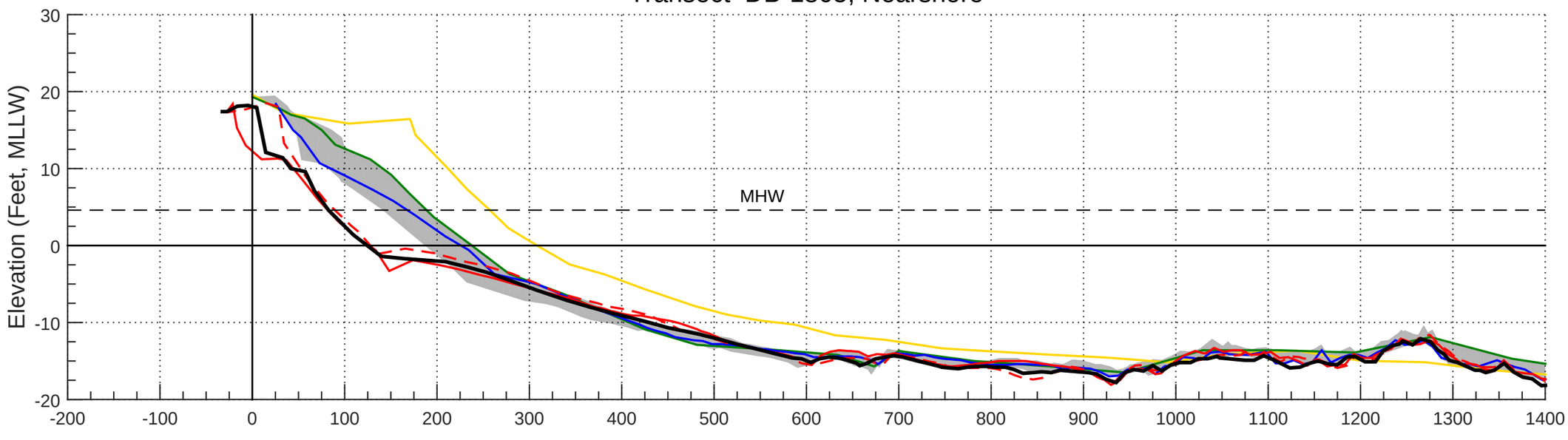
Transect DB-1850, Nearshore



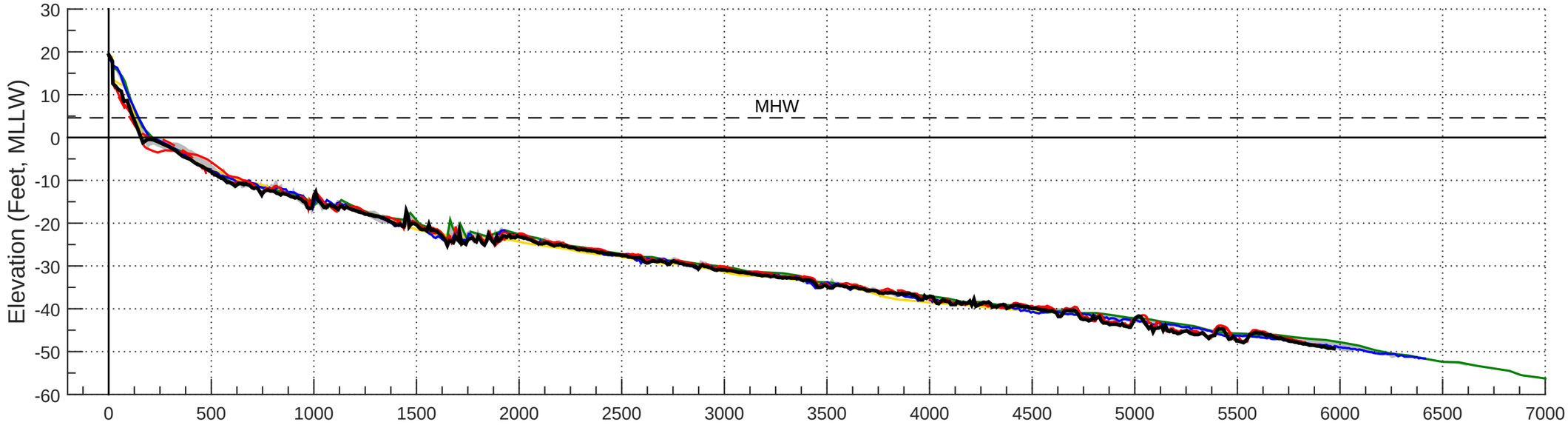
Transect DB-1805
South Doheny State Beach



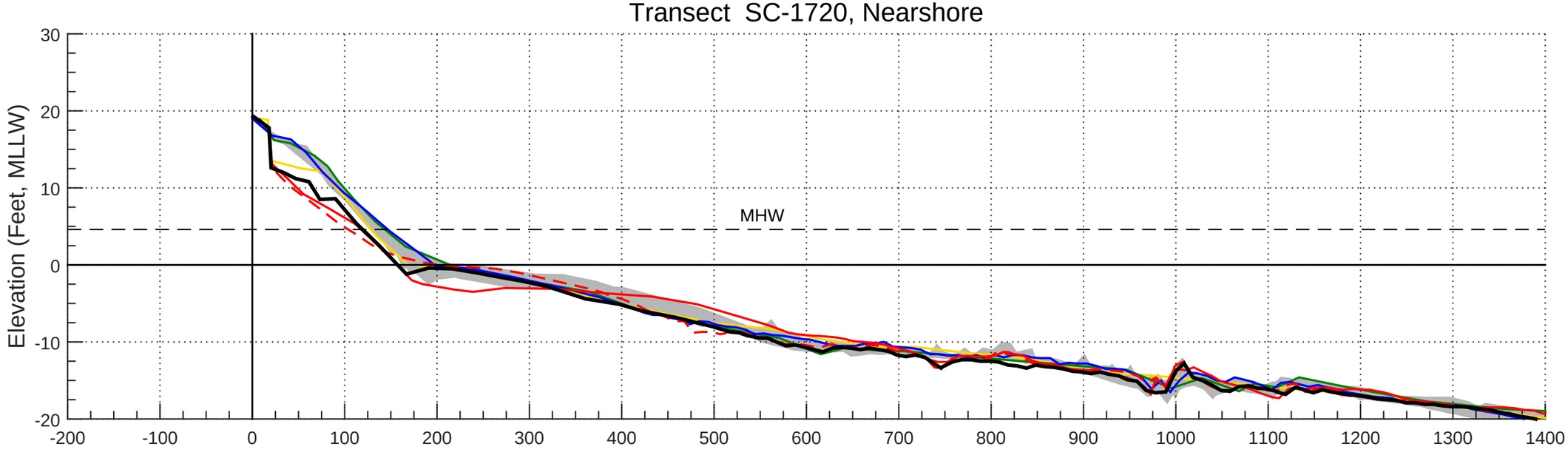
Transect DB-1805, Nearshore



Transect SC-1720
Shorecliffs

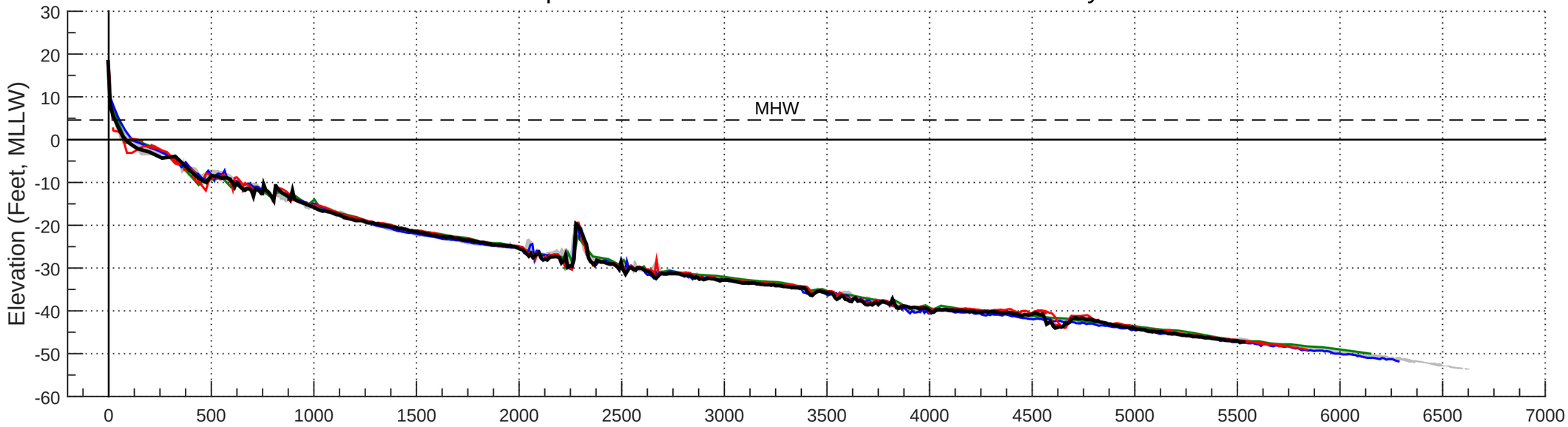


Transect SC-1720, Nearshore

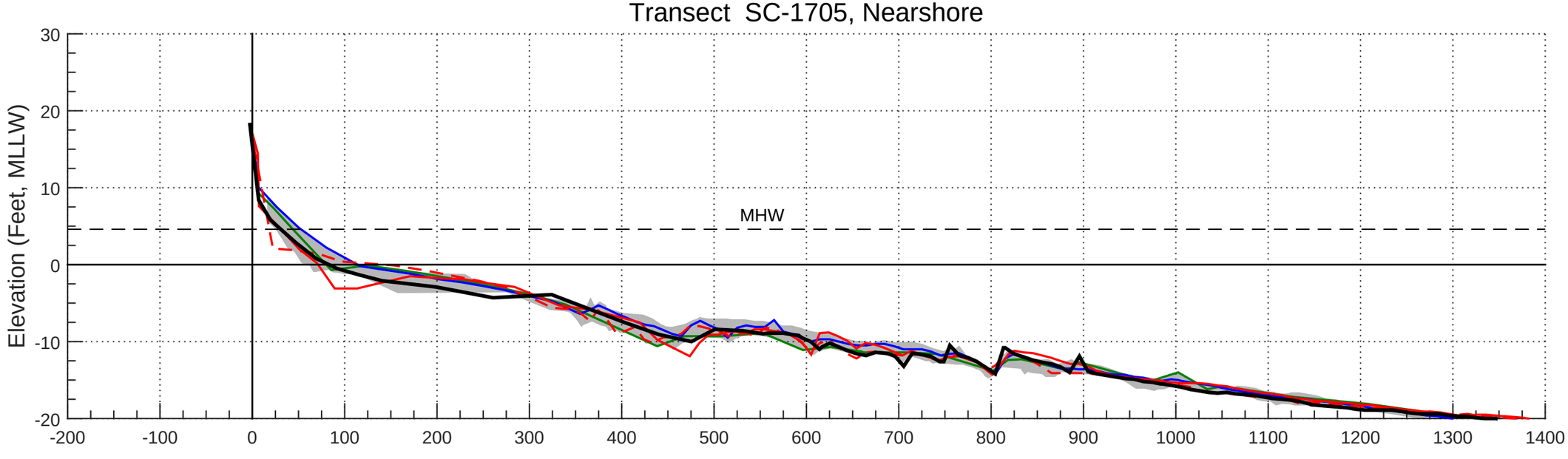


Transect SC-1705

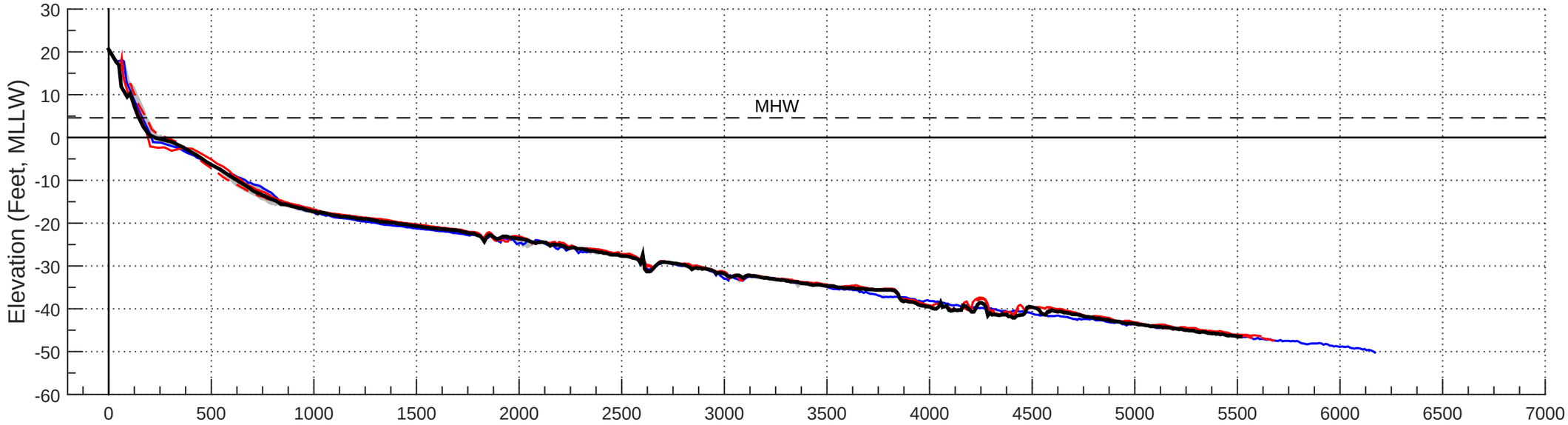
Capistrano Shores manufactured home community



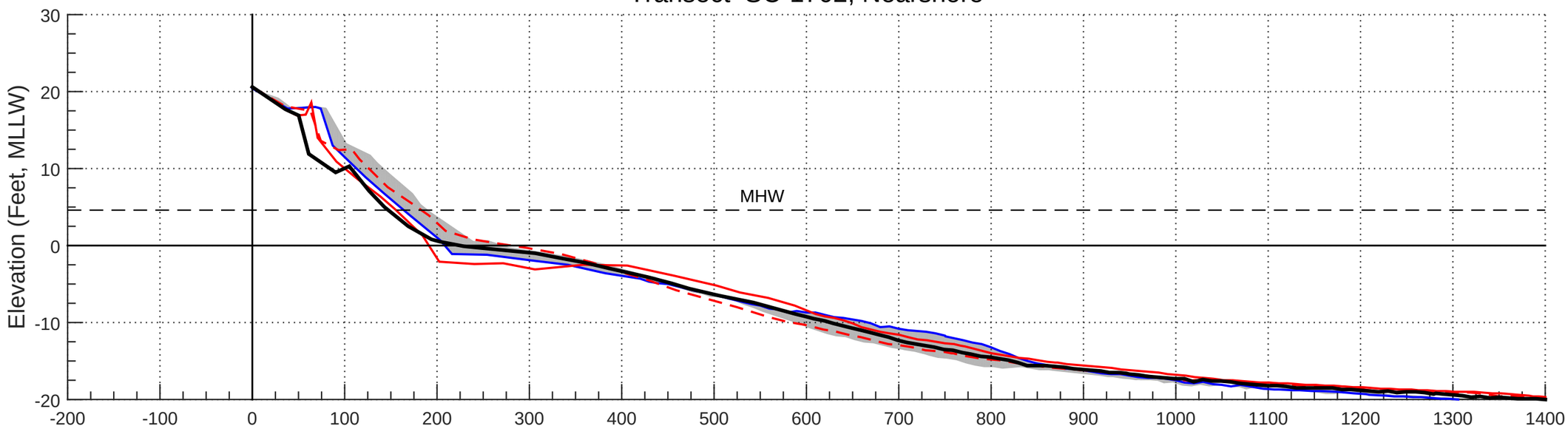
Transect SC-1705, Nearshore



Transect SC-1702
North Beach



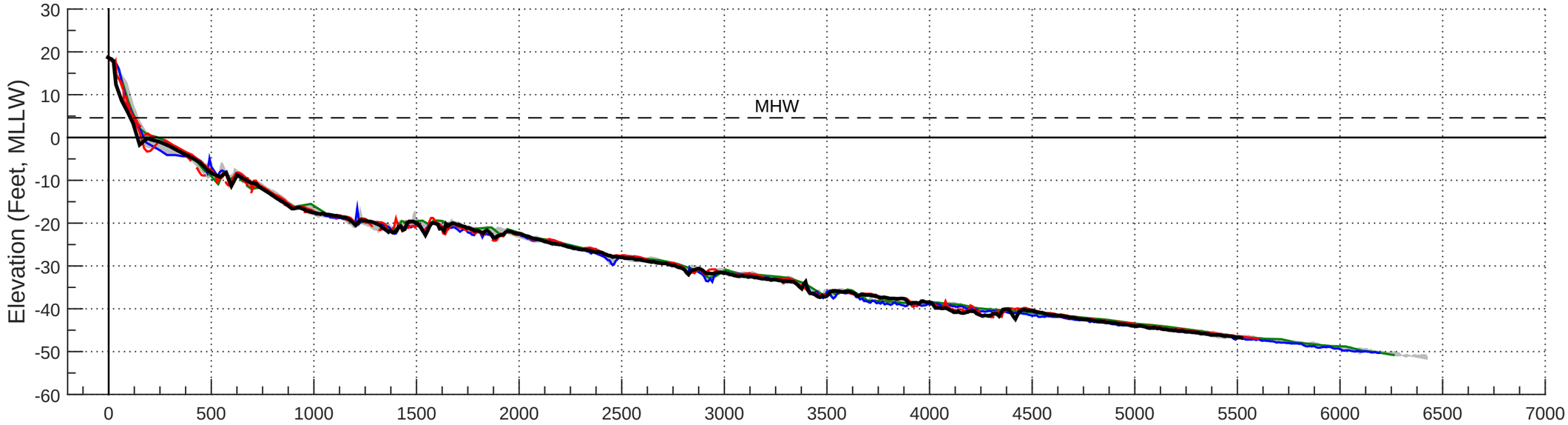
Transect SC-1702, Nearshore



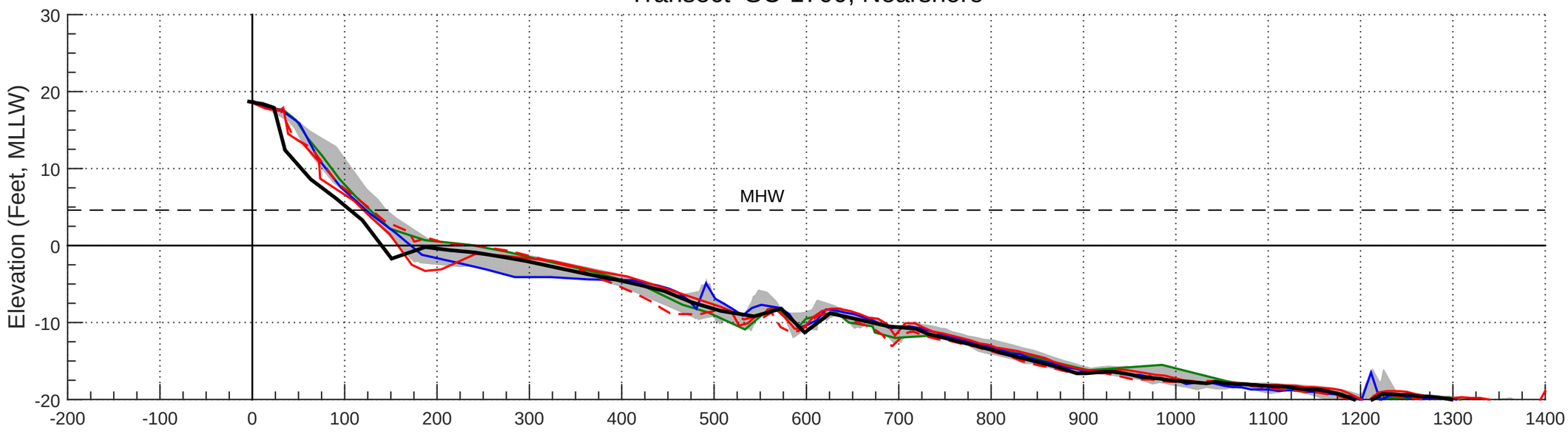
Cross-Shore Distance (Feet Seaward of Transect Origin)

Profile Envelope (Fall 2001 - Spring 2007)
May 2007
May 2023
Oct 2023
May 2024

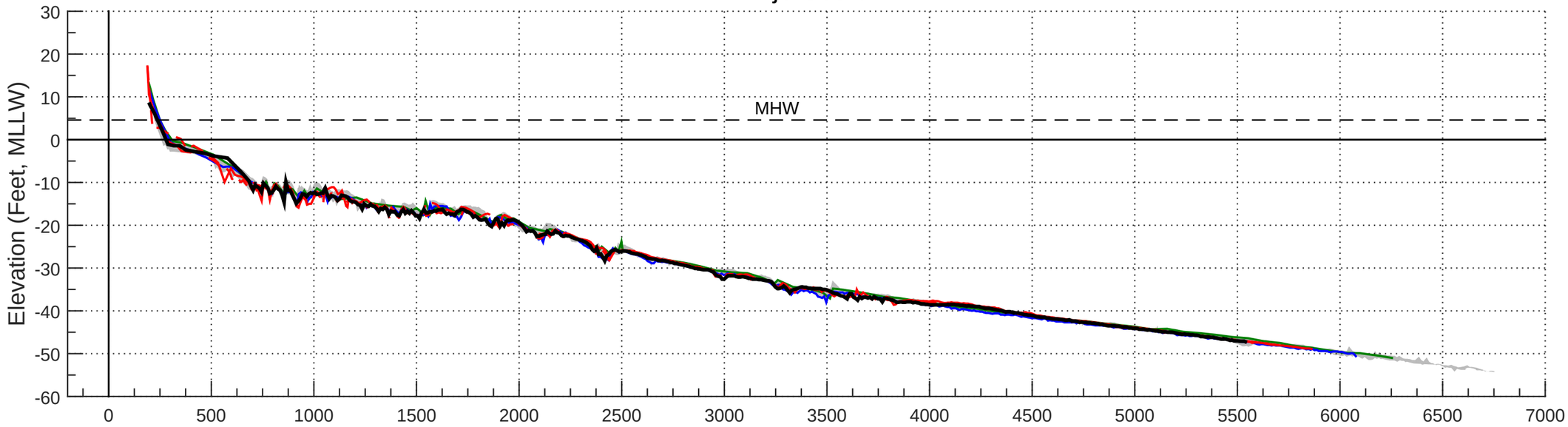
Transect SC-1700
North Beach



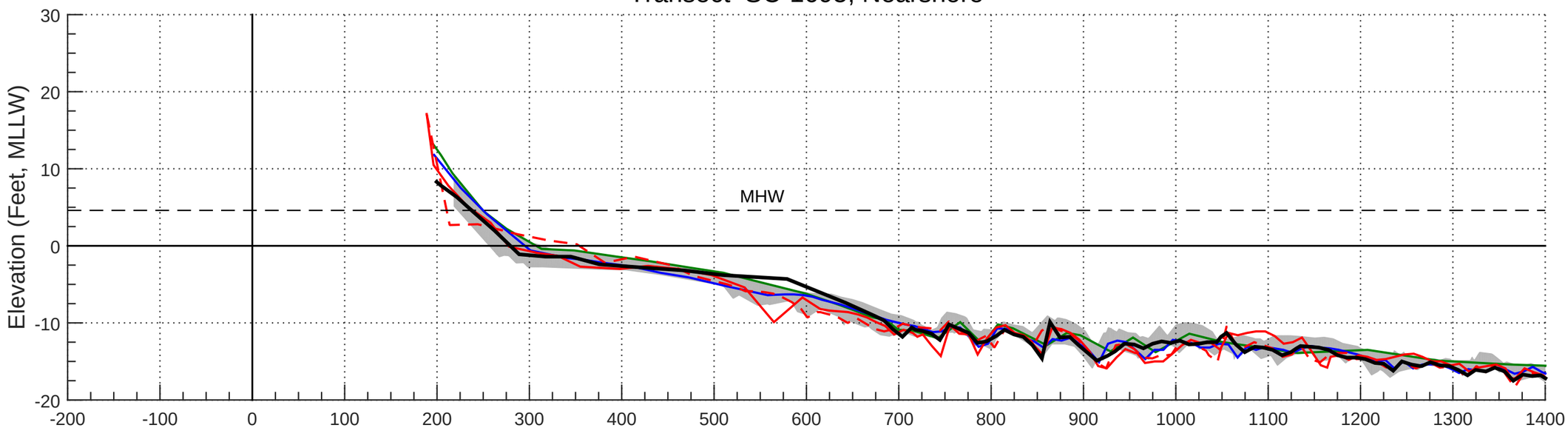
Transect SC-1700, Nearshore



Transect SC-1695
Dije Court



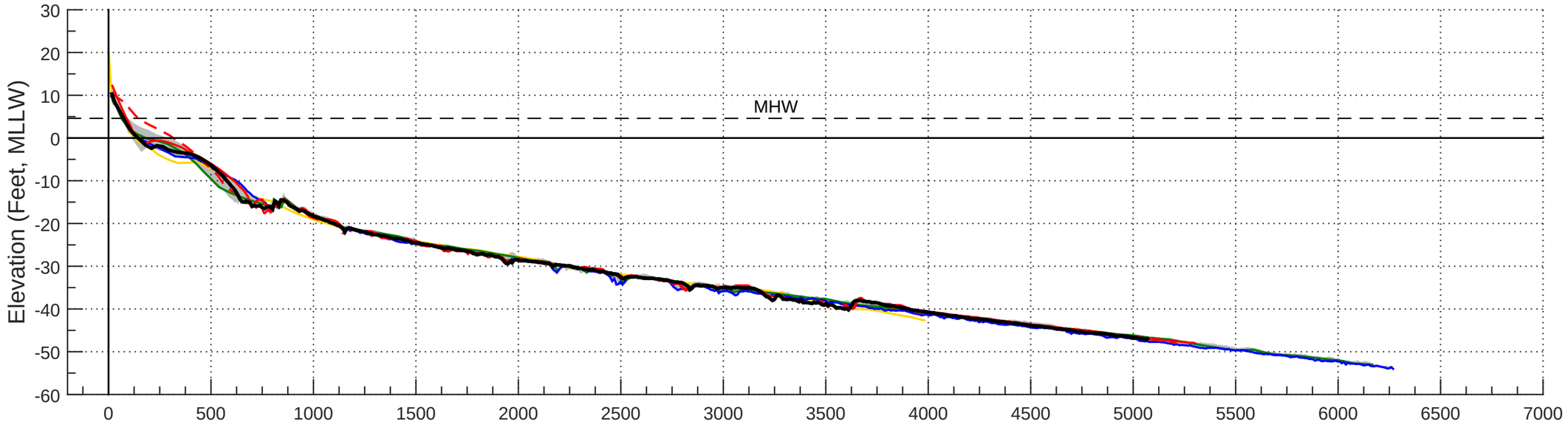
Transect SC-1695, Nearshore



Cross-Shore Distance (Feet Seaward of Transect Origin)

Profile Envelope (Fall 2001 - Spring 2007)
May 2002
May 2007
May 2023
Oct 2023
May 2024

Transect SC-1680
Linda Lane



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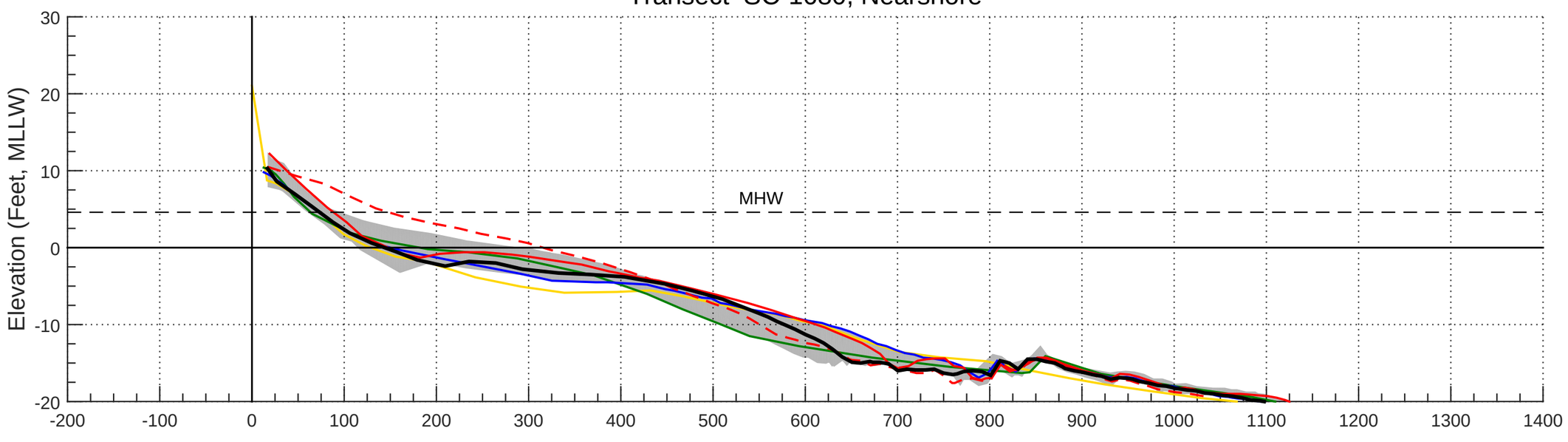
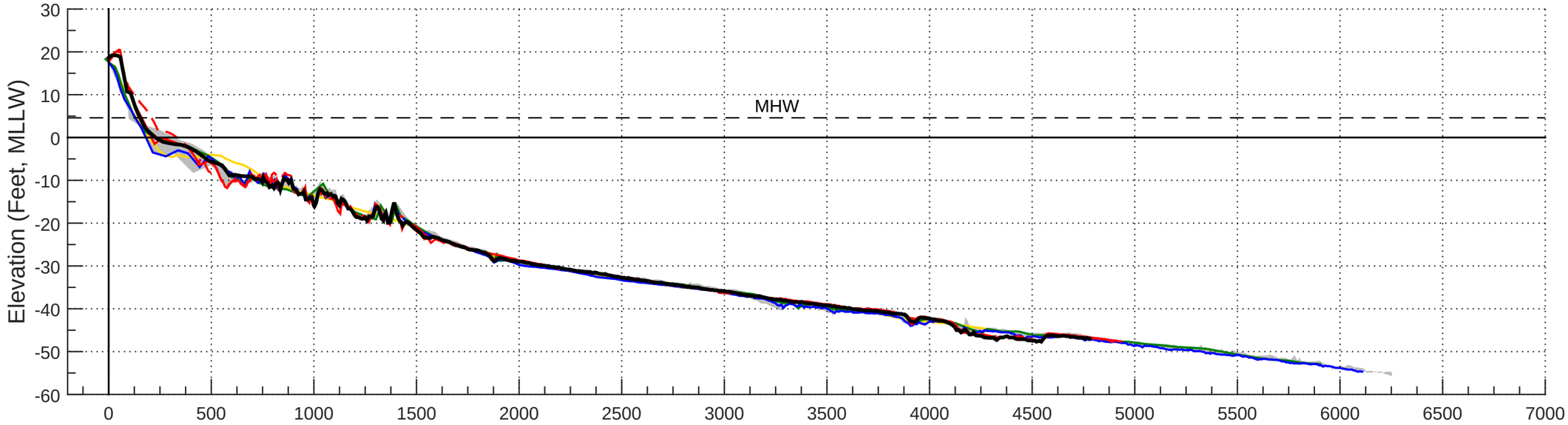
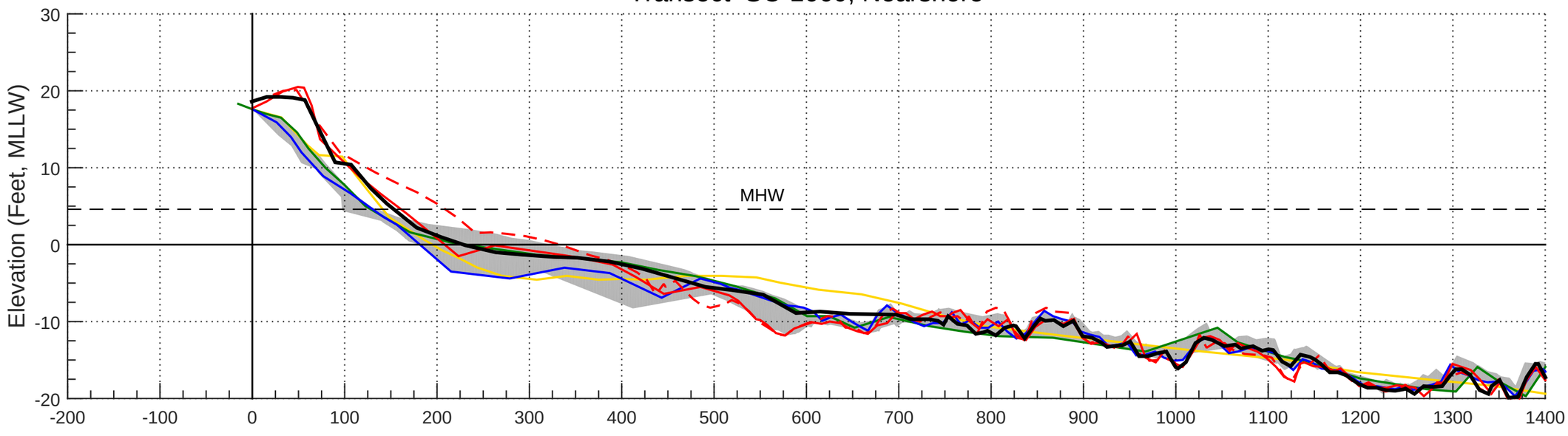


Transect SC-1660
T-Street



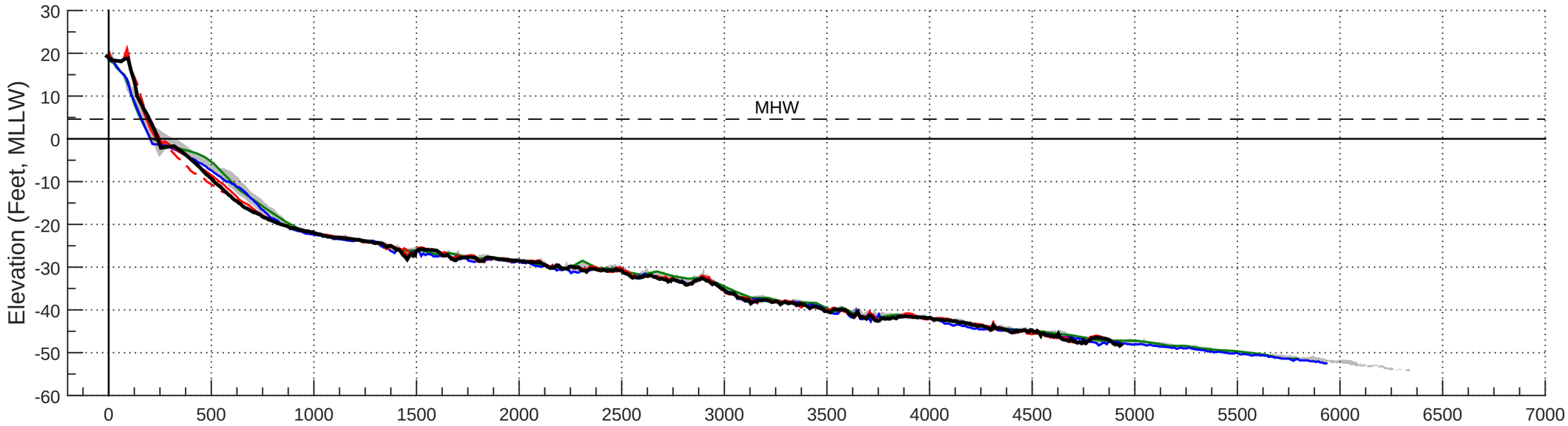
Transect SC-1660, Nearshore



Cross-Shore Distance (Feet Seaward of Transect Origin)

Profile Envelope (Fall 2001 - Spring 2007)
Apr 1986
May 2002
May 2007
May 2023
Oct 2023
May 2024

Transect SC-1645
Lost Winds



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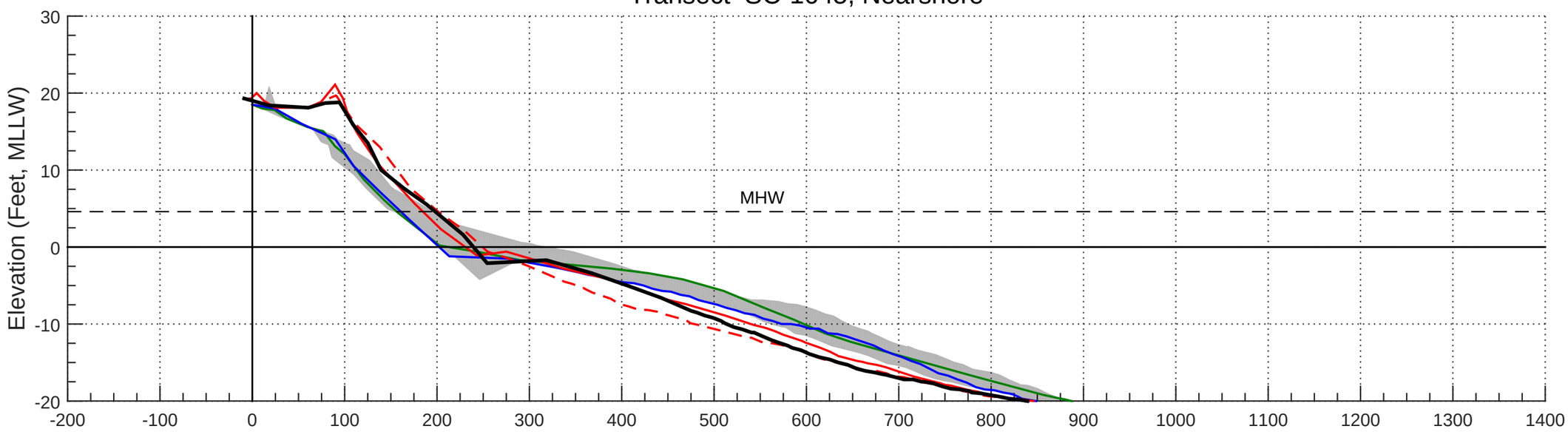
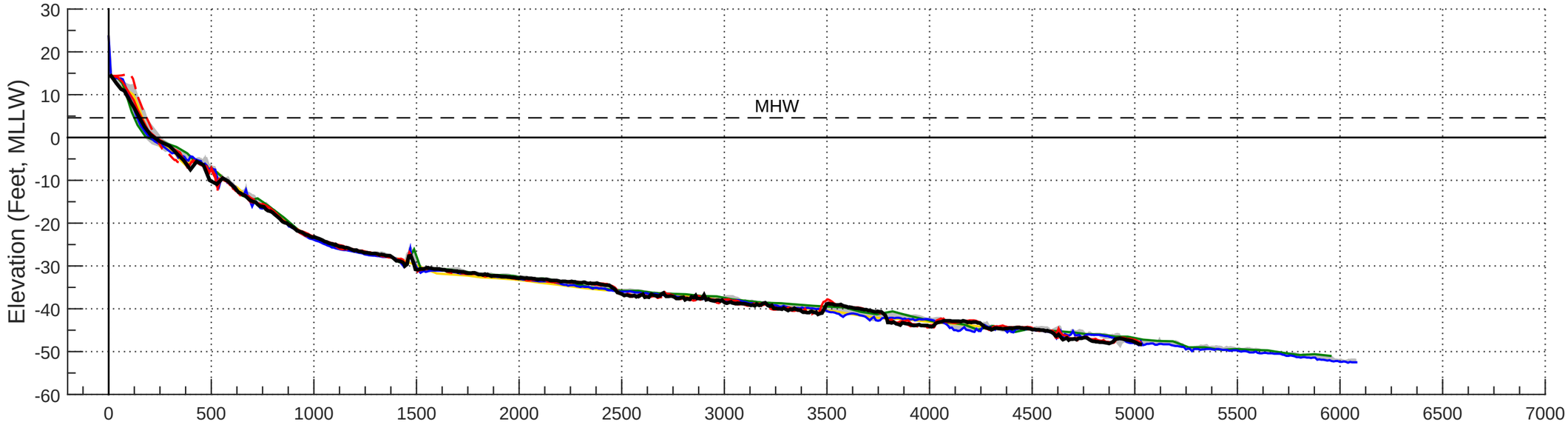
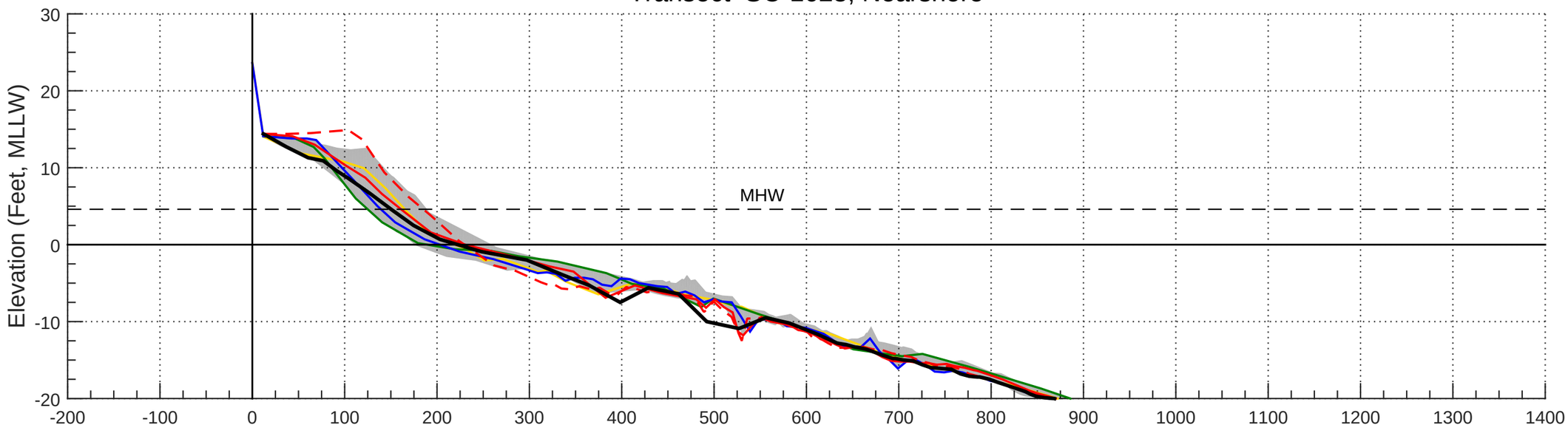


Transect SC-1623
San Clemente State Beach



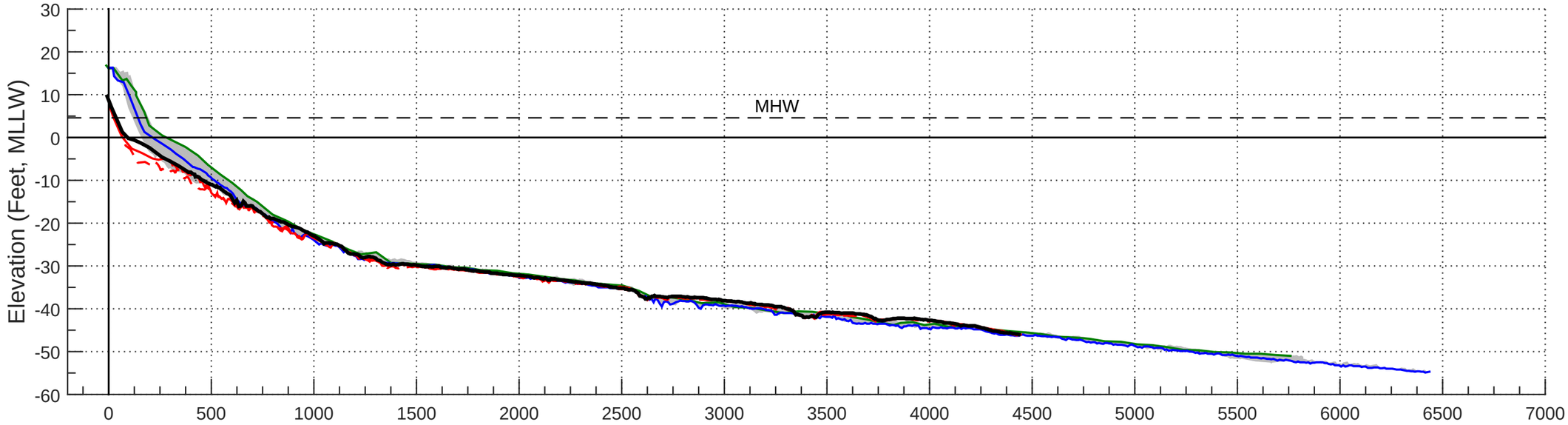
Transect SC-1623, Nearshore



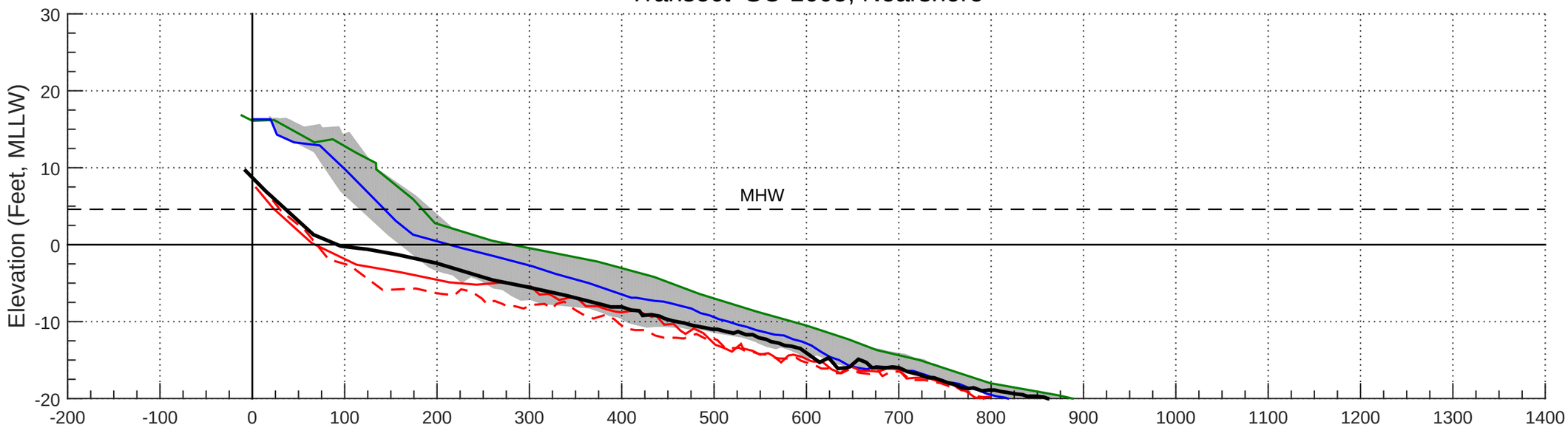
Cross-Shore Distance (Feet Seaward of Transect Origin)

Profile Envelope (Fall 2001 - Spring 2007)
Apr 1986
May 2002
May 2007
May 2023
Oct 2023
May 2024

Transect SC-1605
Cottons Point



Transect SC-1605, Nearshore



Cross-Shore Distance (Feet Seaward of Transect Origin)

Profile Envelope (Fall 2001 - Spring 2007)
May 2002
May 2007
May 2023
Oct 2023
May 2024

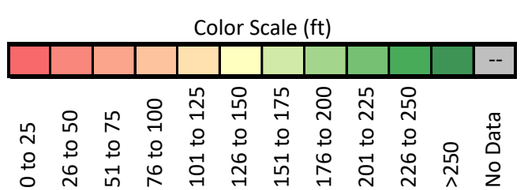
APPENDIX B

MEAN HIGH WATER BEACH WIDTHS DERIVED FROM BEACH PROFILE AND LIDAR DATA

Mean High Water Beach Widths Derived from Beach Profile and LiDAR Surveys

Transect	Mean High Water Beach Width (feet) [1]																										Landward Limit of Sand (offset from origin) [2]
	Nov/ Dec 1983 [3]	Jun/ Jul 1984 [3]	Nov/ Dec 1984 [3]	Jun 1985 [3]	Apr 1986 [3]	Oct 1986 [3]	Apr 1987 [3]	Oct 1987 [3]	Jan 1988 [3]	Dec 1989 [3]	Oct 1997 [4]	Apr 1998 [4]	Oct 2001 [3]	May 2002 [3]	Oct 2002 [3]	May 2003 [3]	Oct 2003 [3]	May 2004 [3]	Oct 2004 [3]	May 2005 [3]	Oct 2005 [3]	Oct 2006 [3]	May 2007 [3]	Nov 2007 [4]	Apr 2008 [4]	Sep 2008 [4]	Mar 2009 [4]	Oct 2009 [4]	
DB-1850 North Doheny State Beach	429	355	358	341	301	299	243	223	218	--	--	435	253	205	218	189	210	158	184	360	339	258	195	196	165	179	187	181	Campground (50 ft)
DB-1805 South Doheny State Beach	302	315	301	303	284	300	253	280	--	237	250	225	211	216	196	196	181	176	170	175	168	182	195	189	189	166	166	161	Bike Path (-27 ft)
SC-1720 Shorecliffs	148	151	150	149	174	151	180	153	184	179	198	207	172	189	179	188	182	180	183	184	185	175	192	193	190	176	197	186	Railroad Pad (-45 ft)
SC-1705 Capistrano Shores manufactured home community	--	--	--	--	--	--	--	--	--	--	42	45	13	28	12	32	14	23	16	32	12	9	37	22	41	9	38	29	Revetment (16 ft)
SC-1702 North Beach	--	--	--	--	--	--	--	--	--	--	154	141	--	--	--	--	--	--	--	--	151	147	124	148	129	155	124	145	Revetment (40 ft)
SC-1700 North Beach	--	--	--	--	--	--	--	--	--	--	163	141	148	131	143	123	144	134	149	123	149	149	126	151	138	152	132	144	Railroad Fence (-3 ft)
SC-1695 Dije Court	--	--	--	--	--	--	--	--	--	--	28	64	11	32	15	30	15	18	4	20	6	6	32	27	30	15	40	15	Revetment (218 ft)
SC-1680 Linda Lane	--	66	68	63	49	87	27	72	--	83	74	30	59	40	64	39	60	52	66	36	72	66	48	77	71	95	65	77	Revetment (24 ft)
SC-1660 T-Street	196	157	138	142	141	161	124	132	124	154	122	113	97	128	122	127	131	127	132	132	128	135	130	131	143	157	132	124	Light Post (0 ft)
SC-1645 Lost Winds	--	--	--	--	--	--	--	--	--	--	141	166	145	134	131	153	150	151	176	152	159	172	139	181	187	210	177	169	Dune (22 ft)
SC-1623 San Clemente State Beach	133	105	115	92	117	129	108	130	--	166	98	105	127	77	140	81	122	86	134	104	136	141	91	153	129	164	154	159	Dune/Revetment (48 ft)
SC-1605 Cottons	--	--	--	--	--	--	--	--	--	--	143	142	130	166	107	151	154	176	132	139	98	115	125	105	143	129	117	118	Revetment (18 ft)

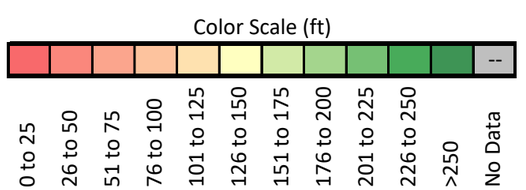
Notes:
[1] Color-coded cells illustrate each beach width value according to the color scale shown to the right.
[2] Horizontal distance from transect origin to landward limit of sand. A (+) positive value indicates the landward limit of sand is seaward of transect origin. A (-) negative value indicates landward limit of sand is landward of transect origin.
[3] Beach width derived from beach profile survey data.
[4] Beach width derived from LiDAR data (NOAA, 2023b).



Mean High Water Beach Widths Derived from Beach Profile and LiDAR Surveys

Transect	Mean High Water Beach Width (feet) [1]											Landward Limit of Sand (offset from origin) [2]
	Sep 2014 [4]	May 2016 [4]	Nov 2016 [3]	Dec 2016 [3]	May 2017 [3]	Nov 2017 [3]	Aug 2018 [4]	Oct 2022 [3]	May 2023 [3]	Oct 2023 [3]	May 2024 [3]	
DB-1850 North Doheny State Beach	--	100	--	--	--	--	124	156	175	181	148	Campground (50 ft)
DB-1805 South Doheny State Beach	--	144	--	--	--	--	130	92	109	116	110	Bike Path (-27 ft)
SC-1720 Shorecliffs	--	188	--	--	--	--	141	146	163	149	164	Railroad Pad (-45 ft)
SC-1705 Capistrano Shores manufactured home community	--	53	7	25	20	4	3	0	15	2	15	Revetment (16 ft)
SC-1702 North Beach	--	96	135	119	125	141	147	134	116	143	107	Revetment (40 ft)
SC-1700 North Beach	--	114	142	130	126	139	--	131	123	132	109	Railroad Fence (-3 ft)
SC-1695 Dije Court	--	29	17	26	24	7	13	0	21	0	19	Revetment (218 ft)
SC-1680 Linda Lane	--	51	--	--	--	--	83	96	64	124	49	Revetment (24 ft)
SC-1660 T-Street	--	129	--	--	--	--	--	159	161	209	153	Light Post (0 ft)
SC-1645 Lost Winds	163	173	--	--	--	--	--	194	163	179	176	Dune (22 ft)
SC-1623 San Clemente State Beach	173	148	--	--	--	--	171	148	113	137	102	Dune/Revetment (48 ft)
SC-1605 Cottons	81	122	--	--	--	--	--	0	6	12	18	Revetment (18 ft)

Notes:
[1] Color-coded cells illustrate each beach width value according to the color scale shown to the right.
[2] Horizontal distance from transect origin to landward limit of sand. A (+) positive value indicates the landward limit of sand is seaward of transect origin. A (-) negative value indicates landward limit of sand is landward of transect origin.
[3] Beach width derived from beach profile survey data.
[4] Beach width derived from LiDAR data (NOAA, 2023b).



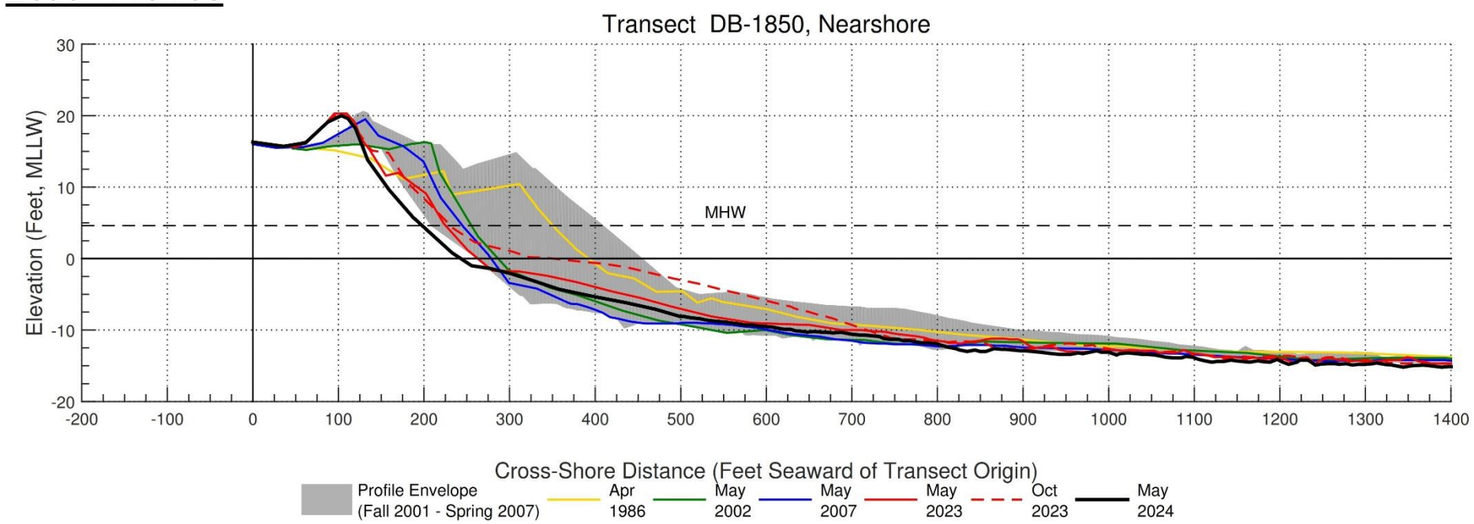
APPENDIX C

BEACH PROFILE TRANSECT SYNOPSIS PLATES

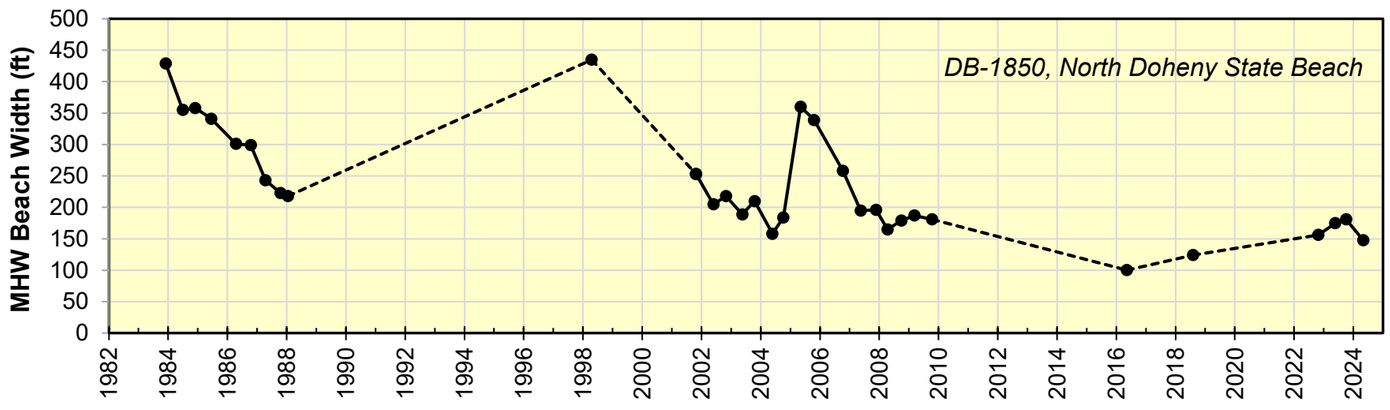
Transect DB-1850: North Doheny State Beach

COASTAL FRONTIERS

Beach Profiles



MHW Beach Width



Beach Width

May 2024 = 148 ft

Historical Range (Spring only, 1984-2024) = 100 – 435 ft

Summer Seasonal Change (May 2023 - Oct 2023) = +6 ft

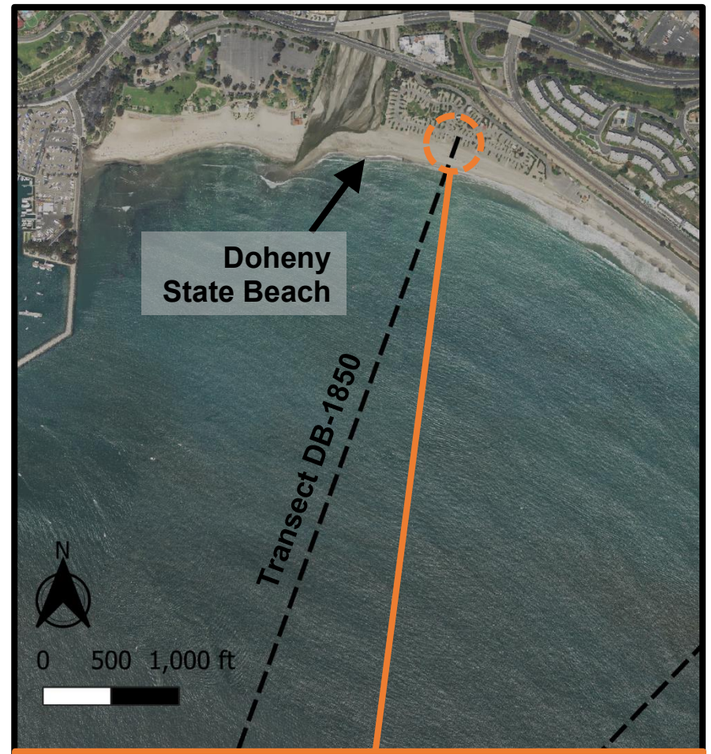
Winter Seasonal Change (Oct 2023 – May 2024) = -33 ft

Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	-0.9 ft/yr	-176 ft
Oct. 2001 – May 2024:	-3.9 ft/yr	-105 ft

** Trend derived using linear regression*

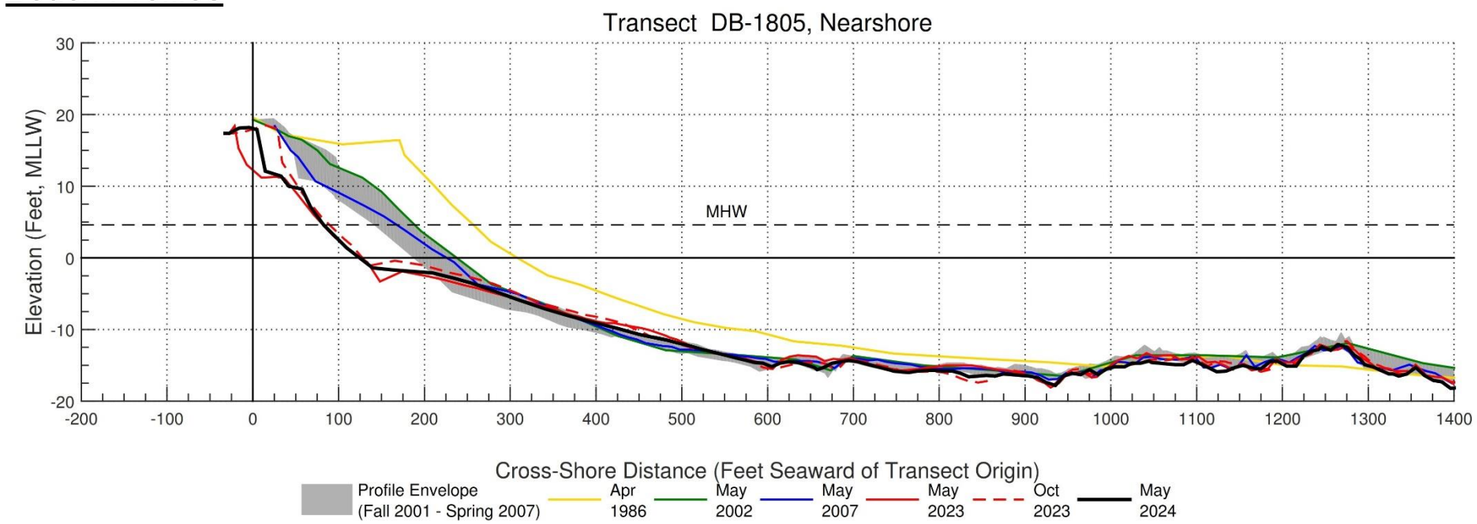
Location Map



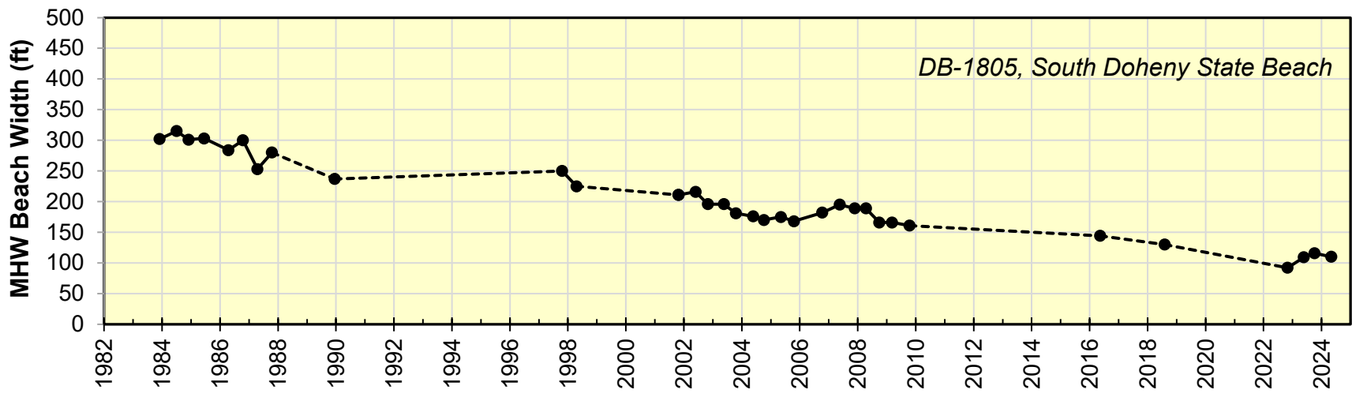
Transect DB-1805: South Doheny State Beach

COASTAL FRONTIERS

Beach Profiles



MHW Beach Width



Beach Width

May 2024 = 110 ft

Historical Range (Spring only, 1983-2024) = 109 – 315 ft

Summer Seasonal Change (May 2023 – Oct 2023) = +7 ft

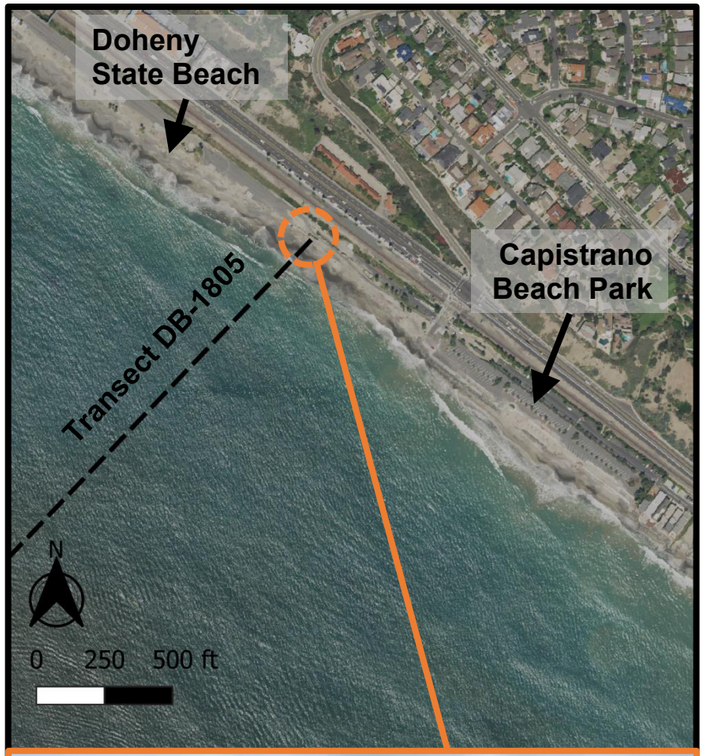
Winter Seasonal Change (Oct 2023 – May 2024) = -6 ft

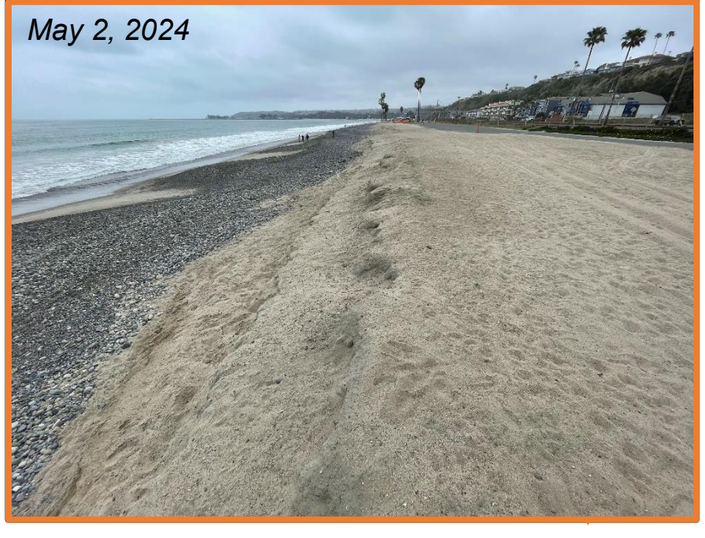
Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	-5.0 ft/yr	-91 ft
Oct. 2001 – May 2024:	-4.2 ft/yr	-101 ft

** Trend derived using linear regression*

Location Map

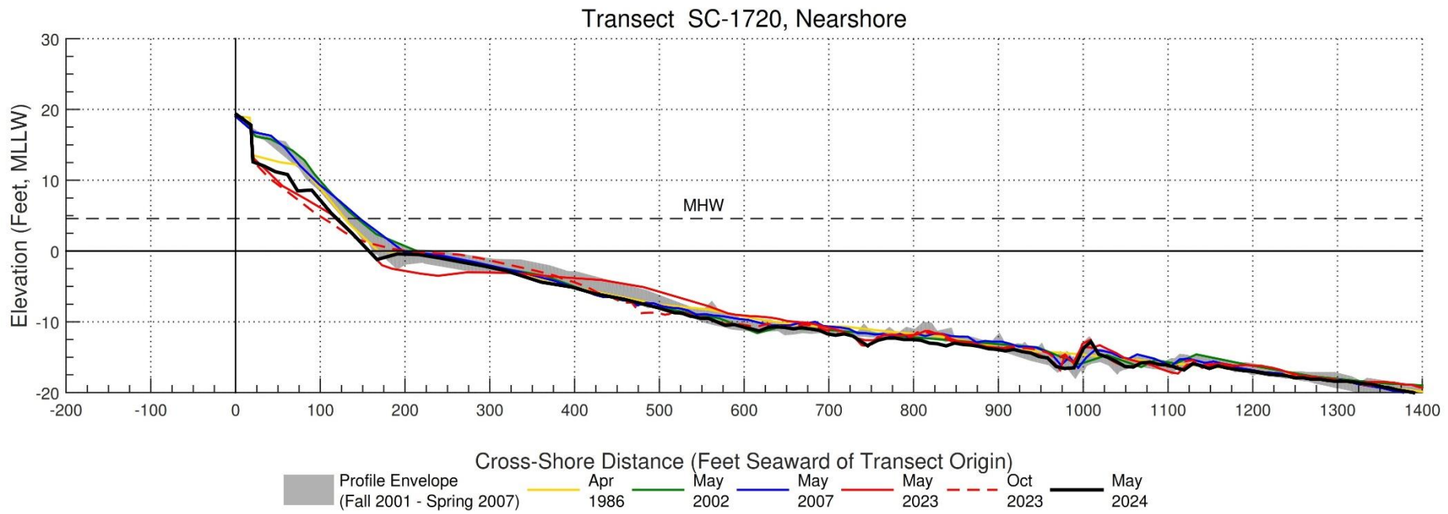




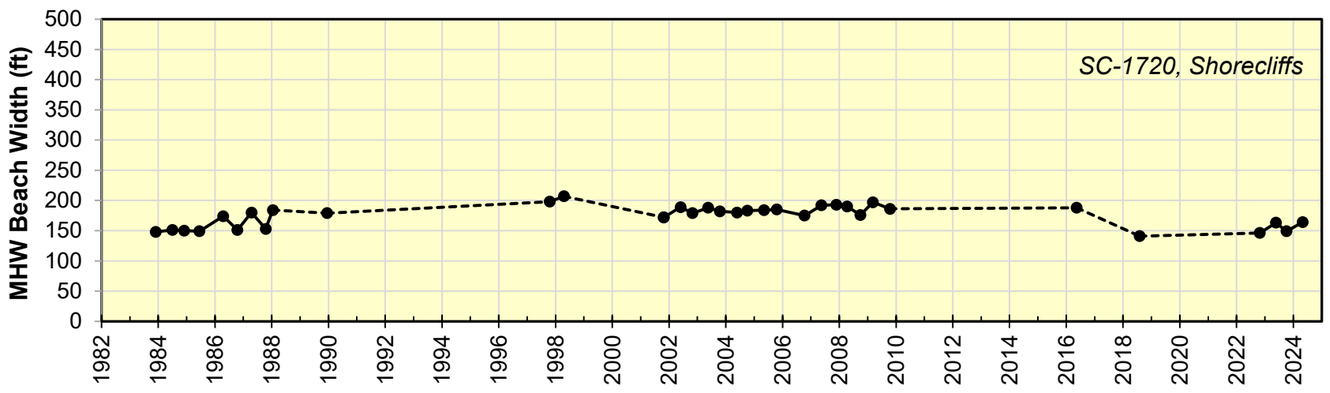
Transect SC-1720: Shorecliffs

COASTAL FRONTIERS

Beach Profiles



MHW Beach Width



Beach Width

May 2024 = 164 ft

Historical Range (Spring only, 1984-2024) = 149 – 207 ft

Summer Seasonal Change (May 2023 – Oct 2023) = -14 ft

Winter Seasonal Change (Oct 2023 – May 2024) = +15 ft

Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	+2.4 ft/yr	+24 ft
Oct. 2001 – May 2024:	-1.4 ft/yr	-8 ft

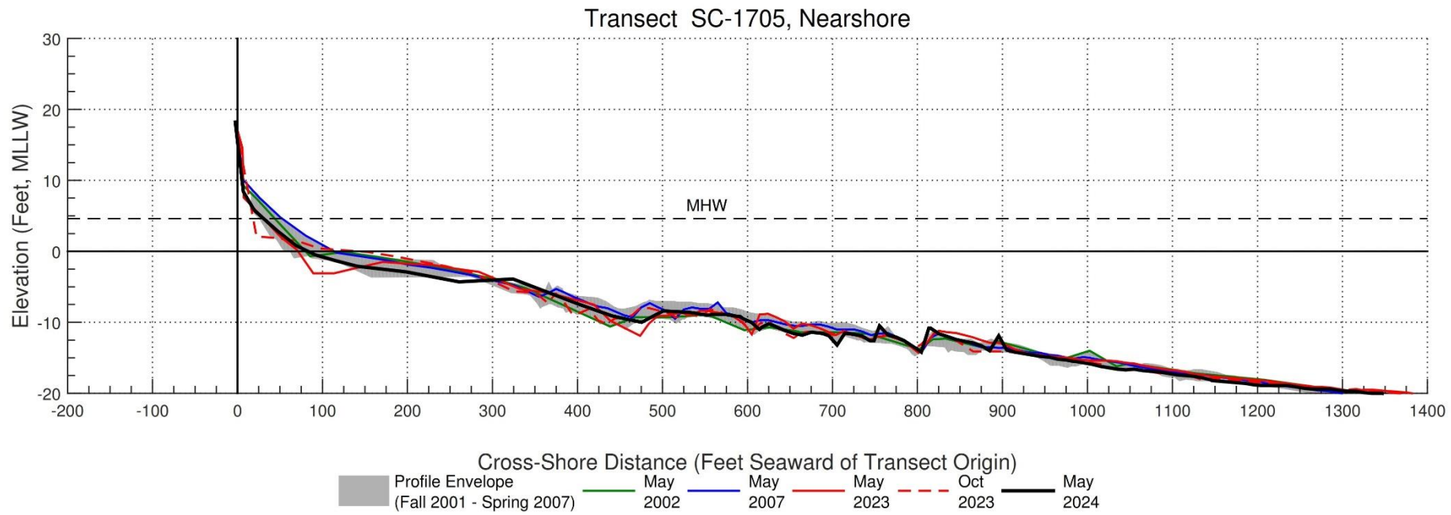
** Trend derived using linear regression*

Location Map

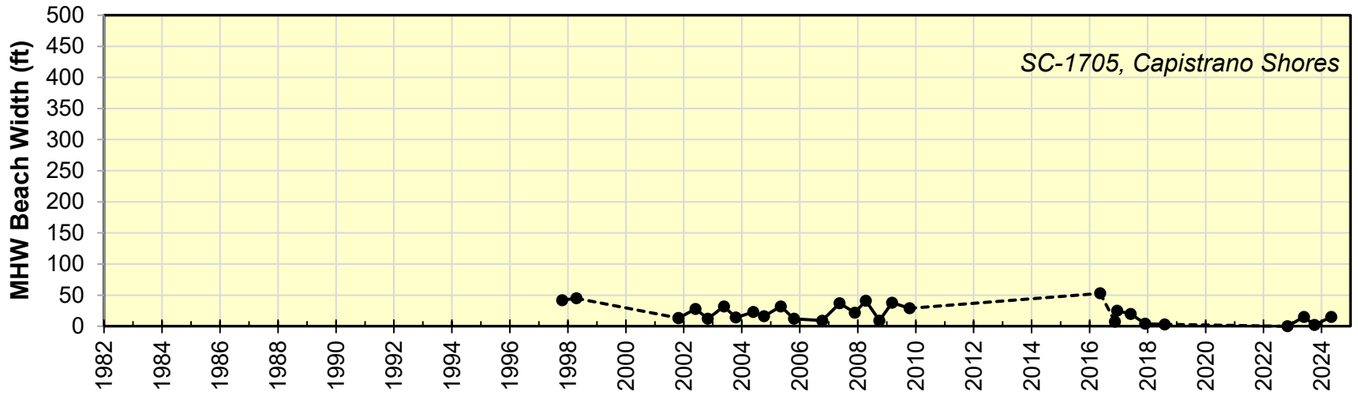
Transect SC-1705: Capistrano Shores Manufactured Home Community

COASTAL FRONTIERS

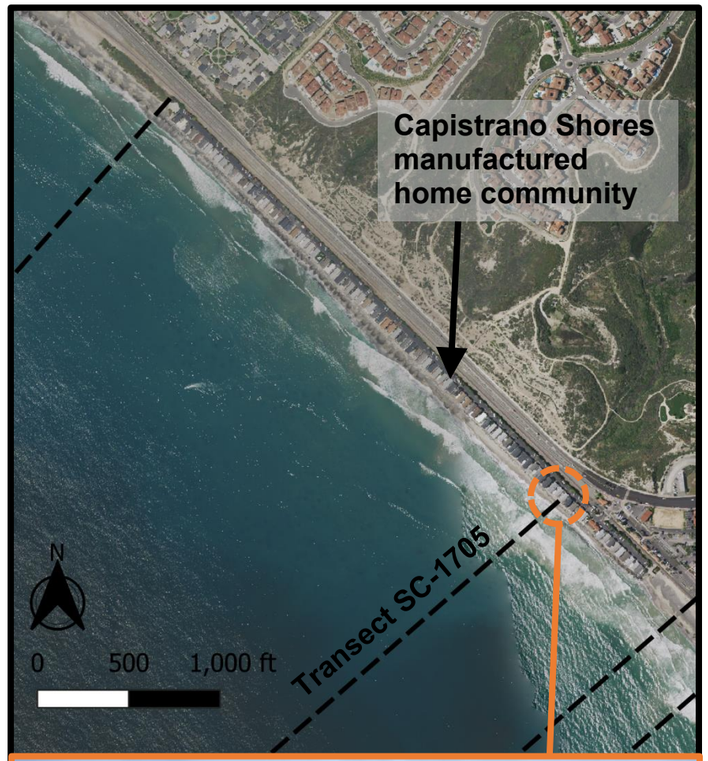
Beach Profile



MHW Beach Width



Location Map



Beach Width

May 2024 = 15 ft

Historical Range (Spring only, 1998-2024) = 15 – 53 ft

Summer Seasonal Change (May 2023 – Oct 2023) = -13 ft

Winter Seasonal Change (Oct 2023 – May 2024) = +13 ft

Beach Width Trends

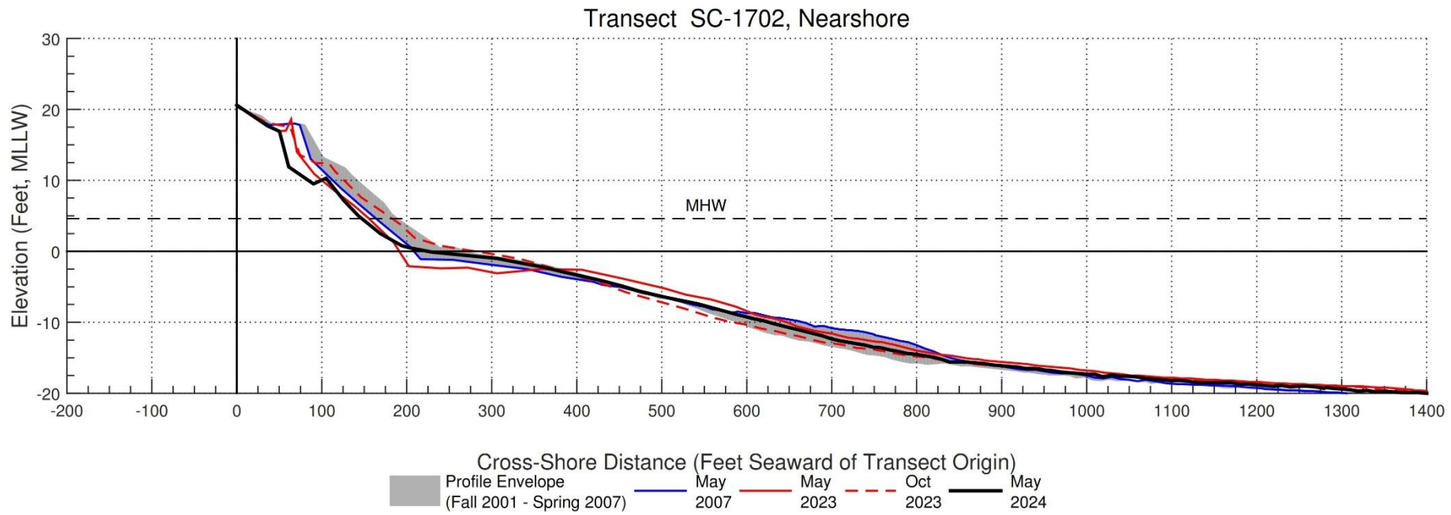
Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	--	--
Oct. 2001 – May 2024:	-0.6 ft/yr	+2 ft

** Trend derived using linear regression*

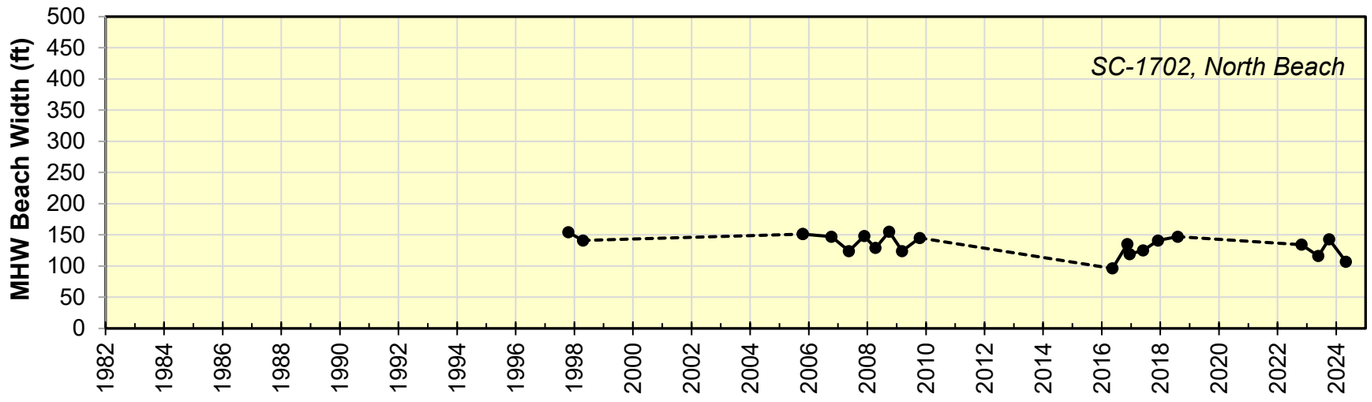
Transect SC-1702: North Beach

COASTAL FRONTIERS

Beach Profiles



MHW Beach Width



Beach Width

May 2024 = 107 ft

Historical Range (Spring Only, 1998-2024) = 96 – 141 ft

Summer Seasonal Change (May 2023 – Oct 2023) = +27 ft

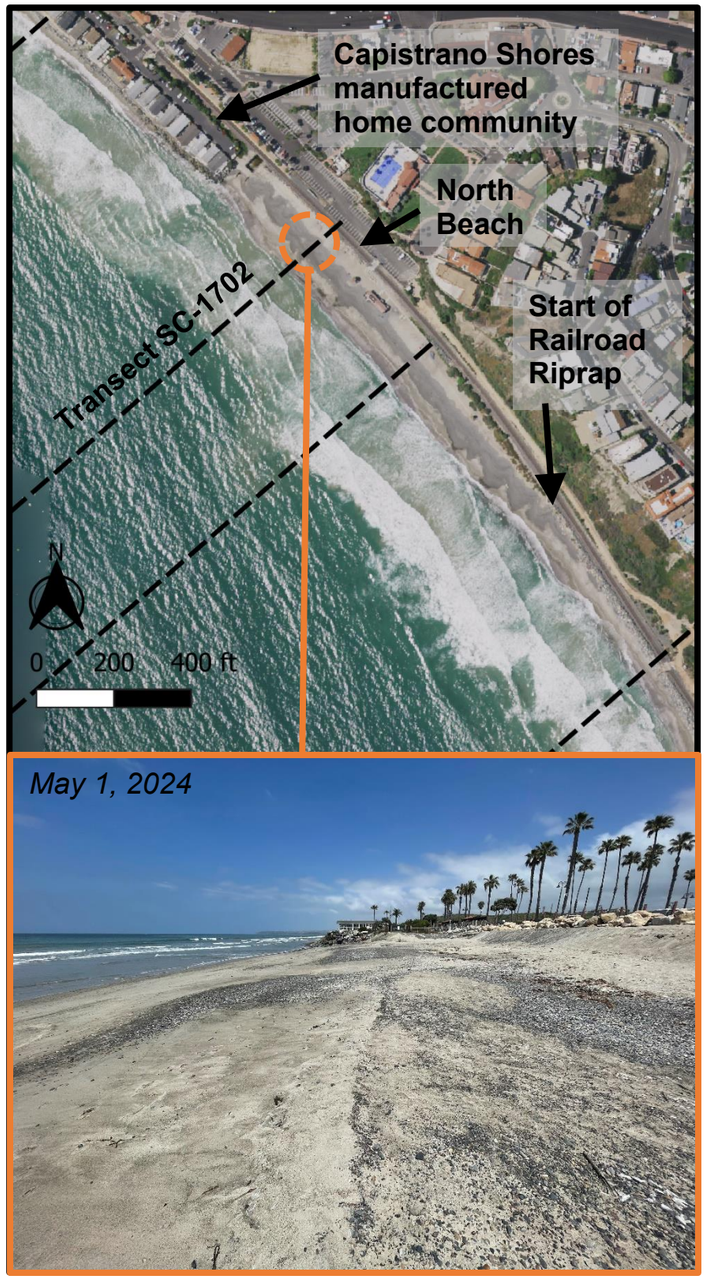
Winter Seasonal Change (Oct 2023 – May 2024) = -36 ft

Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	--	--
Oct. 2001 – May 2024:	--	--

** Trend derived using linear regression*

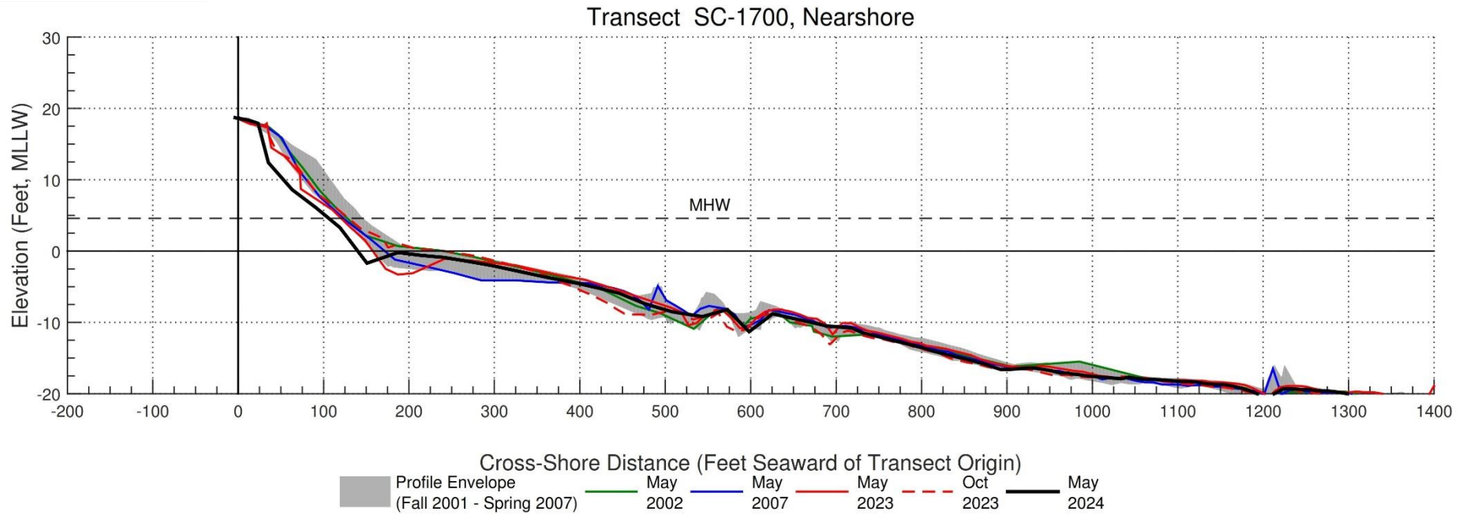
Location Map



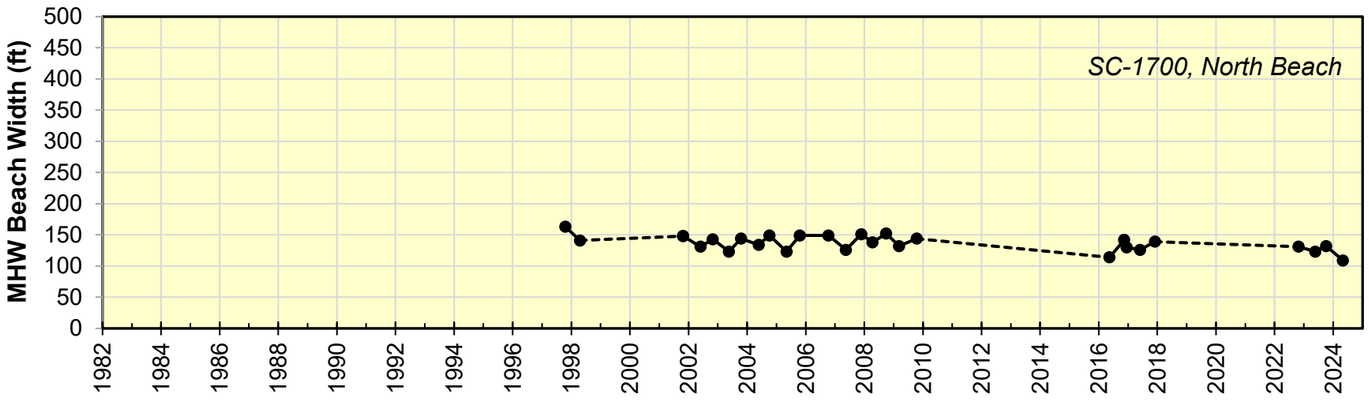
Transect SC-1700: North Beach

COASTAL FRONTIERS

Beach Profiles



MHW Beach Width



Beach Width

May 2024 = 109 ft *(Narrowest on Record)*

Historical Range (Spring only, 1998-2024) = 109 – 141 ft

Summer Seasonal Change (May 2023 – Oct 2023) = +9 ft

Winter Seasonal Change (Oct 2023 – May 2024) = -23 ft

Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	--	--
Oct. 2001 – May 2024:	-0.8 ft/yr	-39 ft

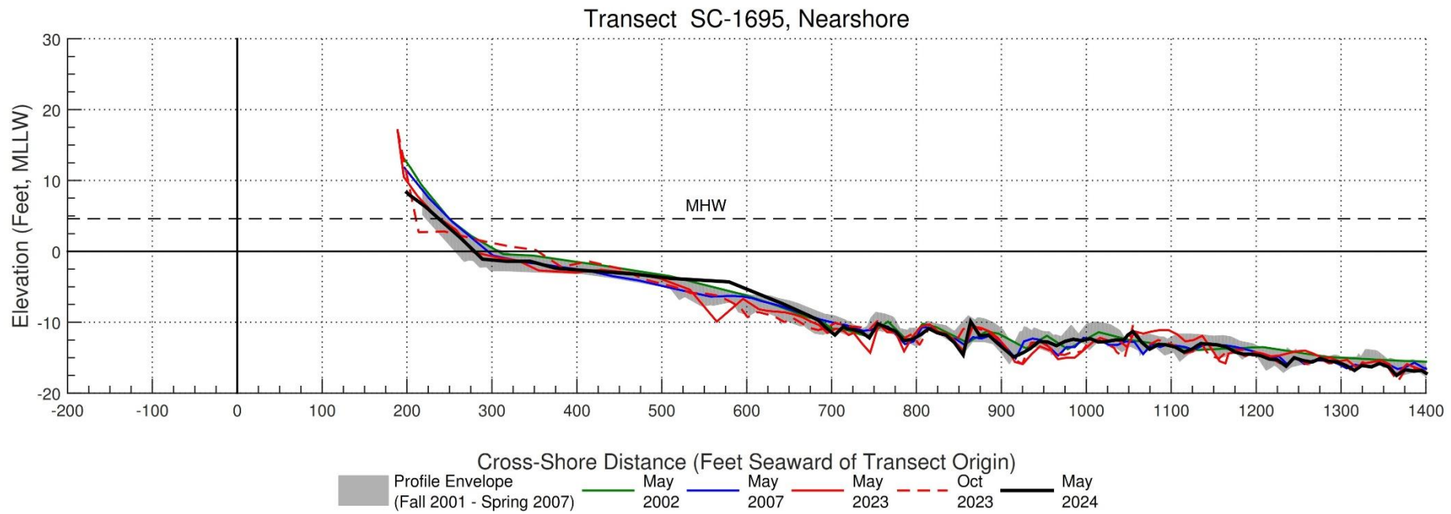
** Trend derived using linear regression*

Location Map

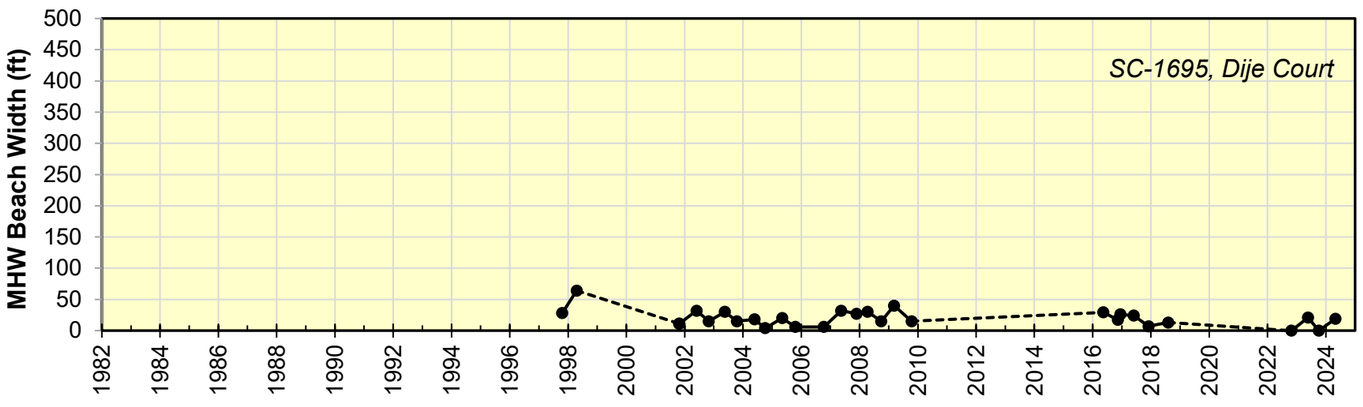
Transect SC-1695: Dije Court

COASTAL FRONTIERS

Beach Profile



MHW Beach Width



Beach Width

May 2024 = 19 ft

Historical Range (Spring only, 1998-2024) = 18 – 64 ft

Summer Seasonal Change (May 2023 – Oct 2023) = -21 ft

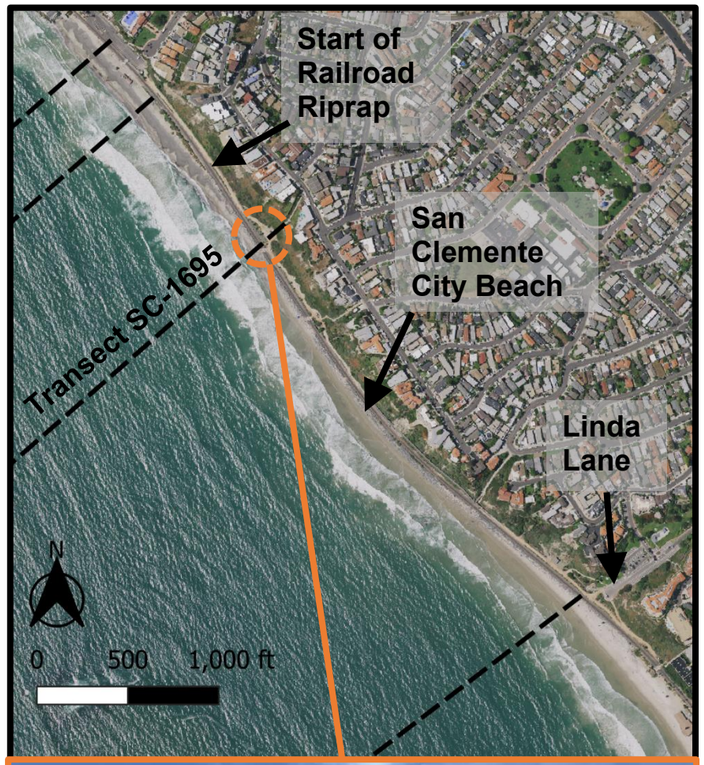
Winter Seasonal Change (Oct 2023 – May 2024) = +19 ft

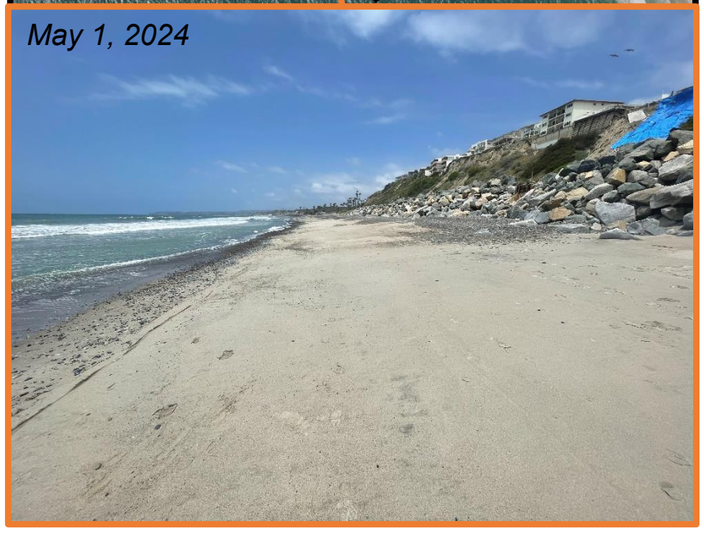
Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	--	--
Oct. 2001 – May 2024:	-0.3 ft/yr	8 ft

** Trend derived using linear regression*

Location Map

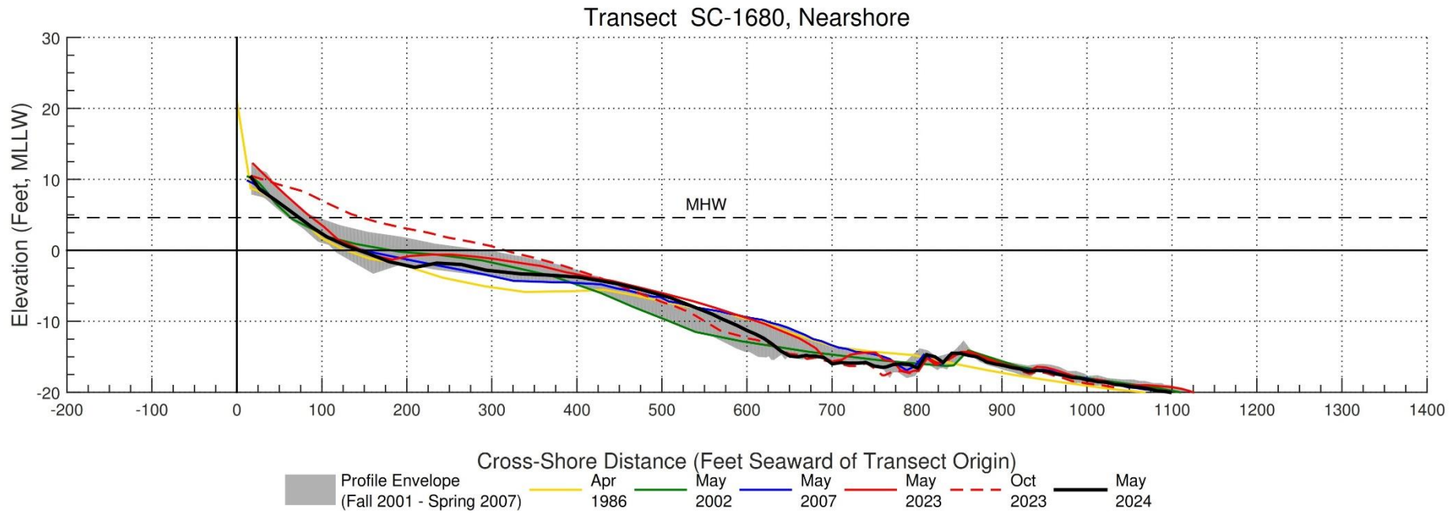




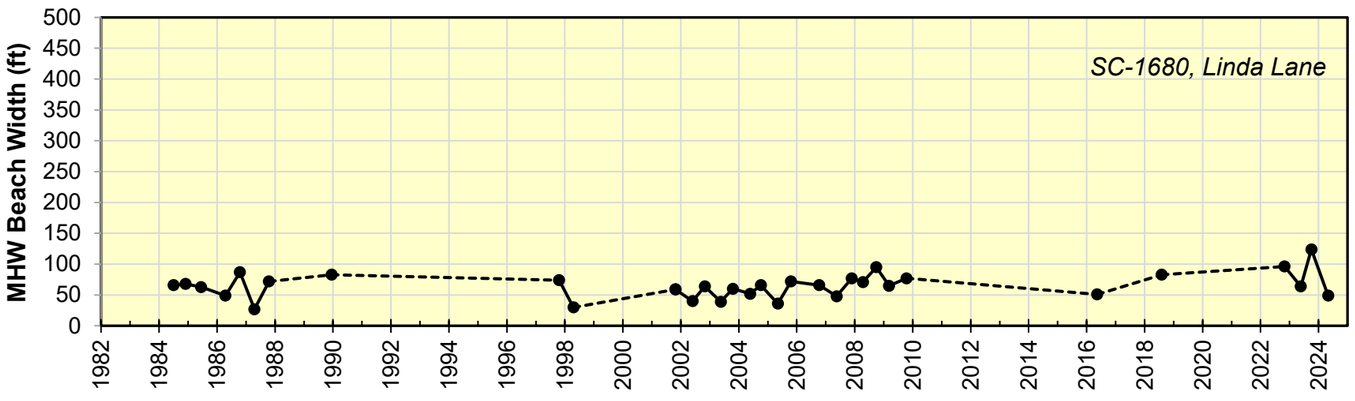
Transect SC-1680: Linda Lane

COASTAL FRONTIERS

Beach Profile



MHW Beach Width



Beach Width

May 2024 = 49 ft

Historical Range (Spring only, 1984-2024) = 27 – 71 ft

Summer Seasonal Change (May 2023 – Oct 2023) = +60 ft

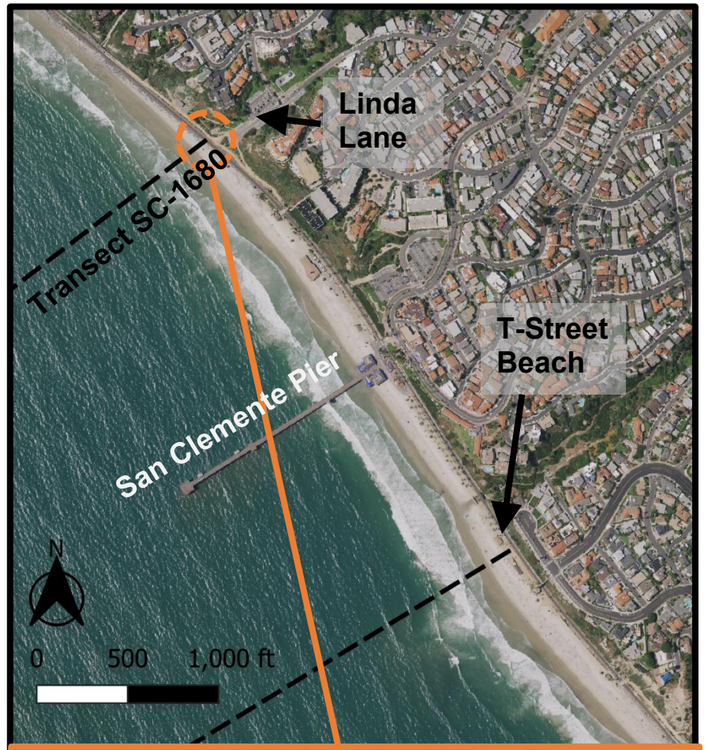
Winter Seasonal Change (Oct 2023 – May 2024) = -75 ft

Beach Width Trends

Period	Trend*	Net Change
Jul. 1984 – Oct. 2001:	-0.6 ft/yr	-7 ft
Oct. 2001 – May 2024:	+1.3 ft/yr	-10 ft

** Trend derived using linear regression*

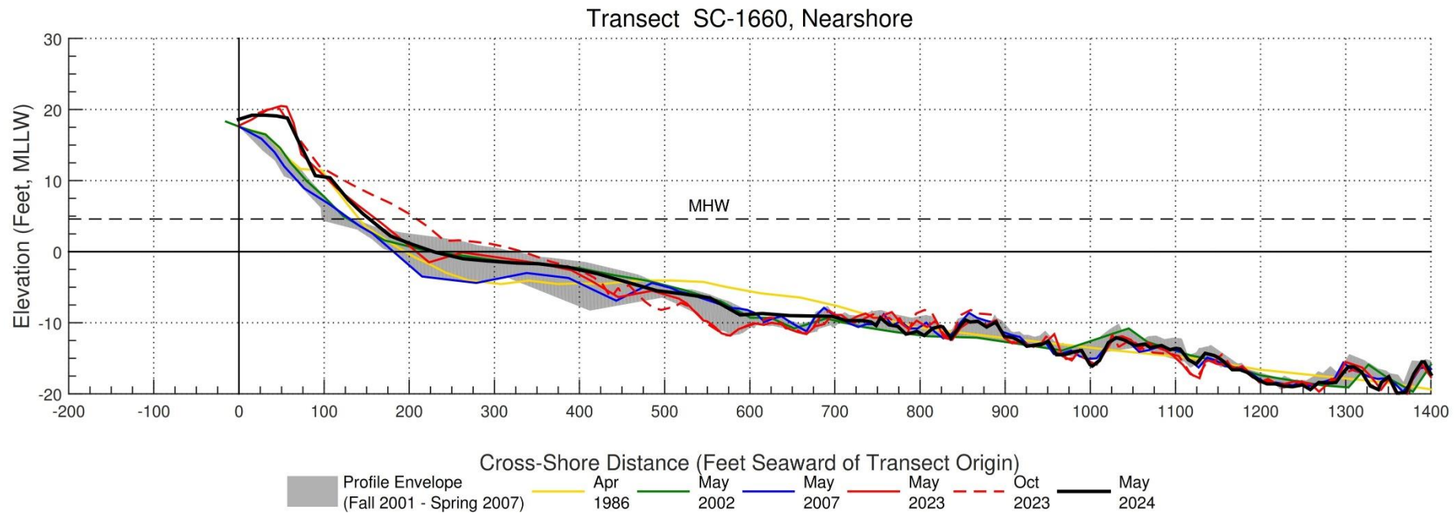
Location Map



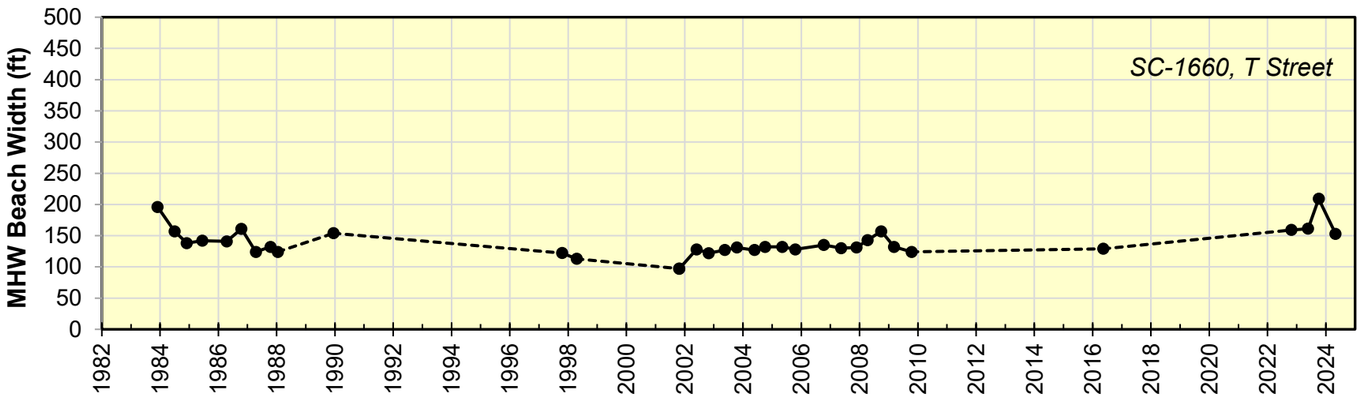
Transect SC-1660: T-Street

COASTAL FRONTIERS

Beach Profile



MHW Beach Width



Beach Width

May 2024 = 153 ft

Historical Range (Spring only, 1984-2024) = 113 – 161 ft

Summer Seasonal Change (May 2023 – Oct 2023) = +48 ft

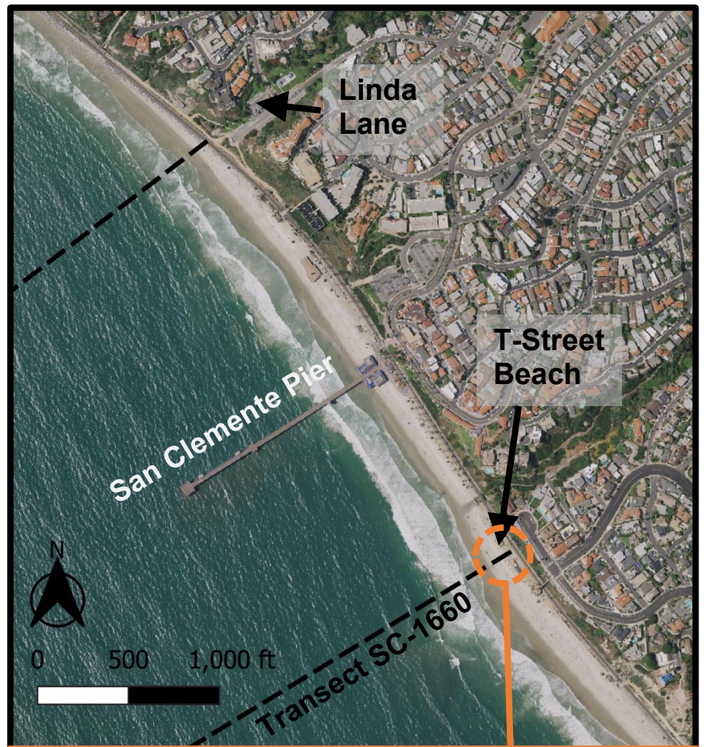
Winter Seasonal Change (Oct 2023 – May 2024) = -56 ft

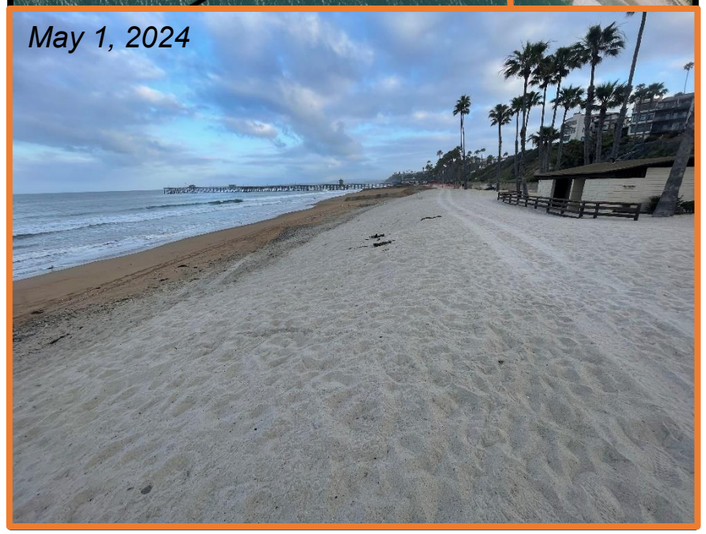
Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	-3.1 ft/yr	-99 ft
Oct. 2001 – May 2024:	+2.2 ft/yr	+56 ft

** Trend derived using linear regression*

Location Map

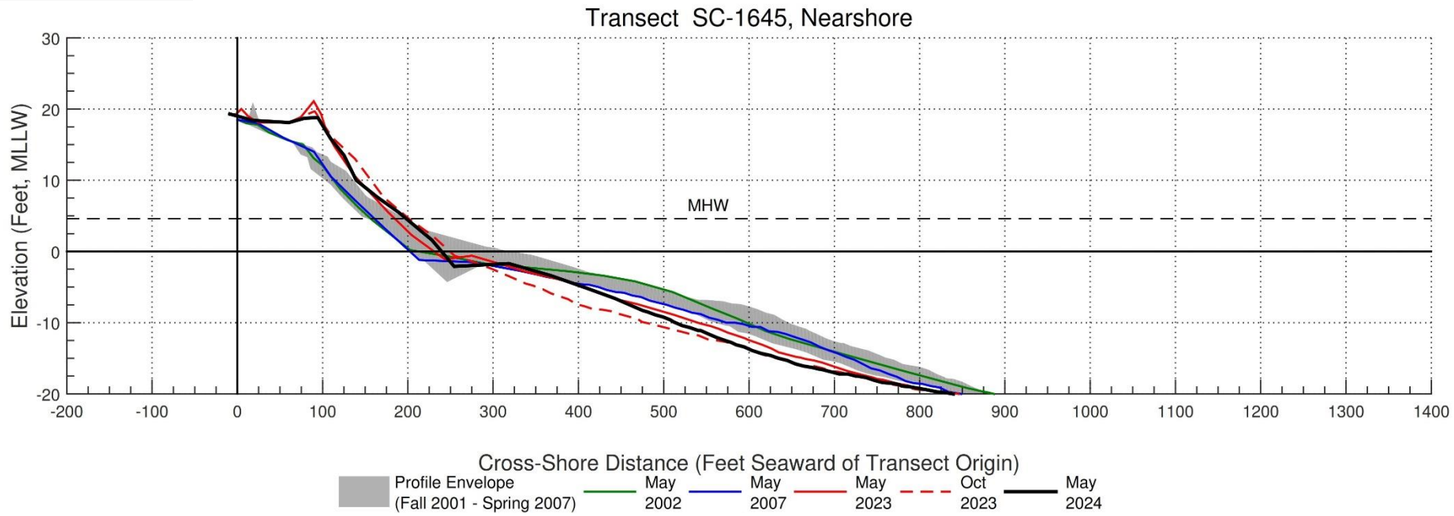




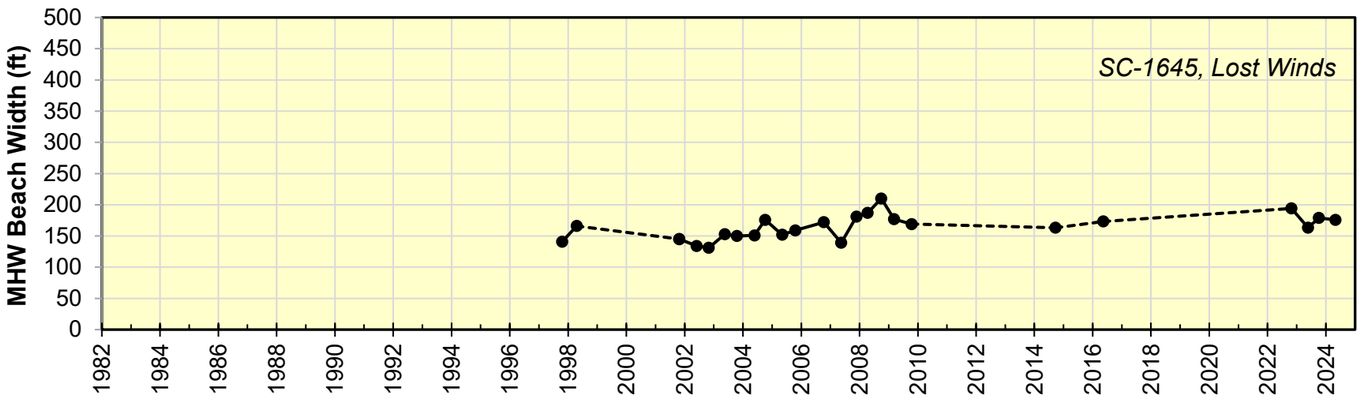
Transect SC-1645: Lost Winds

COASTAL FRONTIERS

Beach Profile



MHW Beach Width



Beach Width

May 2024 = 176 ft

Historical Range (Spring only, 1998-2024) = 134 – 187 ft

Summer Seasonal Change (May 2023 – Oct 2023) = +16 ft

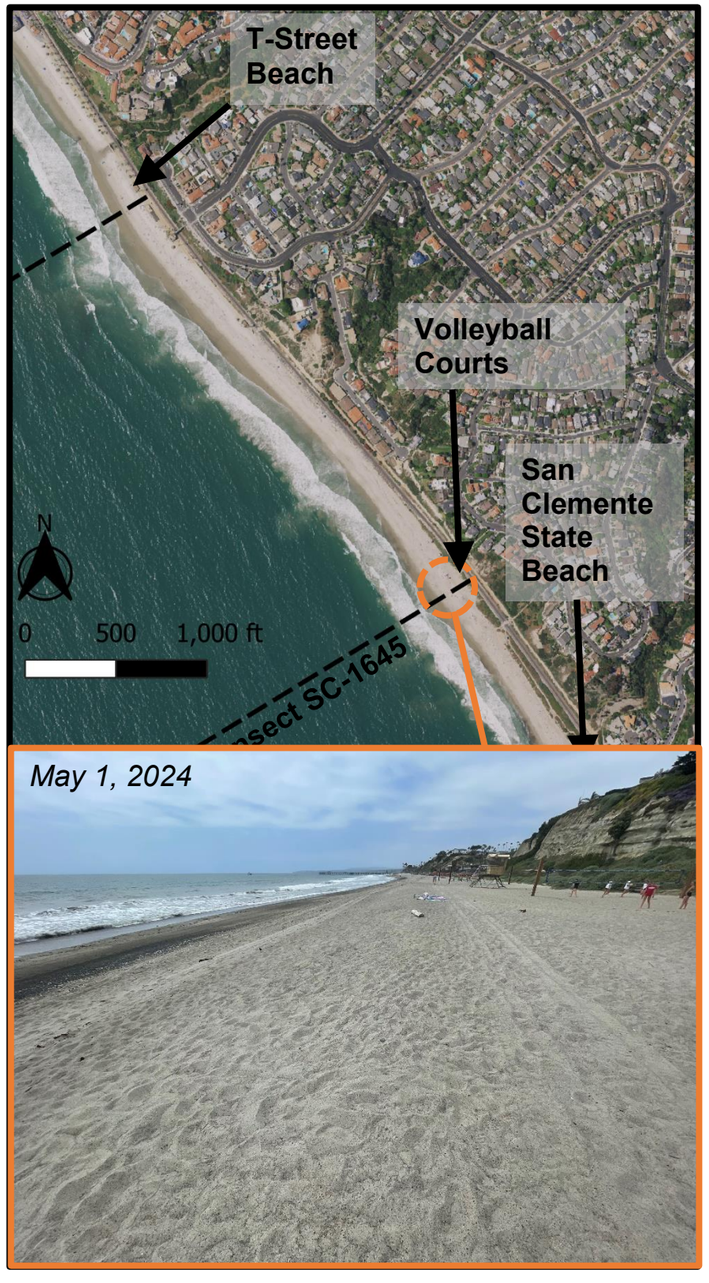
Winter Seasonal Change (Oct 2023 – May 2024) = -3 ft

Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	--	--
Oct. 2001 – May 2024:	+1.3 ft/yr	+31 ft

** Trend derived using linear regression*

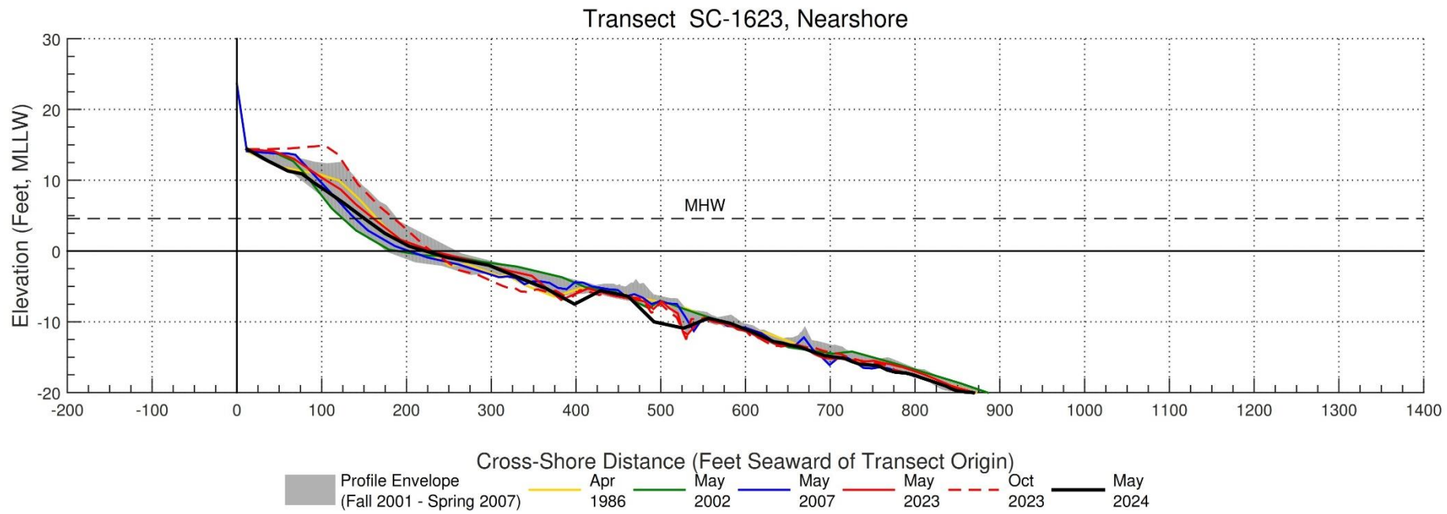
Location Map



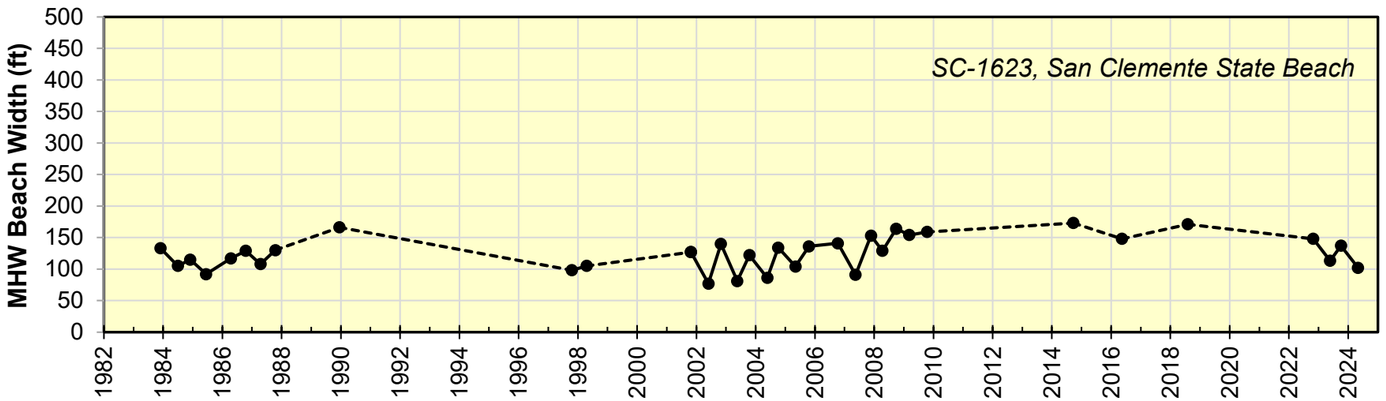
Transect SC-1623: San Clemente State Beach

COASTAL FRONTIERS

Beach Profile



MHW Beach Width



Beach Width

May 2024 = 102 ft

Historical Range (Spring only, 1984-2024) = 77 – 154 ft

Summer Seasonal Change (May 2023 – Oct 2023) = +24 ft

Winter Seasonal Change (Oct 2023 – May 2024) = -35 ft

Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	-0.2 ft/yr	-6 ft
Oct. 2001 – May 2024:	+1.1 ft/yr	-25 ft

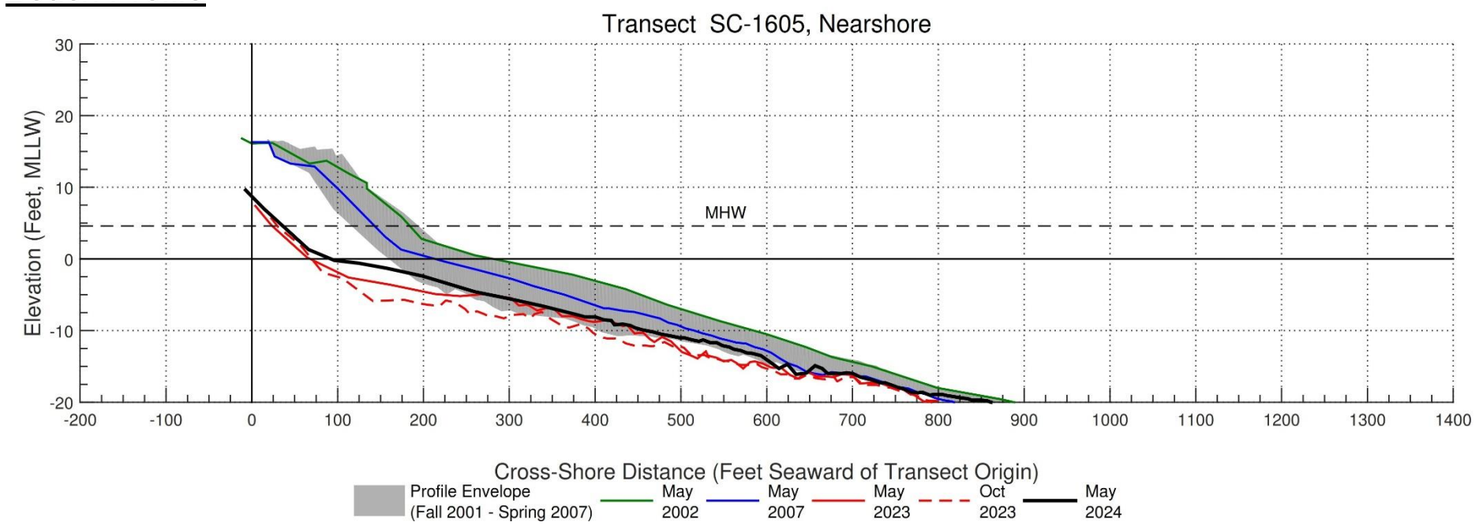
** Trend derived using linear regression*

Location Map

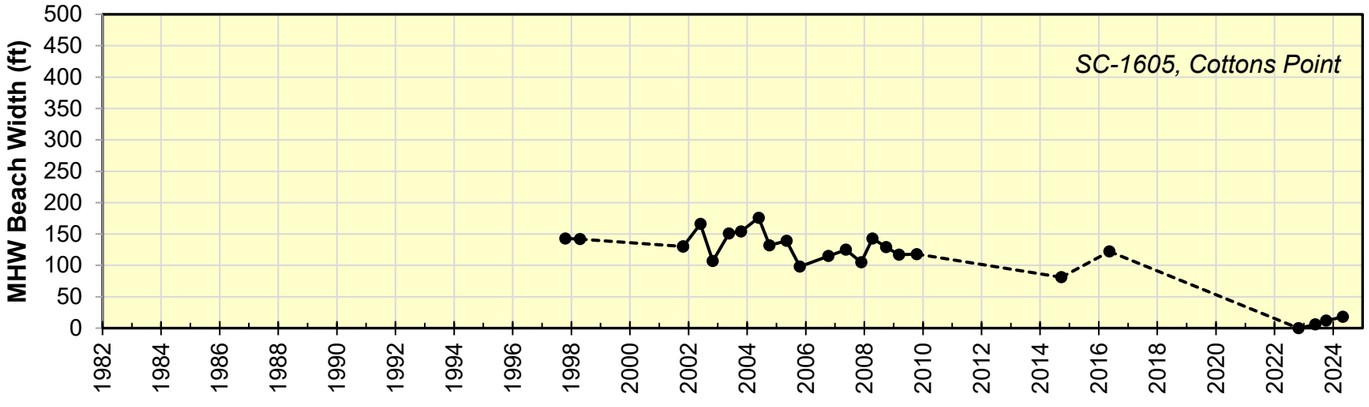
Transect SC-1605: Cottons Point

COASTAL FRONTIERS

Beach Profile



MHW Beach Width



Beach Width

May 2024 = 18 ft

Historical Range (Spring only, 1998-2024) = 6 – 176 ft

Summer Seasonal Change (May 2023 – Oct 2023) = -6 ft

Winter Seasonal Change (Oct 2023 – May 2024) = +6 ft

Beach Width Trends

Period	Trend*	Net Change
Dec. 1983 – Oct. 2001:	--	--
Oct. 2001 – May 2024:	-6.2 ft/yr	-112 ft

** Trend derived using linear regression*

Location Map