

COASTAL
FRONTIERS

July 3, 2013
CFC-888-12

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Subject: Broad Beach Spring 2013 Beach Profile Survey

Mr. Boudreau:

This letter report presents the methods and the results of the Spring 2013 beach profile survey at Broad Beach. The survey activities were conducted in May 2013. The sections that follow provide an overview of the beach profile survey program, discuss the field activities, present the results and offer observations regarding the state of the beaches. Beach profile plots accompany this report in Attachment A.

The vertical datum used throughout this report is National Ocean Service (NOS) Mean Lower Low Water (MLLW) for the 1983-2001 Epoch. Horizontal positions are given in U.S. Survey Feet relative to California State Plane Zone 5, NAD 83 (2000.35 epoch).

OVERVIEW

The initial beach profile survey conducted on behalf of the Trancas Property Owners Association was performed in Fall 2009. In Spring 2010 a temporary rock revetment was constructed along the majority of the length of Broad Beach. The revetment aimed to halt shoreline encroachment on the properties fronting Broad Beach. Subsequent beach profile surveys were performed in Fall 2010, Spring 2011, Fall 2011, Spring 2012, and Fall 2012. The primary objective of the beach profile survey program is to document the condition of the nearshore morphology in the study area.

The Spring 2013 survey program consisted of obtaining beach profile data along 16 shore-perpendicular transects from the backbeach offshore to a minimum depth of 40 ft (MLLW). The transect locations and approximate extent of the rock revetment are shown in Figure 1, with additional details provided in Table 1. Twelve of these transects had been surveyed previously as part of the current program and also by the US Army Corps of Engineers. The remaining four transects (411.7, 411.9, 412.3, and 412.5) were established and surveyed for the first time in support of this project in Spring 2013.

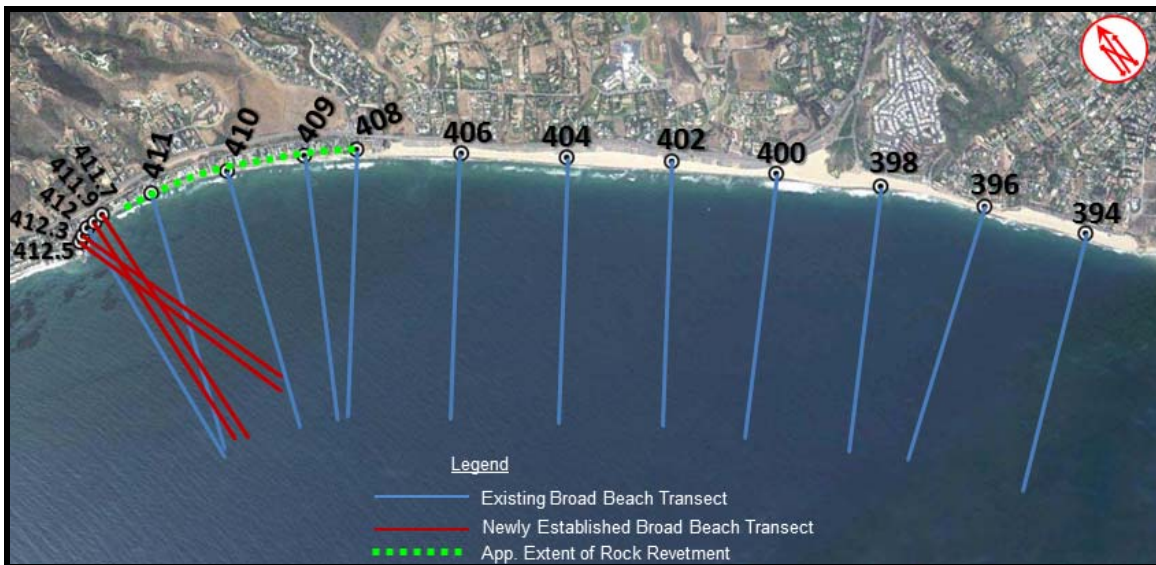


Figure 1. Broad Beach Overview Map

Table 1. Summary of Transect Locations

Transect Designation	Location	Origin ⁽¹⁾		Azimuth (° Grid)
		Northing	Easting	
394 ⁽²⁾	Westward Beach	1,824,802.19	6,316,011.35	231° 53' 23"
396 ⁽²⁾	Westward Beach	1,826,376.47	6,314,793.97	234° 31' 04"
398 ⁽²⁾	Zuma Beach	1,827,877.28	6,313,468.31	224° 30' 39"
400 ⁽²⁾	Zuma Beach	1,829,279.45	6,312,042.00	224° 30' 39"
402 ⁽²⁾	Zuma Beach	1,830,672.98	6,310,607.95	219° 40' 31"
404 ⁽²⁾	Zuma Beach	1,831,949.88	6,309,068.52	219° 40' 30"
406 ⁽²⁾	Zuma Beach	1,833,226.81	6,307,529.08	219° 40' 32"
408 ⁽²⁾	30756 Broad Beach Rd.	1,834,503.71	6,305,989.65	219° 40' 30"
409 ⁽²⁾	30916 Broad Beach Rd.	1,835,016.93	6,305,131.68	210° 40' 52"
410 ⁽²⁾	31108 Broad Beach Rd.	1,835,676.64	6,303,789.98	201° 22' 14"
411 ⁽²⁾	31324 Broad Beach Rd.	1,836,223.30	6,302,393.07	201° 22' 14"
411.7 ⁽³⁾	31438 Broad Beach Rd.	1,836,473.37	6,301,399.38	185° 15' 18"
411.9 ⁽³⁾	31460 Broad Beach Rd.	1,836,448.49	6,301,197.21	183° 43' 05"
412 ⁽²⁾	31506/31504 Victoria Pt. Rd.	1,836,448.10	6,301,017.78	186° 45' 28"
412.3 ⁽³⁾	31520 Victoria Point Rd.	1,836,380.35	6,300,859.18	159° 11' 06"
412.5 ⁽³⁾	31536/31532 Victoria Point Rd.	1,836,324.45	6,300,747.67	160° 34' 08"

Note: ⁽¹⁾ Horizontal datum is California State Plane, Zone 5, NAD83 (2000.35 epoch), with units expressed in U.S. Survey feet.

⁽²⁾ Historical transect used in Corps of Engineers surveys.

⁽³⁾ New transect surveyed for first time in May 2013.

SPRING 2013 BEACH PROFILE SURVEY

Transect Recovery and Establishment

The twelve historical transects included in the survey program were recovered on May 16 in conjunction with the topographic portion of the beach profile survey. These marks typically consisted of PK nails imbedded near the crest of the revetment, or the beachside path or asphalt comprising Westward Beach Road. The four transects surveyed for the first time under this program (411.7, 411.9, 412.3, and 412.5) were established using the Real Time Kinematic Global Positioning System (RTK GPS). Unlike the other sites, it was not possible to install survey markers due to lack of suitable substrate at the back beach. As such, these transects must be occupied using RTK GPS and nearby survey markers during each survey.

Beach Profile Data Acquisition

The bathymetric and topographic portions of the beach profile survey were conducted on May 16 and 17. Optimal conditions prevailed during the survey with waves typically less than 3 ft. Data were acquired along each transect from the backbeach or revetment crest to the offshore terminus (40 ft isobath, MLLW Datum).

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

Bathymetric data were collected with a digital acoustic echo sounder operated from a shallow-draft inflatable survey vessel. A dynamic motion sensor, which provides real-time corrections to the echo sounder for wave-induced vessel heave, also was utilized. A GPS receiver was used to determine the position of each sounding. To improve the accuracy of each position, differential corrections transmitted in real-time from U.S. Coast Guard beacons were utilized (DGPS). All systems were interfaced to a laptop computer using the Hypack Max software package.

The boat traveled along each transect from the offshore terminus to the surf zone guided by DGPS navigation. Soundings were acquired on a continuous basis (approximately 3 soundings per second), while positions were recorded at 1-second intervals. The DGPS position data and sounding data were merged using the Hypack software, with interpolated positions being assigned to the soundings acquired between position fixes.

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

Beach Profile Data Reduction

The data from the wading portion of the survey were processed using software developed by Trimble. The raw total station data were read by the software, and the coordinates and elevation of each data point were calculated and inserted into a CAD drawing.

The raw data from the bathymetric portion of the survey consisted of Hypack files containing the position data and heave-compensated soundings. These data were edited for outliers using the Hypack Single-Beam Processing Module. Corrections for the draft of the transducer and the speed of sound in sea water then were applied to the measured depths. The corrected soundings were adjusted to MLLW utilizing tide measurements made by the U.S. Department of Commerce, NOAA, at Santa Monica.

The adjusted soundings were thinned to a nominal interval of 10 ft to produce a file size suitable for developing beach profile plots. The resulting x, y, z data (easting, northing, and elevation) were inserted into the CAD drawing containing the wading data. As indicated above, the field work was conducted in such a manner as to provide substantial overlap between the wading and bathymetric portions of the survey. The processed data were examined in this region to insure 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 single digital file.

Based on past experience, the vertical accuracy of the processed soundings is approximately ± 0.5 ft. According to the Hemisphere GPS equipment specifications, the accuracy of horizontal positions obtained in the manner described above is less than 2.0 ft. The electronic total station used to conduct the survey is capable of measuring elevation differences to within ± 0.1 ft and ranges to within ± 0.5 ft. However, because the swimmer was subjected to waves and currents in the surf zone, the horizontal accuracy perpendicular to each transect (parallel to the shoreline) varied from minimal at short ranges to approximately ± 15 ft at the offshore end.

RESULTS

The beach profile plots developed from the survey data are provided in Attachment A. Data from the October 2009, November 2010, May 2011, October 2011, May 2012, and November 2012 survey efforts also are included on each plot. The range on the profile plot represents the distance in feet seaward of the transect origin (Table 1) measured along the transect alignment. The elevations are given in feet relative to MLLW for the 1983-2001 Epoch.

The beach profile data, which include ASCII files of: (1) range and elevation for each profile, and (2) northing, easting, and elevation triplets (n,e,z) for the entire survey are included as separate attachments to this report transmittal. In the case of the geo-referenced data, the horizontal positions are in U.S. Survey Feet relative to California State Plane Zone 5, NAD 83 (2000.35 epoch). Elevations are given in feet relative to MLLW for the 1983-2001 Epoch.

It is cautioned that the vertical datum utilized for the recent (2002 to 2005) US Army Corps of Engineers surveys at the Broad Beach sites was MLLW for the 1960-1978 Epoch (the previous National Tidal Datum Epoch). As a result, these Corps surveys are not directly comparable with those provided herein. The difference attributable to the tidal datum epoch is small in the project area, amounting to 0.13 ft. However, to facilitate a direct comparison with the included survey data, the US Army Corps of Engineers data (2002 and 2005) should be adjusted to the new Tidal Datum Epoch by subtracting 0.13 ft from all elevations.

OBSERVATIONS

A detailed analysis of the state of the coast at Broad Beach exceeds the present Scope of Work. General observations are offered, however, based on the profile plots presented in Attachment A, and the Mean Sea Level (MSL) beach width data shown in Table 2. The MSL beach width was computed as the horizontal distance from the landward extent of the sandy beach to the point at which the beach profile intersected the plane of the MSL Datum, which lies 2.79 ft above MLLW in the project area. Where applicable, the landward extent of the beach profile data is measured from the junction of the sand with the newly installed rock revetment. It is important to note that beach width values reported here-in reference a consistent landward point at each transect (established in November 2010).

1. MSL Beach Widths (Table 2): At the time of the May 2013 survey, beach widths ranged from 23 ft at Transect 412.3 to 267 ft at Transect 398. The average beach width in the Broad Beach area (Transects 409 through 412.5) was 46 ft.

Table 2. MSL Beach Widths Derived From Profile Data ^(1,2)

Transect	MSL Beach Width (ft) ^(1,2)							Landward Boundary
	Oct 2009	Nov 2010	May 2011	Oct 2011	May 2012	Nov 2012	May 2013	
394	-	-	-	-	-	248	259	Asphalt Parking Lot
396	-	-	-	-	-	90	119	Westward Beach Rd.
398	-	-	-	-	-	281	267	Westward Beach Rd.
400	-	-	-	-	-	273	230	Concrete Wall
402	-	-	-	-	-	257	218	Concrete Wall
404	-	-	-	-	-	232	199	Concrete Wall
406	-	-	-	-	-	205	204	Concrete Wall
408	217	185	180	197	179	181	175	Concrete Wall
409	41	30	15	28	39	18	35	Rock Revetment/ Sand
410	59	47	26	63	51	30	47	Rock Revetment/ Sand
411	51	52	22	79	37	41	47	Rock Revetment/ Sand
411.7 ⁽³⁾	-	-	-	-	-	-	76	Sand/Vegetation
411.9 ⁽³⁾	-	-	-	-	-	-	54	Landward Edge of Sand
412	32	36	31	27	40	33	40	Rock Revetment/ Sand
412.3 ⁽³⁾	-	-	-	-	-	-	23	Landward Edge of Sand
412.5 ⁽³⁾	-	-	-	-	-	-	42	Landward Edge of Sand

Notes:

- ⁽¹⁾ Mean Sea Level (MSL) lies 2.79 ft above NOS MLLW Datum.
- ⁽²⁾ MSL beach width reckoned from the landward extent of the sandy beach.
- ⁽³⁾ New transect surveyed for first time in May 2013.

Table 3. Changes in Beach Width Derived From Profile Data ^(1, 2)

Transect	MSL Beach Width Changes (ft)	
	Seasonal	Annual
	Nov 2012 to May 2013	May 2012 to May 2013
394	11	-
396	29	-
398	-14	-
400	-43	-
402	-39	-
404	-33	-
406	-1	-
408	-6	-4
409	17	-4
410	17	-4
411	6	10
411.7 ⁽³⁾	-	-
411.9 ⁽³⁾	-	-
412	7	0
412.3 ⁽³⁾	-	-
412.5 ⁽³⁾	-	-

Notes:

- ⁽¹⁾ Mean Sea Level (MSL) lies 2.79 ft above NOS MLLW Datum.
- ⁽²⁾ MSL beach width reckoned from the landward extent of the sandy beach.
- ⁽³⁾ New transect surveyed for first time in May 2013.

2. Winter Seasonal Changes (Table 3): During the six-month period encompassing the 2012-2013 winter season (November 2012 to May 2013), shoreline changes were mixed at the 12 sites for which data are available. The MSL shoreline retreated at four transects, remained essentially unchanged (10 ft or less) at four sites, and advanced at the remaining four locations. The greatest loss (43 ft) occurred at Transect 400, while the largest gain (17 ft) was measured at Transects 409 and 410. The average beach width change for the four transects at Broad Beach (Transects 409 through 412) was a gain of 12 ft.

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3. Annual Changes (Table 3): During the one-year period between May 2012 and May 2013, the MSL shoreline remained essentially unchanged (10 ft or less) at the five sites for which data are available.
4. Profile Changes (Attachment A): Comparison of Fall 2012 and Spring 2013 profiles at the Zuma and Westward Beach sites (Transects 394 to 406) suggests a typical pattern of cross-shore sediment exchange during the winter wave season (November to May). This pattern generally consisted of above-water erosion accompanied by sediment accumulation in depths typically between -2 ft and -18 ft. At the Broad Beach sites (Transects 408 to 412), the above-water changes have been modest since 2009. However, a trend of offshore sediment losses is apparent at these sites between the MLLW shoreline and a depth of approximately -20 ft. The exception is Transect 412, where the nearshore seabottom appears to contain numerous rocky outcrops.

We sincerely appreciate the opportunity to assist Moffatt and Nichol and the Trancas Property Owners Association. Please do not hesitate to contact us if you have any questions or require additional information.

Sincerely,
Coastal Frontiers Corporation



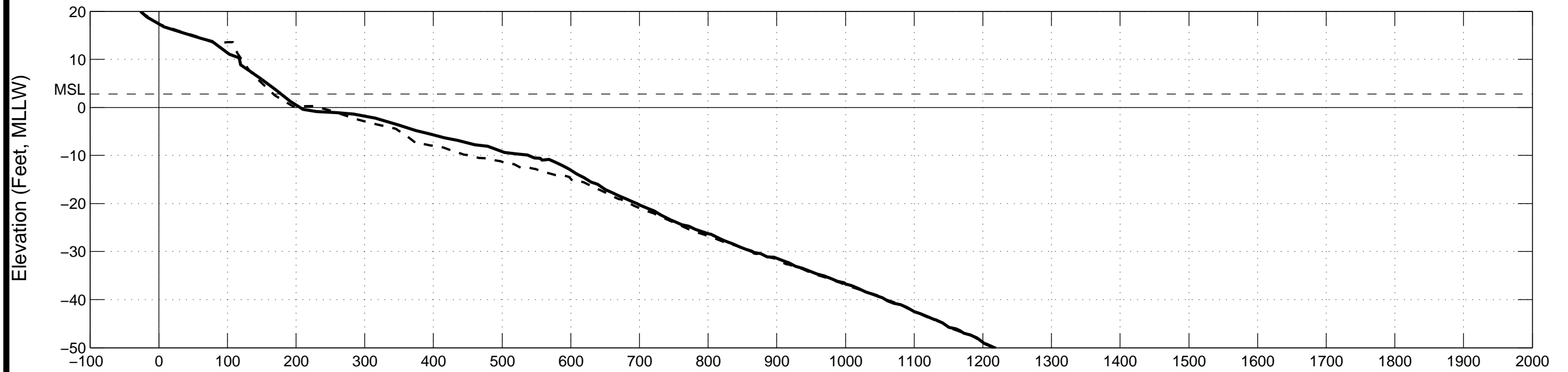
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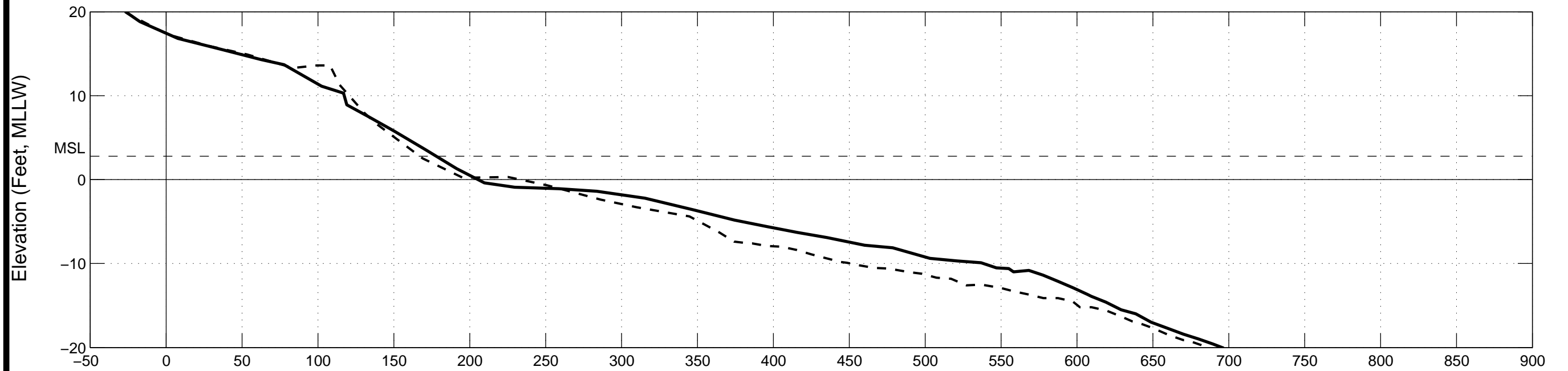
Attachment: A – Beach Profile Plots

Attachment A
Beach Profile Plots

Transect 394



Transect 394 Nearshore

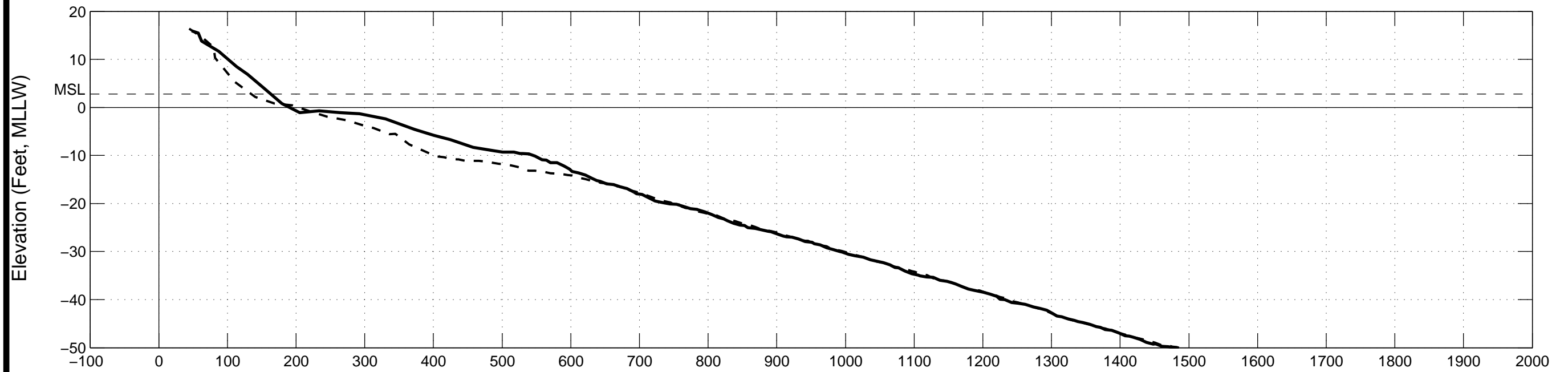


Cross-Shore Distance (Feet Seaward of Transect Origin)

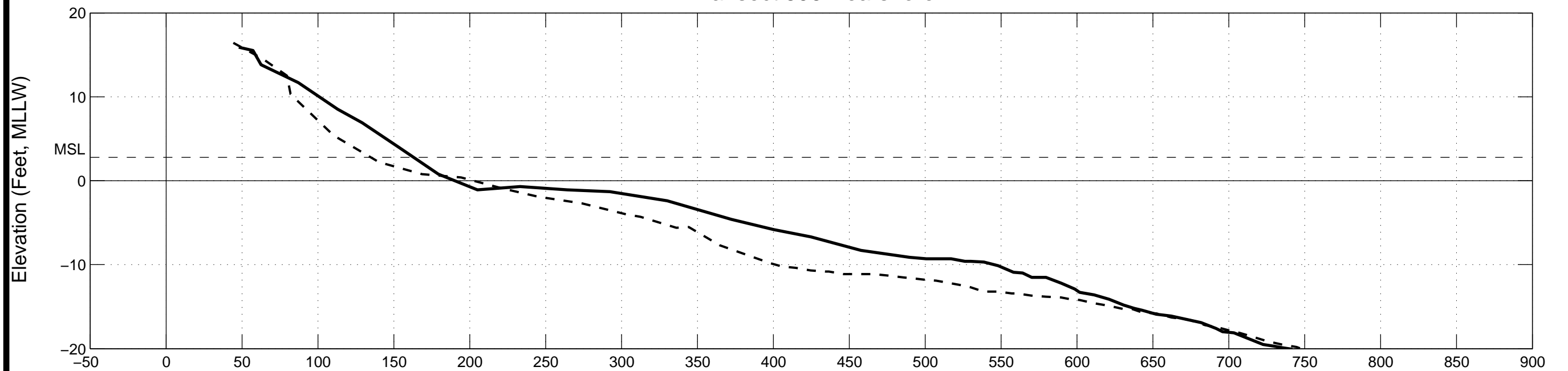
--- Nov 2012

— May 2013

Transect 396



Transect 396 Nearshore

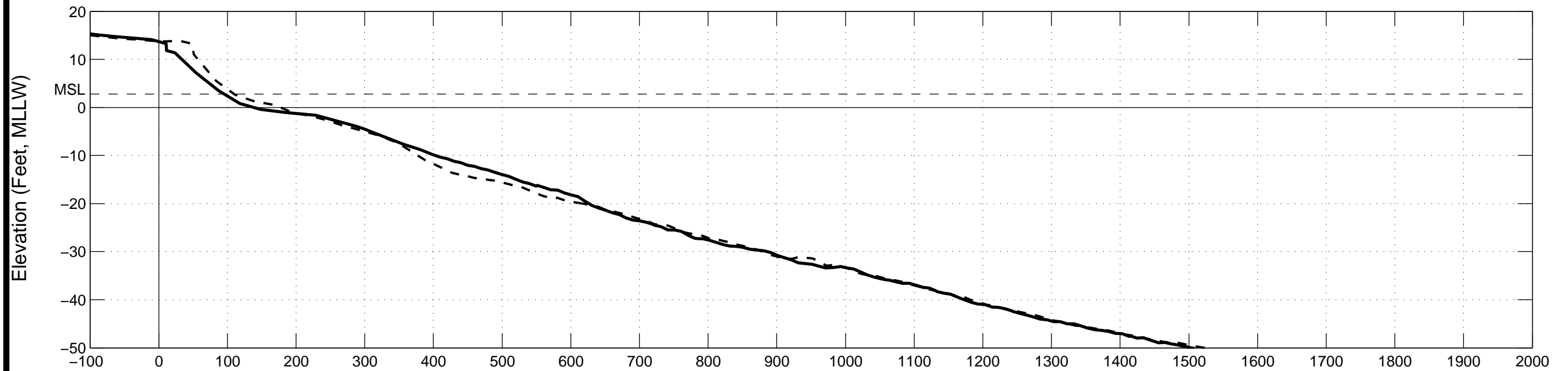


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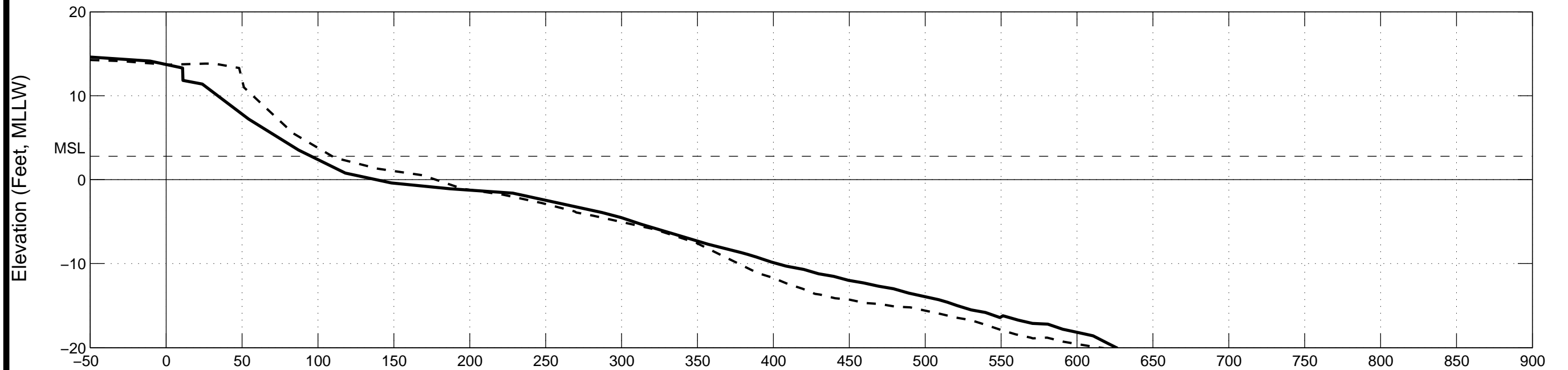
--- Nov 2012

— May 2013

Transect 398



Transect 398 Nearshore

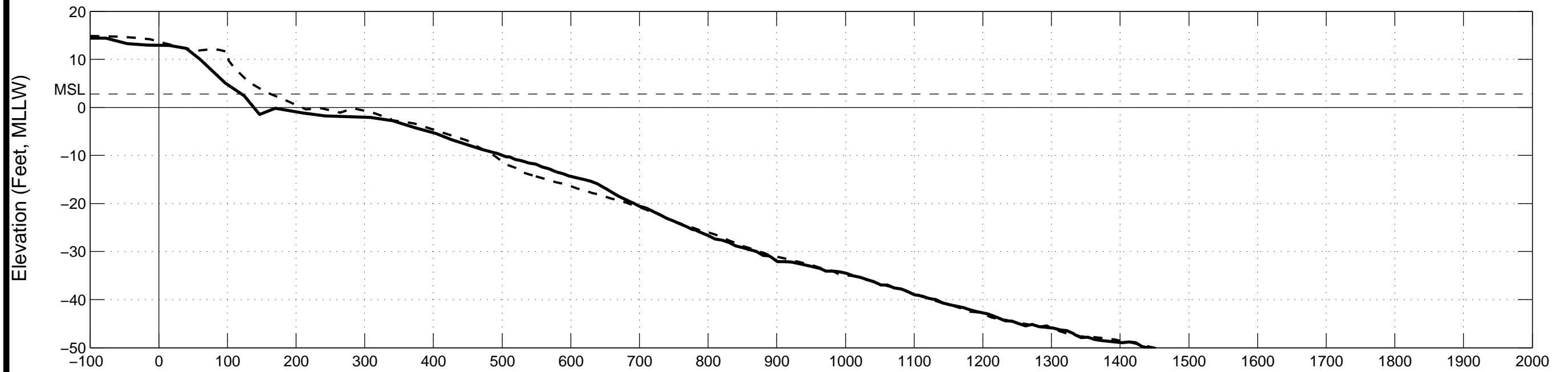


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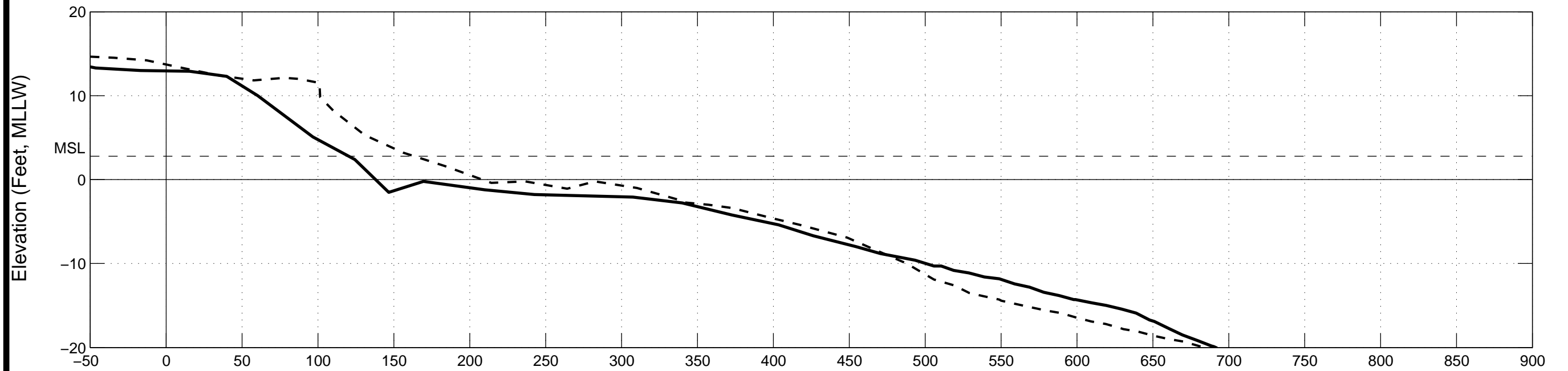
--- Nov 2012

— May 2013

Transect 400



Transect 400 Nearshore

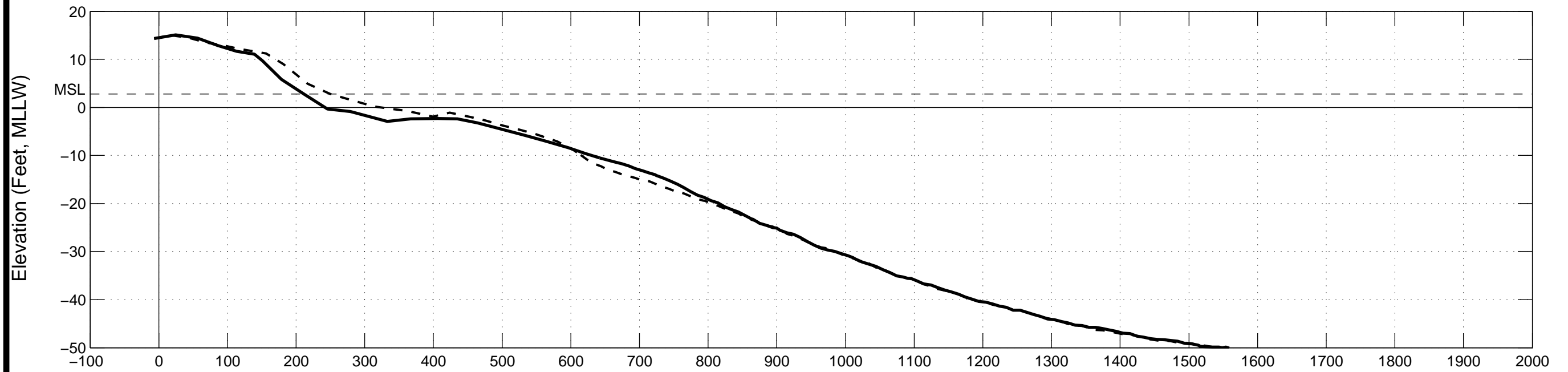


Cross-Shore Distance (Feet Seaward of Transect Origin)

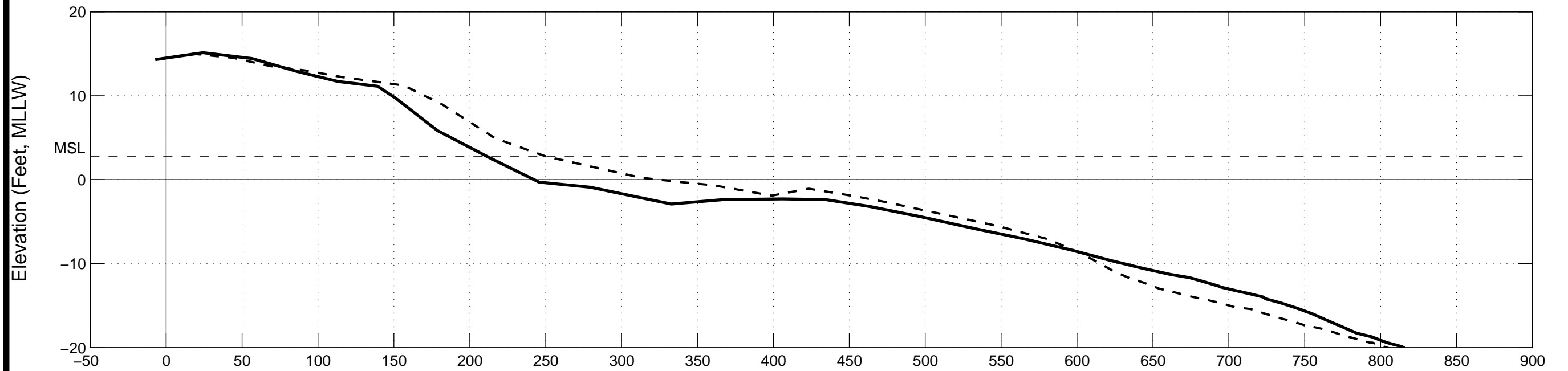
--- Nov 2012

— May 2013

Transect 402



Transect 402 Nearshore

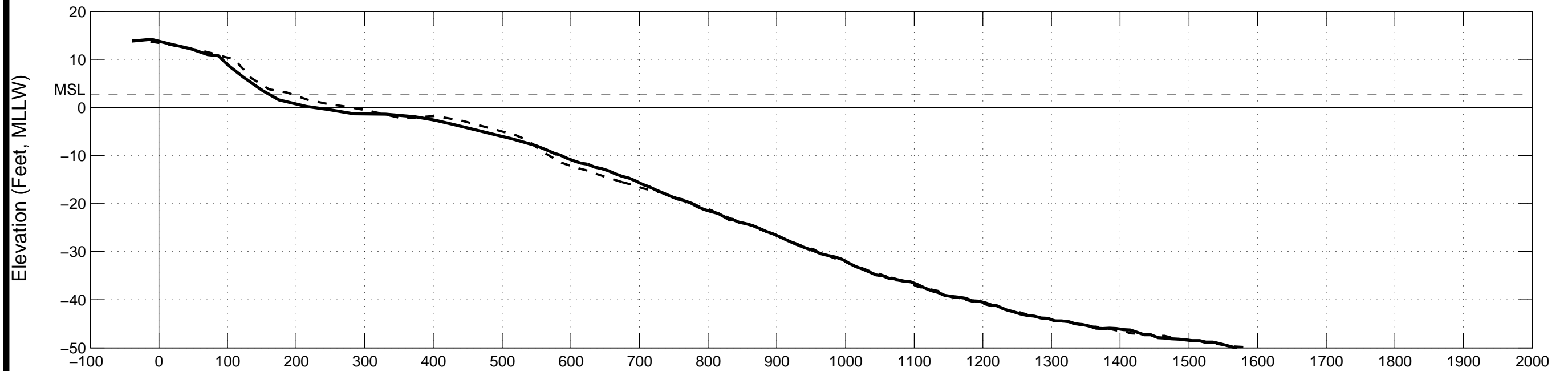


Cross-Shore Distance (Feet Seaward of Transect Origin)

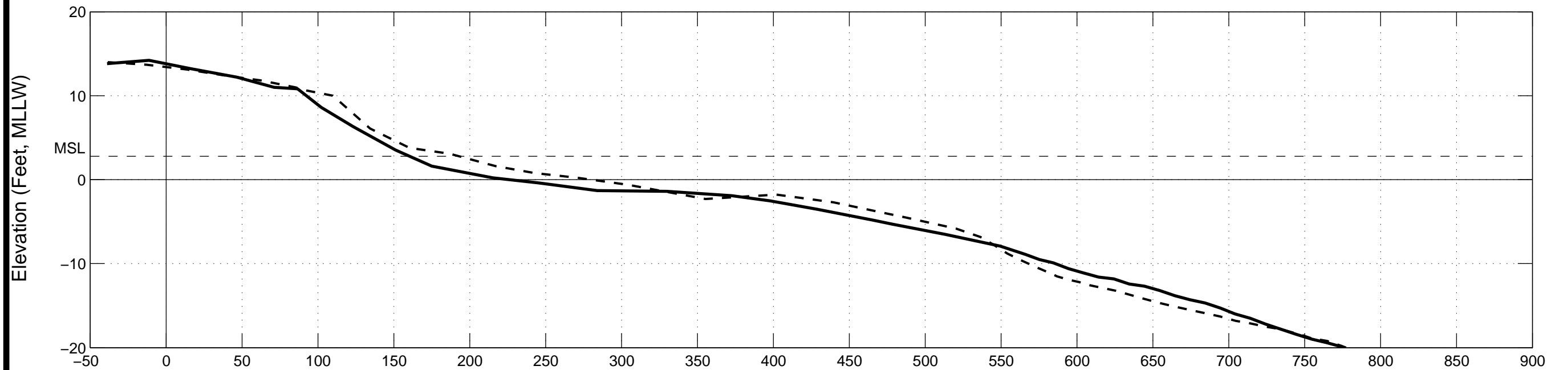
- - - - - Nov 2012

————— May 2013

Transect 404



Transect 404 Nearshore

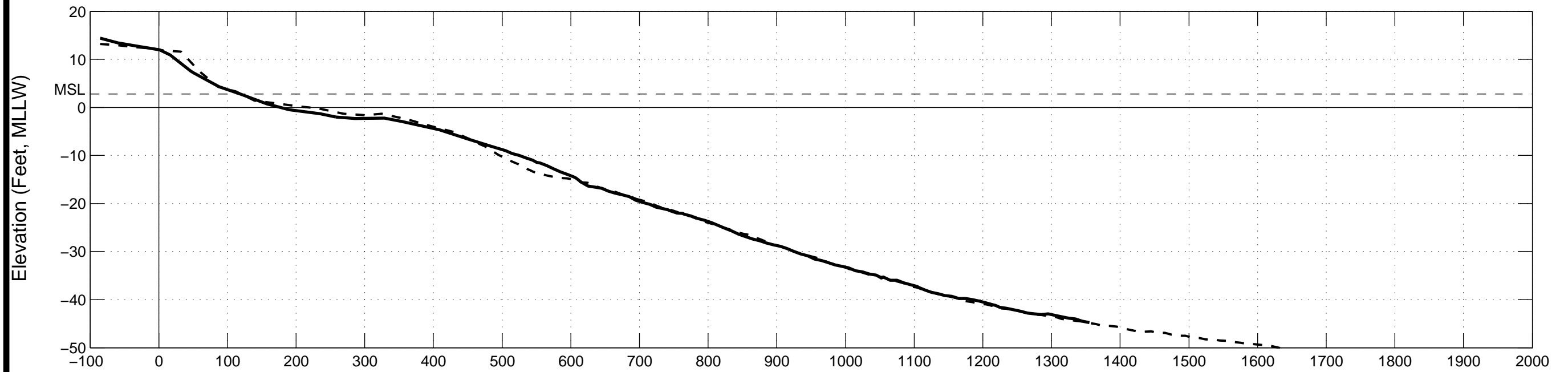


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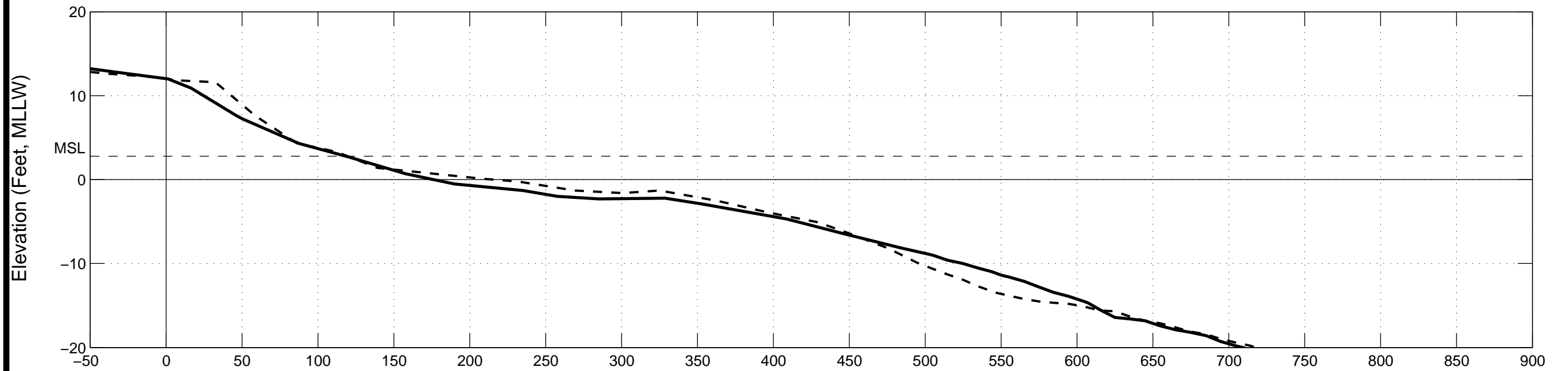
--- Nov 2012

— May 2013

Transect 406



Transect 406 Nearshore

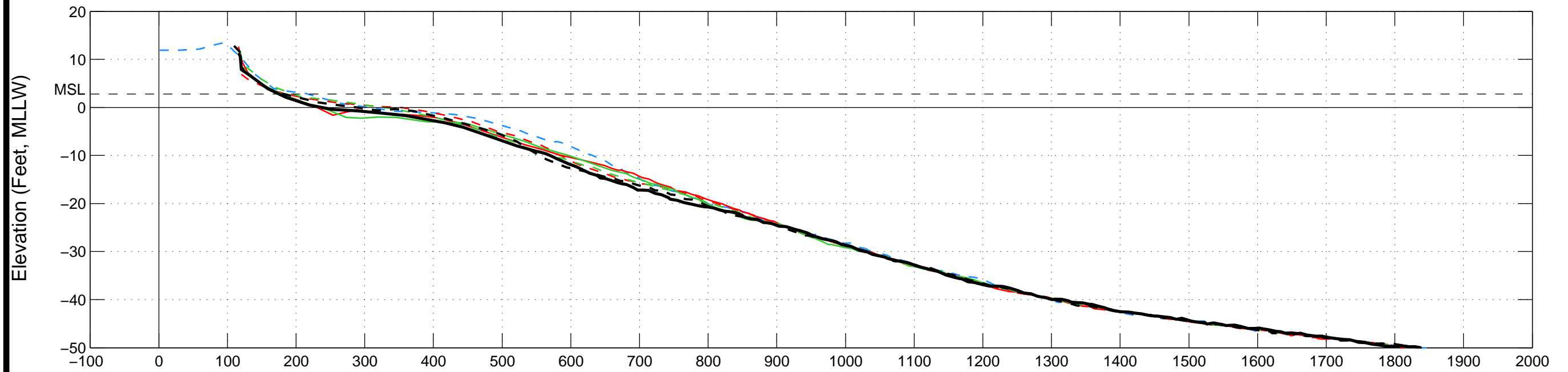


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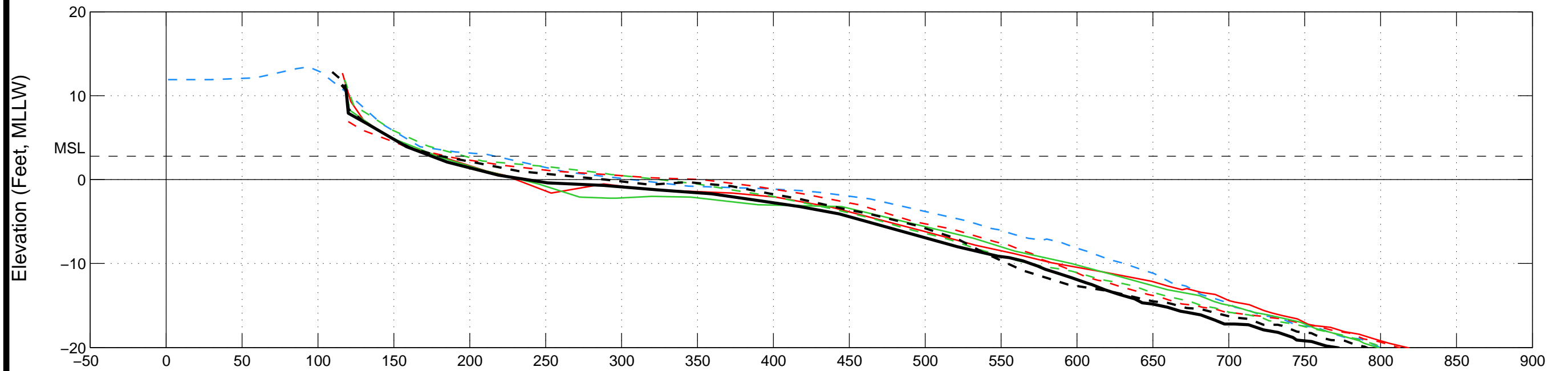
--- Nov 2012

— May 2013

Transect 408



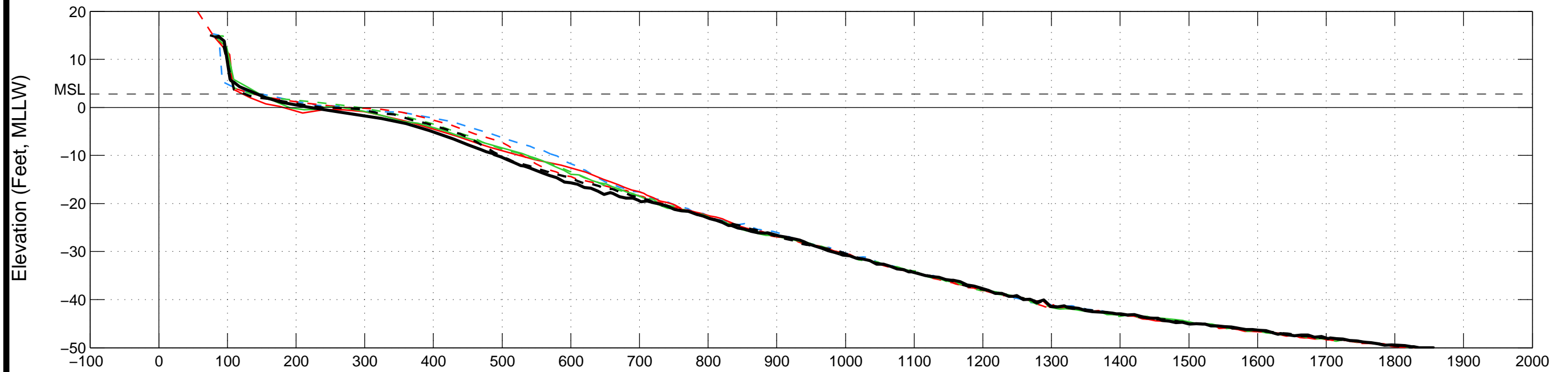
Transect 408 Nearshore



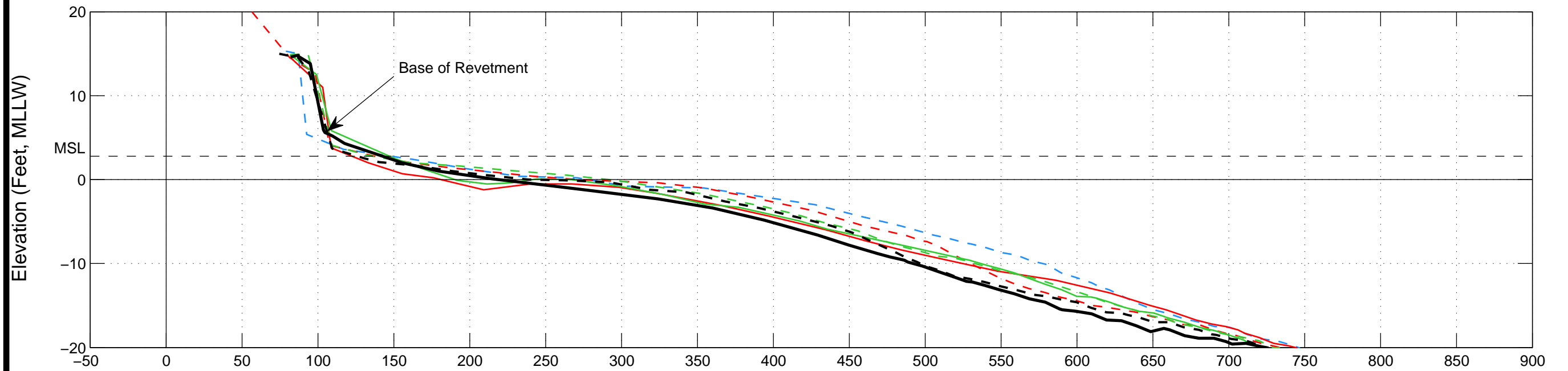
Cross-Shore Distance (Feet Seaward of Transect Origin)

Oct 2009 Nov 2010 May 2011 Oct 2011 May 2012 Nov 2012 May 2013

Transect 409



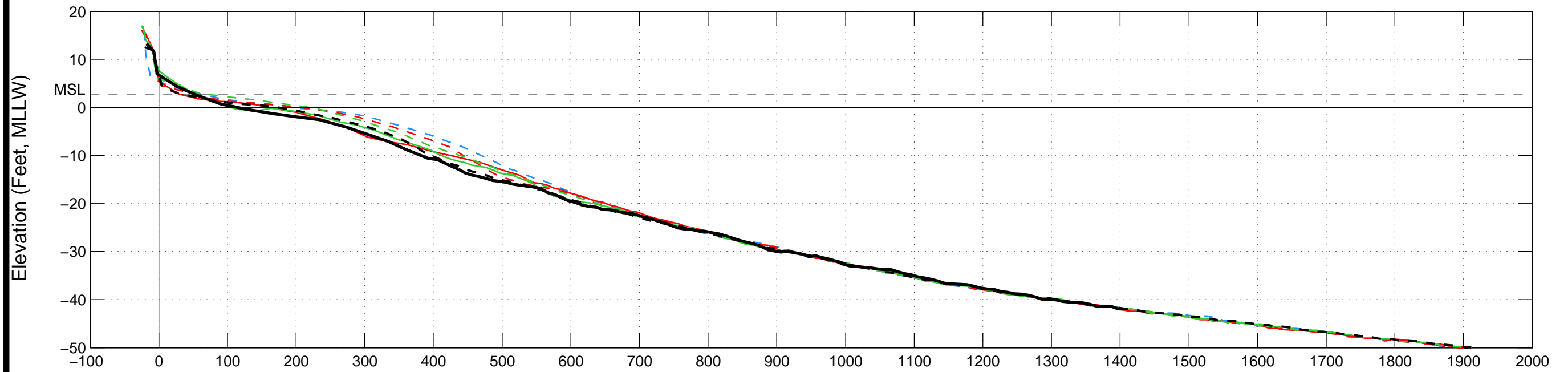
Transect 409 Nearshore



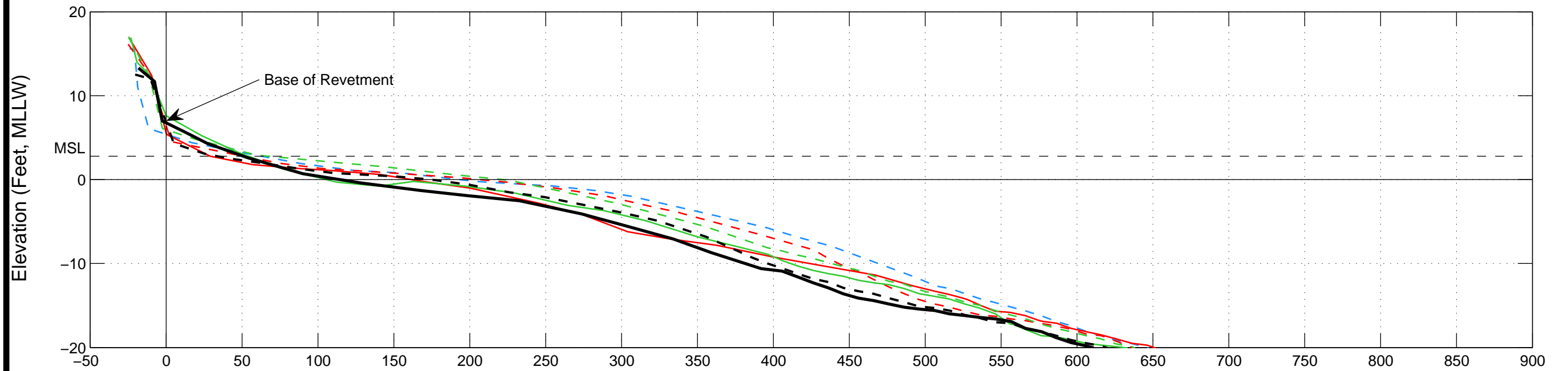
Cross-Shore Distance (Feet Seaward of Transect Origin)

Oct 2009 Nov 2010 May 2011 Oct 2011 May 2012 Nov 2012 May 2013

Transect 410



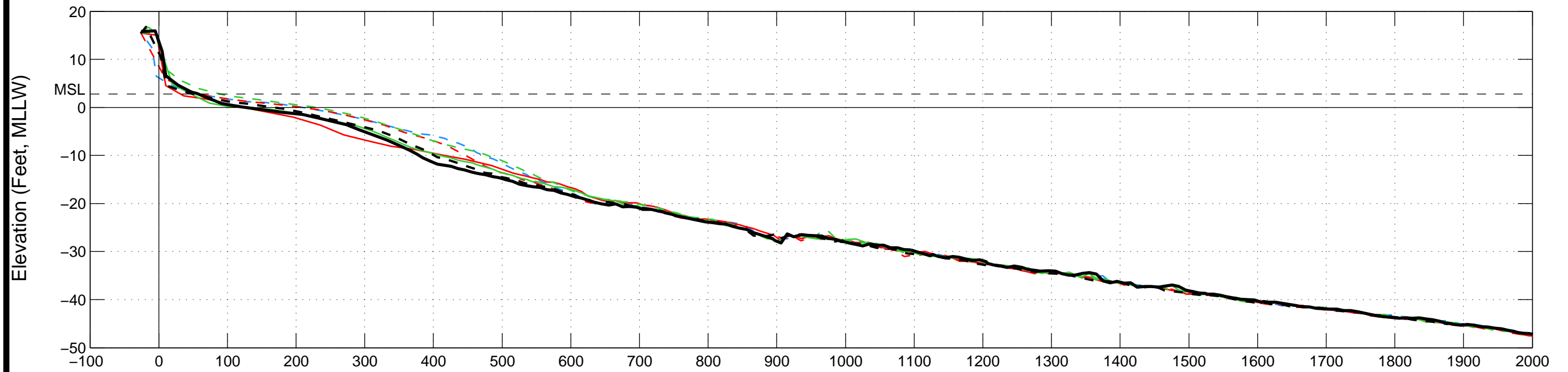
Transect 410 Nearshore



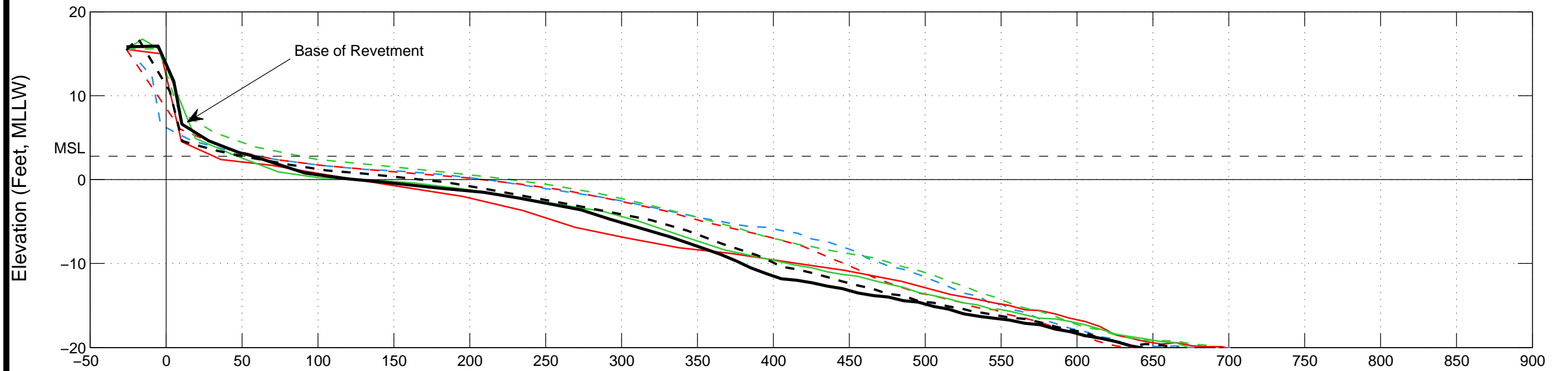
Cross-Shore Distance (Feet Seaward of Transect Origin)

Oct 2009 Nov 2010 May 2011 Oct 2011 May 2012 Nov 2012 May 2013

Transect 411



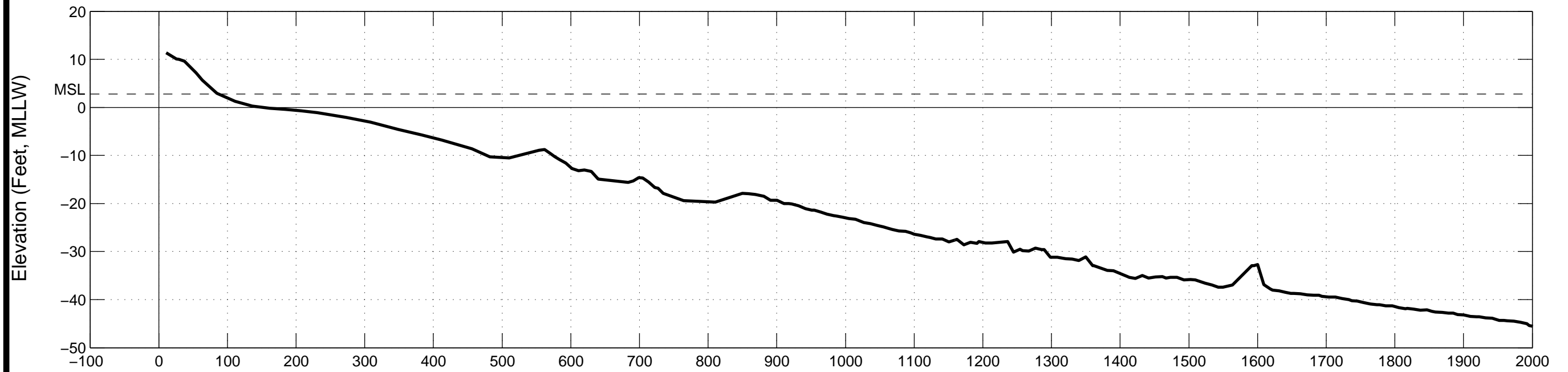
Transect 411 Nearshore



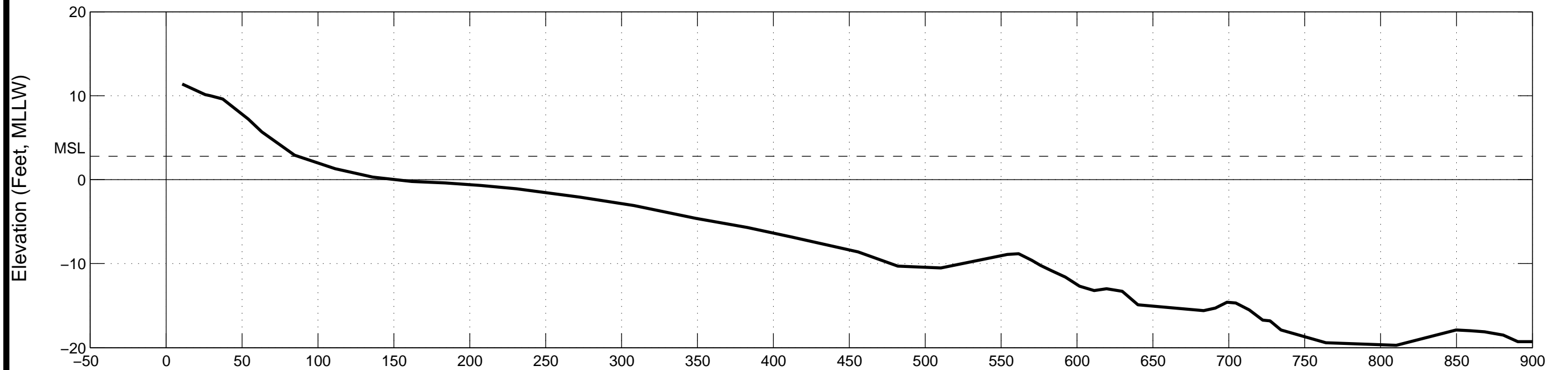
Cross-Shore Distance (Feet Seaward of Transect Origin)

Oct 2009 Nov 2010 May 2011 Oct 2011 May 2012 Nov 2012 May 2013

Transect 411.7



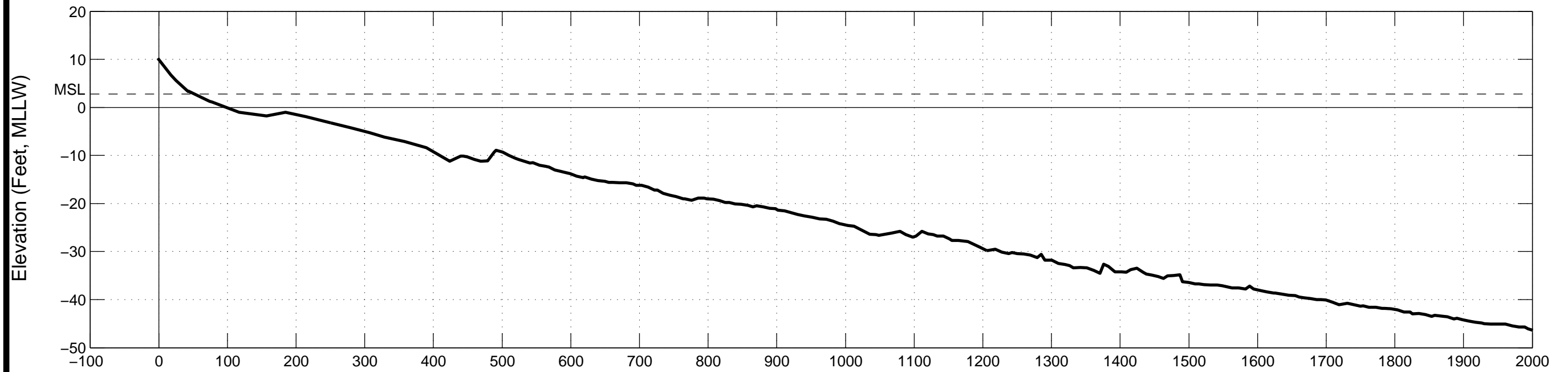
Transect 411.7 Nearshore



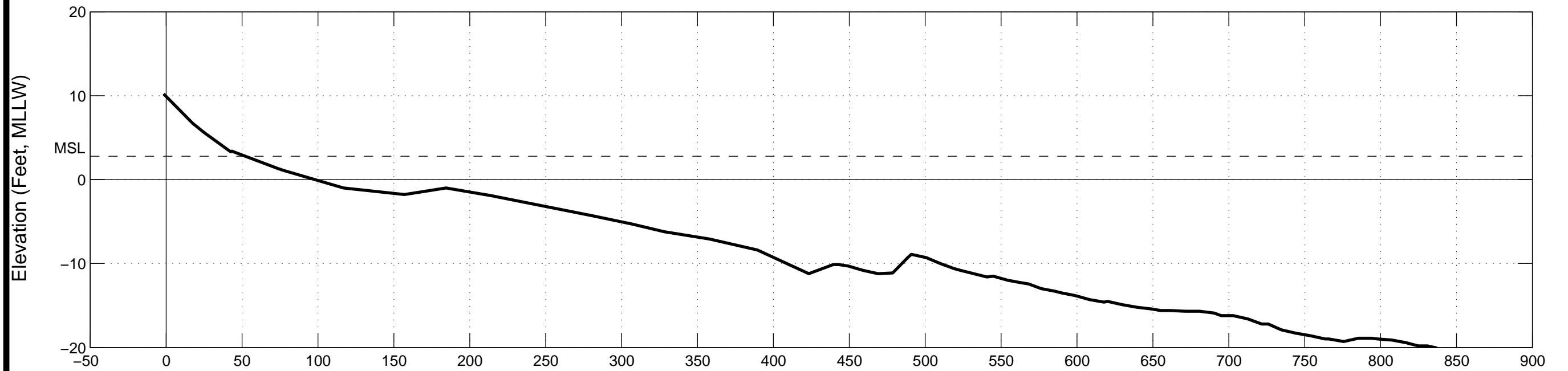
Cross-Shore Distance (Feet Seaward of Transect Origin)

May 2013

Transect 411.9



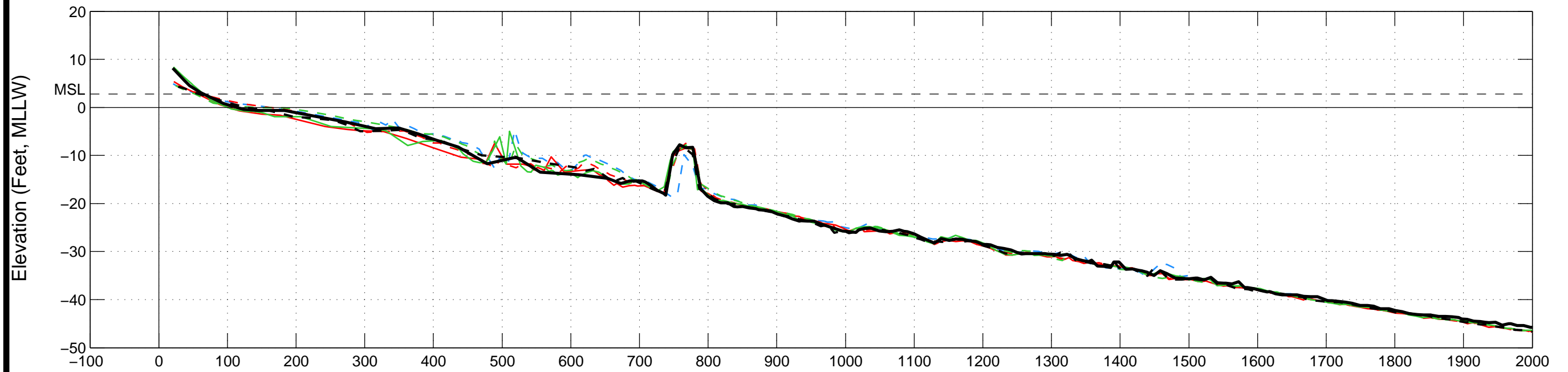
Transect 411.9 Nearshore



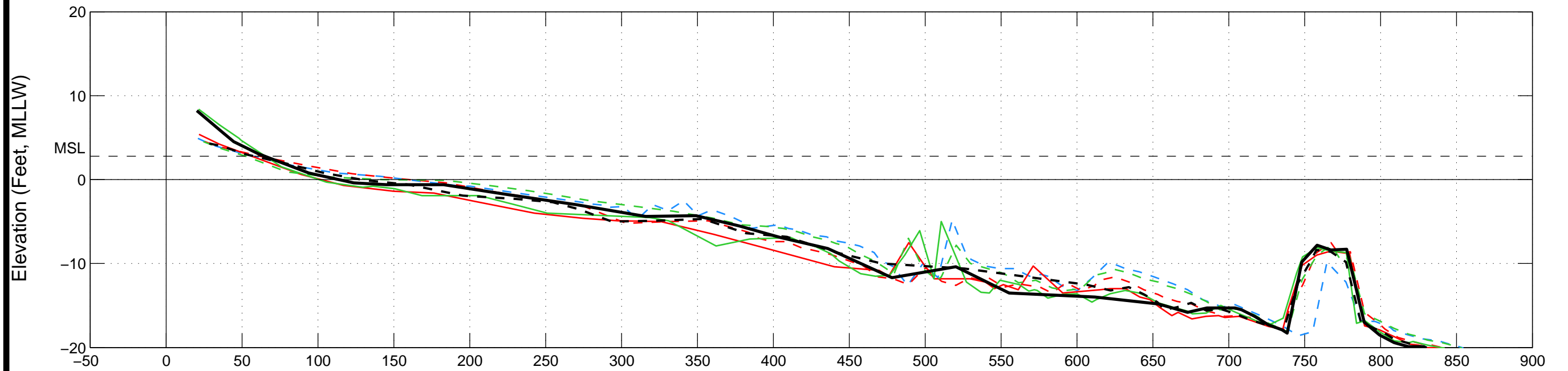
Cross-Shore Distance (Feet Seaward of Transect Origin)

May 2013

Transect 412



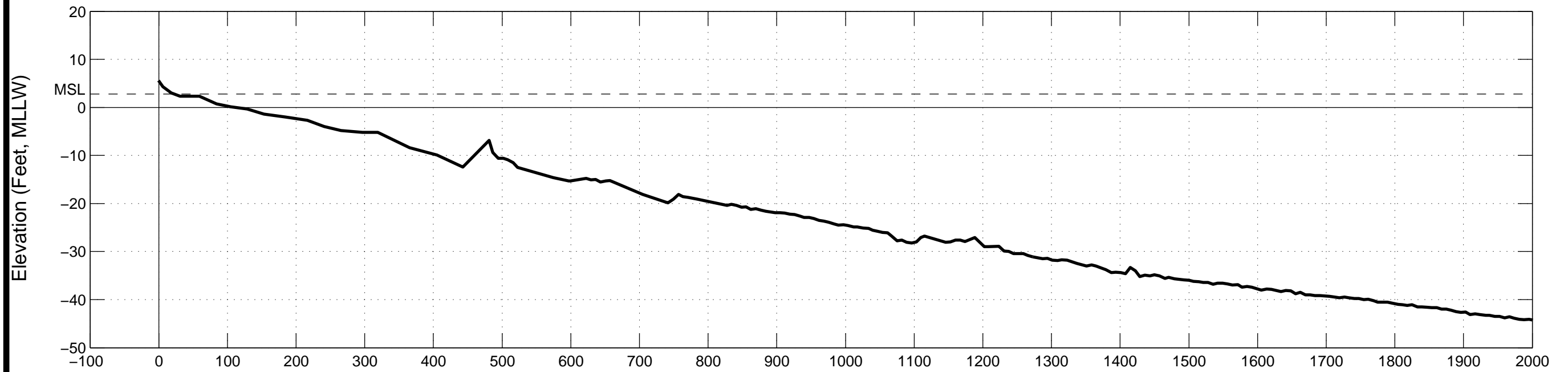
Transect 412 Nearshore



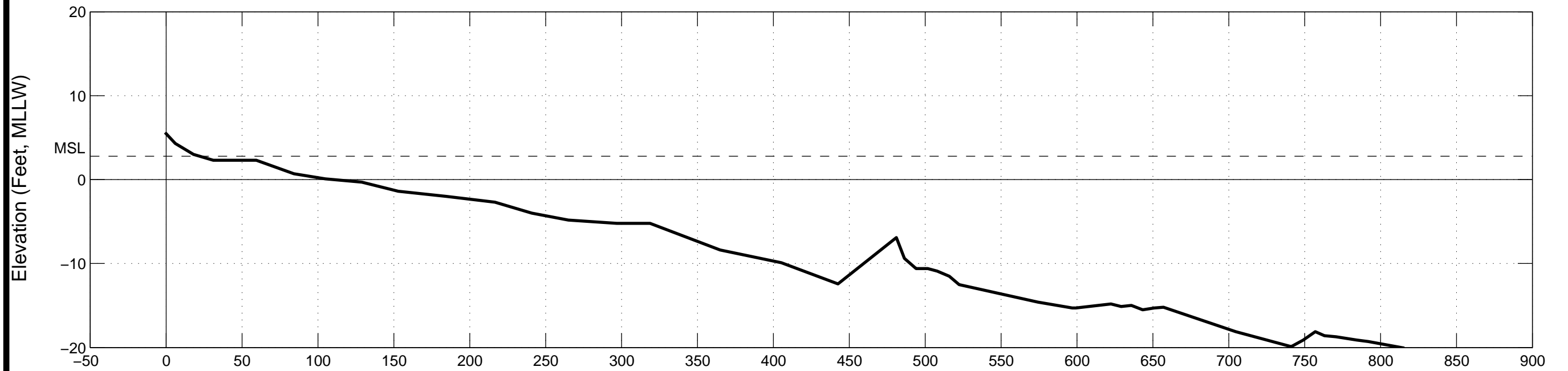
Cross-Shore Distance (Feet Seaward of Transect Origin)

Oct 2009 Nov 2010 May 2011 Oct 2011 May 2012 Nov 2012 May 2013

Transect 412.3



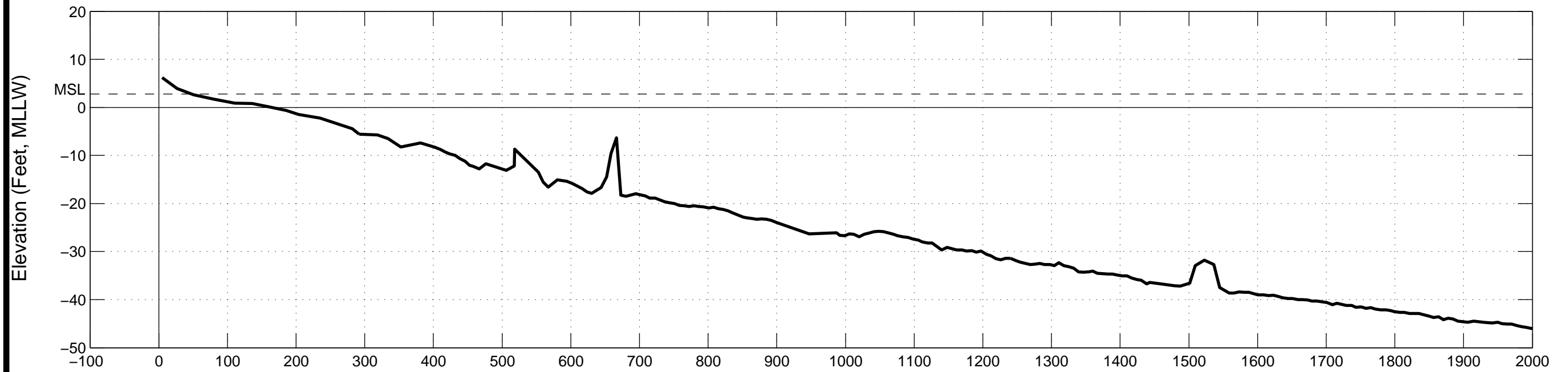
Transect 412.3 Nearshore



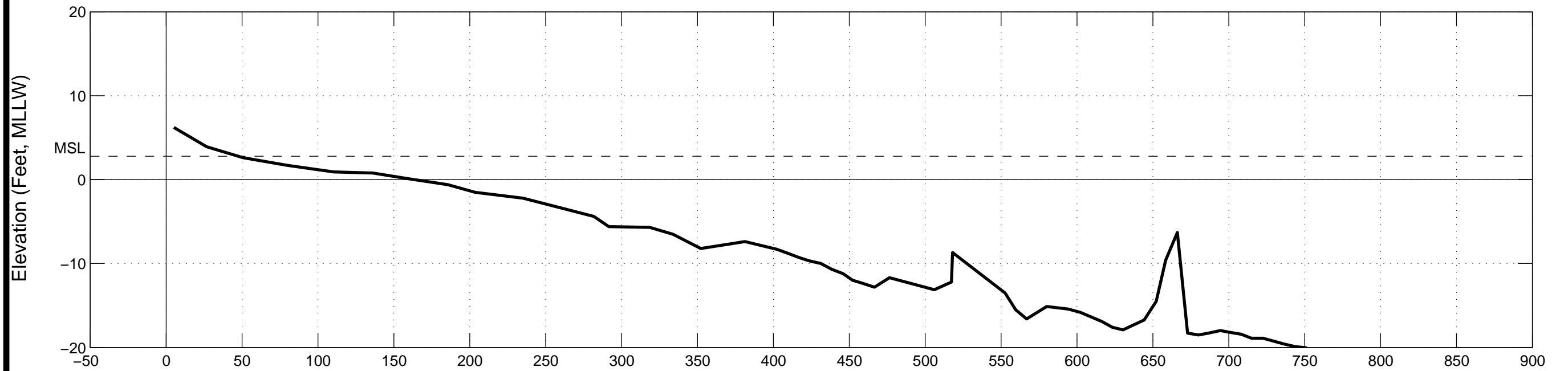
Cross-Shore Distance (Feet Seaward of Transect Origin)

— May 2013

Transect 412.5



Transect 412.5 Nearshore



Cross-Shore Distance (Feet Seaward of Transect Origin)

May 2013