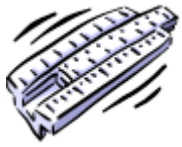
PUBLIC WORKS DEPARTMENT

Monthly Report

Kevin D. Blayton, PE
Director

ENGINEERING DIVISION
Dana Hamilton, PE, Engineering Manager



UTILITY DIVISION
Operations Manager

STREET & DRAINAGE DIVISION
John Bruton, Operations Manager

SANITATION DIVISION
Lent Williams, Operations Manger

FLEET MAINTENANCE DIVISION
David Snider, Superintendent

FACILITIES MAINTENANCE DIVISION
Richard Vernon, Superintendent

January 2024

Public Works Department

Monthly Statistics for December

	2023	2022
Water Supply & Use		
• Average Daily Water Use	6.5 MGD	4.6 MGD
• Water Pumped	200,584,600 Gallons	125,943,750 Gallons
• Water Billed**	118,540,000 Gallons	113,849,000 Gallons
Wastewater Treatment		
• Average Daily Sewer Treated	3.0 MGD	2.2 MGD
• Peak Daily Sewer Treated	7.9 MGD	4.0 MGD
• Sewer Treated	92,700,000 Gallons	67,550,000 Gallons
• Sewer Billed**	118,540,000 Gallons	84,947,000 Gallons
Utility Locate Requests	283	471
Solid Waste Collection & Disposal		
• Volume		
○ MSW	785 Tons	850 Tons
○ Yard Waste	280 Tons	214 Tons
○ Recycled (Includes E-Waste)	176 Tons	170 Tons
○ C & D	76 Tons	88 Tons
○ Total Pick-up/Disposal	2,415 Tons	24823 Tons
• Recycling %	22%	20%
• Landfill Disposal Cost	$40,349	$38,909

MGD=Million Gallons per Day
**Includes portion of current month and prior month based on meter reading schedule

Public Works Department
Capital Improvement Project Update

Water and Sewer System Improvements

Description	Location	Design Construction	Fund Cost	Status	Progress & Goal
Water Transmission	Windy Hill	AECOM TBD	RIA/Impact 10,000,000	Design Eng. Agreement	Begin Design
Water Tank & BPS Improvements	Bridge Road @ Windy Hill Ext.	AECOM TBD	RIA/Impact 6,500,000	Design Eng. Agreement	Begin Design
North End Water Transmission	Vereen Road	TBD TBD	Impact $2,000,000	Preliminary Design	Select Engineer
Sewer Force Main Replacement	Windy Hill - Barefoot	NMB RH Moore	Impact $300,000	Emergency Contract	Begin Construction
Myrtle Beach Water Transmission	Myrtle Beach	Bolton & Menk 	Impact TBD	Contract Award	Begin Construction
LRN Elevated Tank	Little River Neck	City and TBD TBD	Impact $1,500,000	Property Acquisition	Select Engineer
LRN, Jacks Circle & Harrelson Water Line	Little River Neck	City TBD	Horry Co. ARPA $1,500,000	Permitting	Bid

Storm Drainage System Improvements

Description	Location	Design Construction	Fund Cost	Status	Progress & Goal
Priority Group 3 Drainage Imp	Various	City TBD	Stormwater $3,500,000	Survey/Design	Design, Permits, Easements
18th Avenue North Ocean Outfall	Ocean Drive	Bolton & Menk Manson	Stormwater $26,900,000	Under Construction	90% complete
18th Avenue North Outfall - Landward	Ocean Drive	Bolton & Mink TBD	SCOR/Stormwater $6,500,000	NPDES Issued	Obtain Easement & SCDOT Permit
City Drainage Improvements	Various	City City	Stormwater TBD	Under Construction	95%
Tidal Flood Study	CG Marsh & WH Marsh	USACE N/A	Stormwater $300,000	USACE Agreement	Begin Study

Street Improvements

Description	Location	Design Construction	Fund Cost	Status	Progress & Goal
2nd Avenue North Widening & Paving	Highway 17 at 2nd Avenue North	City Coastal Asphalt	St. Imp./CTC $612,000	Construction Complete	Close-out Need As-Builts
Hwy 17 & 27th Ave S Intersection	Highway 17 @ 27th S	SCDOT TBD	GSATS $4,000,000	Design & R/W	Construction Funding FY 2026
NOB ECT	Cherry Grove - 29th N to 34th N	Mead & Hunt Greenwall Construction	Franchise Fund $3,100,000	Under Construction	60%
LRN Road Path	LRN Road	HRT Coastal Asphalt	GSATS/Horry/NMB $1,000,000	Construction Complete	Complete Punch List & Close-out
Edge Parkway Path Phase I	Edge Pkwy.	HRT TBD	GSATS TBD	FY 26 Funding	Begin Survey & Design
Sidewalk	Commons Blvd; Hwy 17N 8th - 11th	HRT TBD	St. Imp. TBD	Design Complete	Hold
Resurfacing 2023	Various	City TBD	Street Imp./CTC $2,000,000	Plan Complete	Permit & Bid
Champions Blvd. Extension Ph. 2	Bourne Trail	Thomas & Hutton AO Hardee	Street Imp. $5,000,000	Under Construction	Continue
Champions Blvd. Extension Ph. 3	Long Bay Rd.	Thomas & Hutton AO Hardee	Street Imp. $3,500,000	Design Complete	Contract Amendment
SC31 Median U-Turn	SC31 North	City TBD	CTC $150,000	Design – Permitting	SCDOT Permit & Bid
N. Myrtle Point Blvd. Alley	Cherry Grove	City TBD	Street Imp. TBD	Design – Permitting	Obtain Right-of-way
Water Tower Road Improvements	Water Tower Rd	DRG King Construction	CTC $242,000	Construction – 90%	Closeout, CTC Reimbursement, and Balance Bill

Facility, Park & Land Improvements

Description	Location	Design Construction	Fund Cost	Status	Progress & Goal
Heritage Point Seawall	Cherry Grove	Beam & Assoc. Seven Seas Marine	Park $315,000	Bulkhead Complete	Install Living Shoreline
Cherry Grove Maintenance Dredge	Cherry Grove	Beam & Assoc. Michels Construction	CG Dredge $2,700,000	Construction Complete	Claims Resolved
Sanitation Facility Improvements	2nd Avenue South	HRT TBD	Sanitation Capital TBD	Design 95%	Permit & Bid
PS/Midcon Building	City /Midcon	HRT TBD	Capital TBD	Bidding	Install Water and Sewer Service
Beach Services Parking	City Hall Campus	HRT TBD	Capital TBD	Temporary Lot Complete	FY 25 Paving
McLean Park Restrooms	McLean Park	HRT Edge Const.	Capital $375,000	Building Permit	Demolition Started
Cherry Grove Restrooms	Cherry Grove	HRT Edge Const.	Capital $368,000	Building Permit	Start Construction
PW Utility Warehouse	Ocean Dr 1020 6th Ave South	HRT Sellers Const.	Utility $736,500	Building Permit	Start Construction

Beach Access & Parking Improvements

Description	Location	Design Construction	Fund Cost	Status	Progress & Goal
1st Ave South Parking Lot	Ocean Drive	HRT JMEC Construction	Capital TBD	Construction 60%	Spring Paving
Cherry Grove Parking Lots	Near 62nd Ave N. Cherry Grove	HRT TBD	Capital TBD	Construction 80%	Spring Paving
46th Ave South Parking Lots	Windy Hill	HRT JMEC	Capital TBD	Temporary Lot Complete	Hold Paving
28th Avenue South	Crescent Beach	HRT AO Hardee	Capital TBD	Temporary Lot Complete	Hold Paving
Parking Lot	6th Ave. S. & SOB	City AO Hardee	Capital TBD	Construction 75%	Determine House Status

Report on the status of the North Myrtle Beach

2022-2023 Monitoring Cycle

North Myrtle Beach, Reach 1

Submitted to:

US Army Corps of Engineers

and

North Myrtle Beach

February 2024

Prepared by:

Burroughs & Chapin Center for Marine & Wetland Studies

Coastal Carolina University

North Myrtle Beach Profile Analysis 2023

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Executive Summary

This 2022 - 2023 mapping report documents the data sources, methods, and results of the shoreline monitoring evaluation performed to compare the August 2023 survey data with the survey collected in September 2022. The monitoring of North Myrtle Beach stretches from White Point Swash in the southwest (Benchmark (BM) 5650) to Hog Inlet in the northeast (BM 5895). In total, forty-two (42) benchmarks were monitored over almost 8.5 miles.

This report utilized survey data collected in September 2022 and August 2023 to compute the shoreline location change at +2.0 ft NAVD88 (North American Vertical Datum of 1988) which is designated as the Mean High Water (MHW) elevation. Volume changes were also calculated above +6.0 ft NAVD88 (berm), +2.0 ft NAVD88 (MHW), -5 ft NAVD88 (wading depth), -10 ft NAVD88 (outer bar), -20 ft NAVD88, and -25 ft NAVD88. The last two elevations of -20 ft NAVD88 and -25 ft NAVD88 were selected to bracket the expected depth of closure (DOC). The DOC is the limiting elevation where significant changes in profile shape occur.

In order to better understand the beach change patterns along the shoreline, North Myrtle Beach was divided into reaches with similar beach profile characteristics. Key shoreline and volume change statistics were computed for all survey reaches; Windy Hill Beach – Crescent Beach, Ingram Beach – Ocean Drive Beach, and Cherry Grove Beach – Futch Beach. Overall statistics for North Myrtle Beach Oceanfront (Windy Hill Beach to Futch Beach) were also calculated. The data from White Point Swash and Hog Inlet were not included in the overall oceanfront summary because the dynamic nature of these areas could skew trends experienced along the oceanfront given the high changes experienced near inlet and swash areas. These statistics reflect annual changes in the beach as surveys were performed during similar time frames each year. Positive values indicate seaward advancement of the shoreline and volumetric accretion while negative values indicate landward recession of the shoreline and volumetric erosion.

Key statistics for the individual reaches along the North Myrtle Beach oceanfront shoreline are as follows (please note that the cubic yards (cy)/ft results in the table are rounded to the nearest 0.1):

2022 vs. 2023 (Total Change)	Reach Length	avg volume change above +6 ft NAVD88	cumulative volume change above +6 ft NAVD88	avg shoreline change @ +2.0 ft NAVD88	avg volume change above +2.0 ft NAVD88	cumulative volume change above +2.0 ft NAVD88	avg volume change above -5 ft NAVD88	cumulative volume change above -5 ft NAVD88	avg volume change above -10 ft NAVD88	cumulative volume change above -10 ft NAVD88	avg volume change above -20 ft NAVD88	cumulative volume change above -20 ft NAVD88	avg volume change above -25 ft NAVD88	cumulative volume change above -25 ft NAVD88
Reach	ft	cy/ft	cy	ft	cy/ft	cy	cy/ft	cy	cy/ft	cy	cy/ft	cy	cy/ft	cy
Windy Hill Beach - Crescent Beach BM 5700 - 5755	14,190	-2.2	-30,898.8	-5.0	-3.8	-54,251.9	-9.0	-127,029.7	-11.5	-162,951.1	-14.4	-204,514.1	-27.5	-390,021.7
Ingram Beach - Ocean Drive Beach BM 5760 - 5825	15,994	-0.2	-3,938.3	-3.5	-0.5	-7,939.0	-1.6	-26,296.7	-4.4	-70,227.6	-7.7	-122,969.4	-19.7	-315,392.1
Cherry Grove Beach Futch Beach BM 5830 -5890	13,574	-2.5	-33,918.9	-11.0	-4.7	-63,541.4	-11.3	-153,493.5	-17.8	-241,592.0	-28.7	-389,479.8	-51.5	-698,532.8
	Reach Length	weighted avg	total	weighted avg	weighted avg	total	weighted avg	total	weighted avg	total	weighted avg	total	weighted avg	total
North Myrtle Beach Oceanfront* BM 5700 - 5890	43,758	-1.6	-68,756.0	-6.3	-2.9	-125,732.3	-7.0	-306,819.9	-10.8	-474,770.7	-16.4	-716,963.3	-32.1	-1,403,946.6

*North Myrtle Beach Oceanfront does not include White Point Swash or Hog Inlet

The North Myrtle Beach – Oceanfront shoreline eroded on average -6.3 ft landward, with Cherry Grove Beach – Futch Beach experiencing the highest average (-11.0 ft). Across the Oceanfront there was an average volume loss of -1.6 cy/ft observed in the dune and berm (above +6 ft NAVD88). There were no average gains in volume across the Oceanfront experienced at any elevation. Volume losses across the Oceanfront increased with depth, indicating little recovery of material. Cherry Grove Beach – Futch Beach saw the largest volume losses across the oceanfront, the proximity of this reach to Hog Inlet is likely having an influence on the volume changes that are being observed, future analyses will continue to track trends in this area.

The surveys analyzed in this report capture a year time period, to hopefully negate any seasonal patterns. The late fall and early spring are when the east coast typically experiences 'nor'easters' storms which have higher velocity winds, large waves, and small surges to erode beaches. Then in the summer months the beach will usually recover some of that sand as smaller waves move material back onshore. Within the time period analyzed Hurricane Ian also likely influenced some of the volume losses observed in the dunes and upper beach (above MHW). The material lost from the upper beach will take longer to recover as this process is largely driven by windblown sand from a wide berm-which might not be present unless a nourishment event occurs. North Myrtle Beach is expected to be nourished in the summer of 2024.

With continued annual monitoring and analysis, these yearly reports will become a useful tool in determining shoreline and volume change trends and help optimize future shoreline management strategies.

Survey Methods and Data Sources

Survey Benchmarks and Reaches

Figure 1 shows the locations of the survey benchmarks for North Myrtle Beach that are used by Coastal Carolina University (CCU) and the SC Department of Health & Environmental Control's Ocean and Coastal Resource Management division (SCDHEC OCRM) when surveying. The established benchmarks will be used in all future survey periods. Overlain on the figure with the survey benchmarks is the August 2023 survey with an elevation color gradient. The figure also details how North Myrtle Beach was divided into three (3) reaches based upon similar profile characteristics (dune height, berm width, etc.). A summary of how the reaches are divided is presented in **Table 1**. These reaches may be modified in the future based on trends observed in subsequent data analysis. Dividing the area into three reaches helps to isolate specific effects (i.e. inlet influence, nourishment) when analyzing the volumes and trends observed. A list of recent survey efforts for North Myrtle Beach are detailed in **Table 2**.

Table 1. Reach Start and End Points

Reach	Benchmarks	Length (ft)	Start Point	End Point
Windy Hill Beach - Crescent Beach	5700 - 5755	14,190	White Point Swash	15th Avenue South
Ingram Beach - Ocean Drive Beach	5760 - 5825	15,994	15th Avenue South	Shorehaven Drive
Cherry Grove - Futch Beach	5830 - 5890	13,574	Shorehaven Drive	Hog Inlet

Table 2. Summary of Survey Data

Location	Date	Source	Extent
North Myrtle Beach	9/10/2013	OCRM	BM 5650 - 5895
North Myrtle Beach	8/28/2015	OCRM	BM 5650 - 5895
North Myrtle Beach	10/1/2016	OCRM	BM 5650 - 5895
North Myrtle Beach	9/20/2017	OCRM	BM 5650 - 5895
North Myrtle Beach	7/20/2018	CCU	BM 5650 -5895
North Myrtle Beach	9/20/2018	CCU	BM 5650 -5895
North Myrtle Beach	10/6/2018	OCRM	BM 5650 - 5895
North Myrtle Beach	5/16/2019	CCU	BM 5650 - 5895, only to elevation -3 ft NAVD88
North Myrtle Beach	9/27/2019	CCU	BM 5650 - 5895
North Myrtle Beach	10/15/2019	OCRM	BM 5650 - 5895
North Myrtle Beach	8/11/2020	CCU	BM 5650 - 5895, only to elevation -3 ft NAVD88
North Myrtle Beach	8/20/2020	OCRM	BM 5650 - 5895
North Myrtle Beach	12/10/2020	CCU	BM 5650 - 5895, only to elevation -3 ft NAVD88 & no dune
North Myrtle Beach	4/5/2021	CCU	BM 5650 - 5895, only to elevation -3 ft NAVD88
North Myrtle Beach	9/8/2021	OCRM	BM 5650 - 5895
North Myrtle Beach	9/28/2022	OCRM	BM 5650 - 5895
North Myrtle Beach	1/29/2023	CCU	BM 5650 - 5895, some topography from 2/18/2023
North Myrtle Beach	8/21/2023	CCU	BM 5650 - 5895

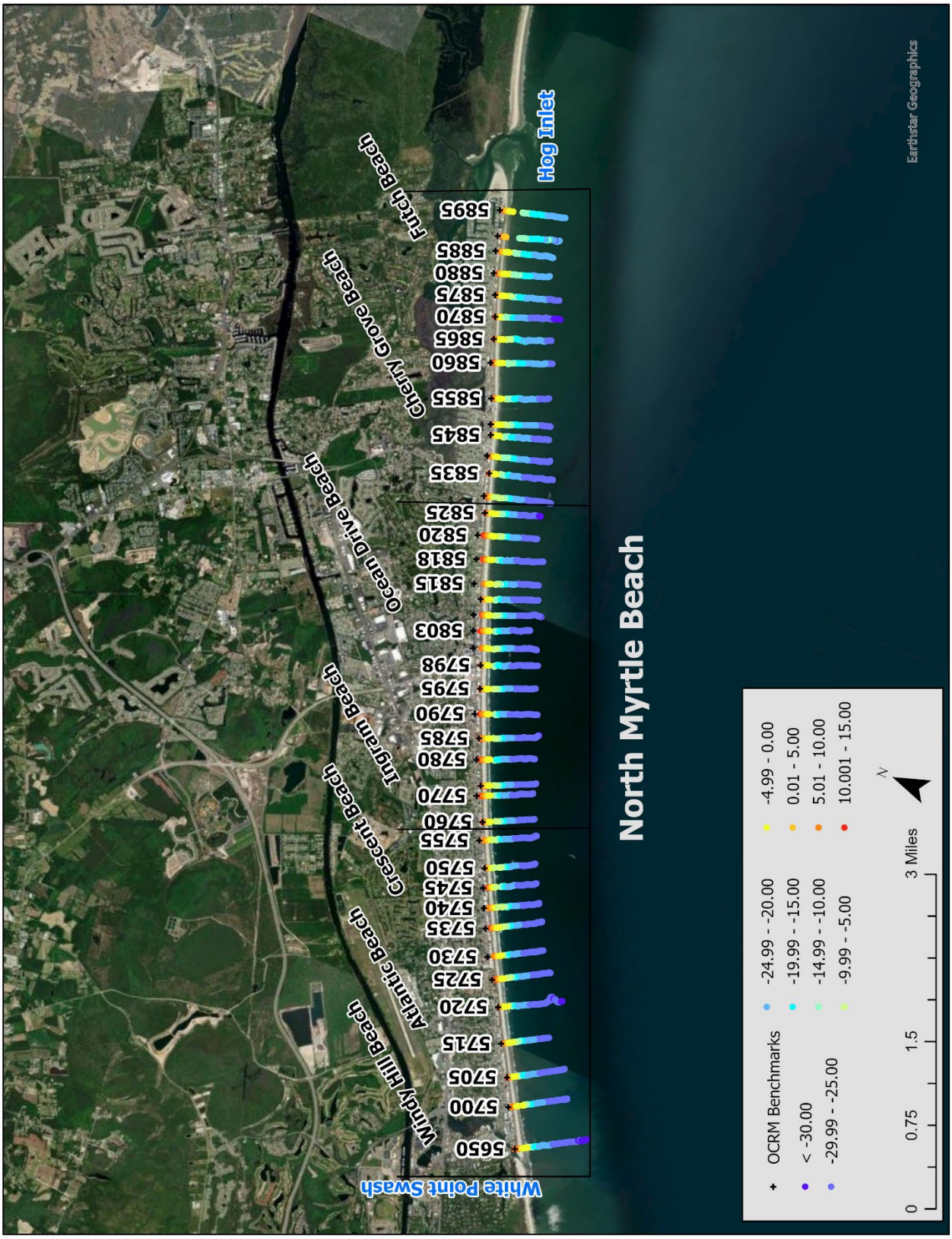


Figure 1. North Myrtle Beach Benchmark Locations and Reaches

Survey Evaluation Methods

To enable a reproducible and consistent result for the monitoring analysis, the survey events for each shoreline segment are assigned a single date for their completion. Assigning the survey date allows the determination of a consistent time frame for each monitoring period between survey events for use in calculating shoreline and volumetric change rates. Below are the provided dates used for the 2022 and 2023 survey events.

2022 Survey Event

- North Myrtle Beach: September 28, 2022.

2023 Survey Event

- North Myrtle Beach:
    - Bathymetry: August 20 and 21, 2023.
    - Topography: August 10 and 11, 2023.

The 2023 survey data was collected by the Burroughs and Chapin Center for Marine and Wetland Studies at CCU. The 2022 survey data was provided by SCDHEC OCRM. SCDHEC OCRM contracted with Coastal Science and Engineering to collect the survey for the 2022 survey used in this report. The data was formatted in ASCII (xyz) and Distance from Baseline (DBL), allowing for compatibility with multiple programs. The survey was referenced in NAD 1983 South Carolina State Plane horizontal datum in US survey feet and NAVD88 vertical datum in US survey feet.

Survey comparisons and respective analysis were performed using MATLAB, a numerical computing environment and proprietary programming language developed by MathWorks. Using MATLAB allowed for automation of the analysis, which performs the same calculation techniques applied by Beach Morphology Analysis Package (BMAP). BMAP is the program developed by the US Army Corps of Engineers (USACE) to analyze morphologic and dynamic properties of beach profiles. Text files containing the September 2022 and August 2023 beach profiles were formatted and imported into MATLAB to allow for comparison of the data. Two types of indicators of beach profile change, shoreline and volume change, were calculated for each benchmark.

Shoreline Change

Shoreline change designated at the mean high water (MHW) contour, defined as +2.0 ft NAVD88 (based on National Oceanic and Atmospheric Administration (NOAA) tidal benchmark at Springmaid Pier, SC shown in **Figure 2**), was calculated at each benchmark between the September 2022 and August 2023 surveys. The resulting values represent the shoreline change (ft) over the time between surveys.

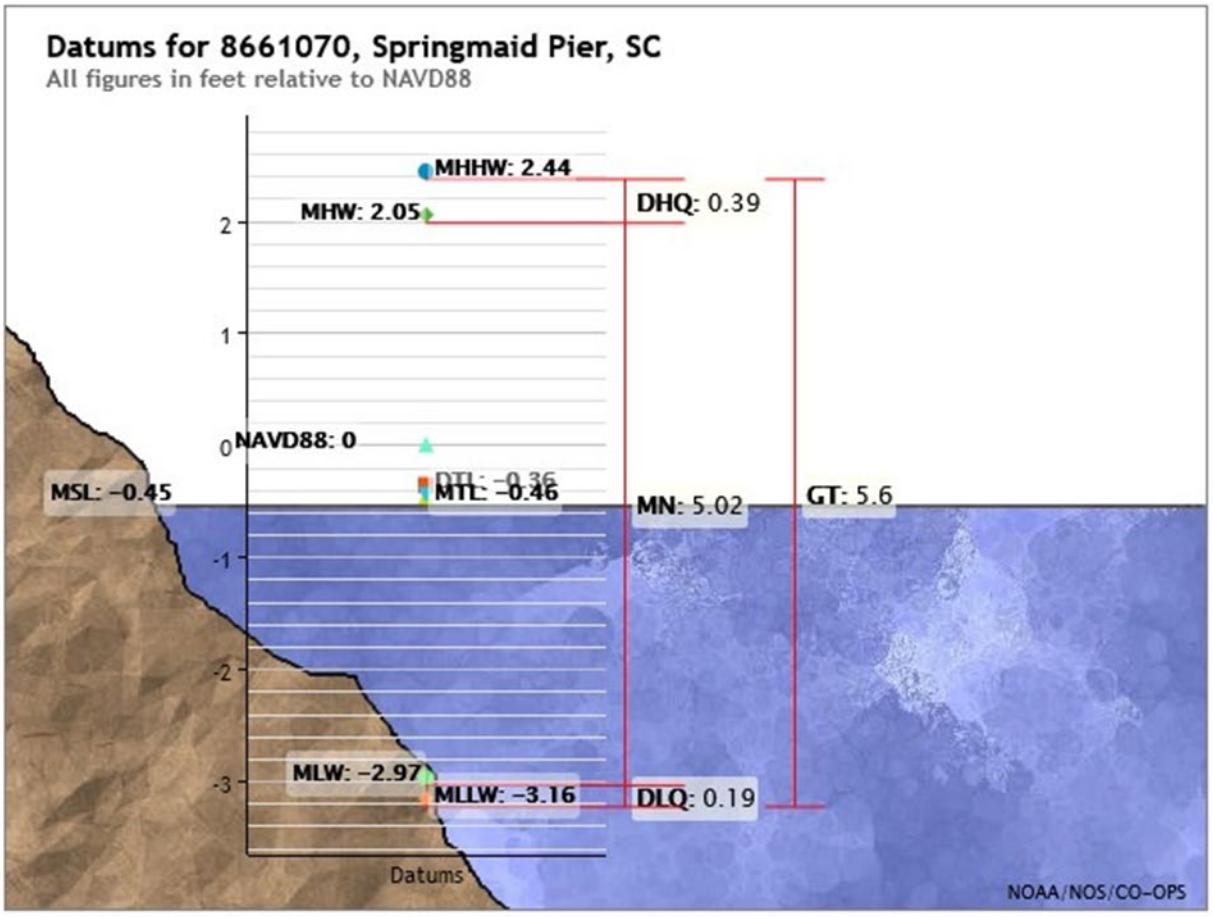


Figure 2. Tidal Datum for Springmaid Pier, SC Station 8661070

Volume Change

Representative volume changes were calculated at each benchmark between the 2022 and 2023 surveys. Volume changes were calculated for six (6) different elevation extents in order to better understand the processes occurring onshore and offshore of North Myrtle Beach. Calculations included volume change above +6.0 ft NAVD88 (berm), above +2.0 ft NAVD88 (MHW), above -5 ft NAVD88 (wading depth/recreational beach), above -10 ft NAVD88 (outer bar), above -20 ft NAVD88, and above -25 ft NAVD88. Upon inspection of recent survey data, it appears the depth of closure (DOC) is somewhere between -20 ft NAVD88 and -25 ft NAVD88. With more survey data, a more precise DOC elevation can be determined. **Figure 3** presents a graphical display of the various elevations for which volume change calculations were made.

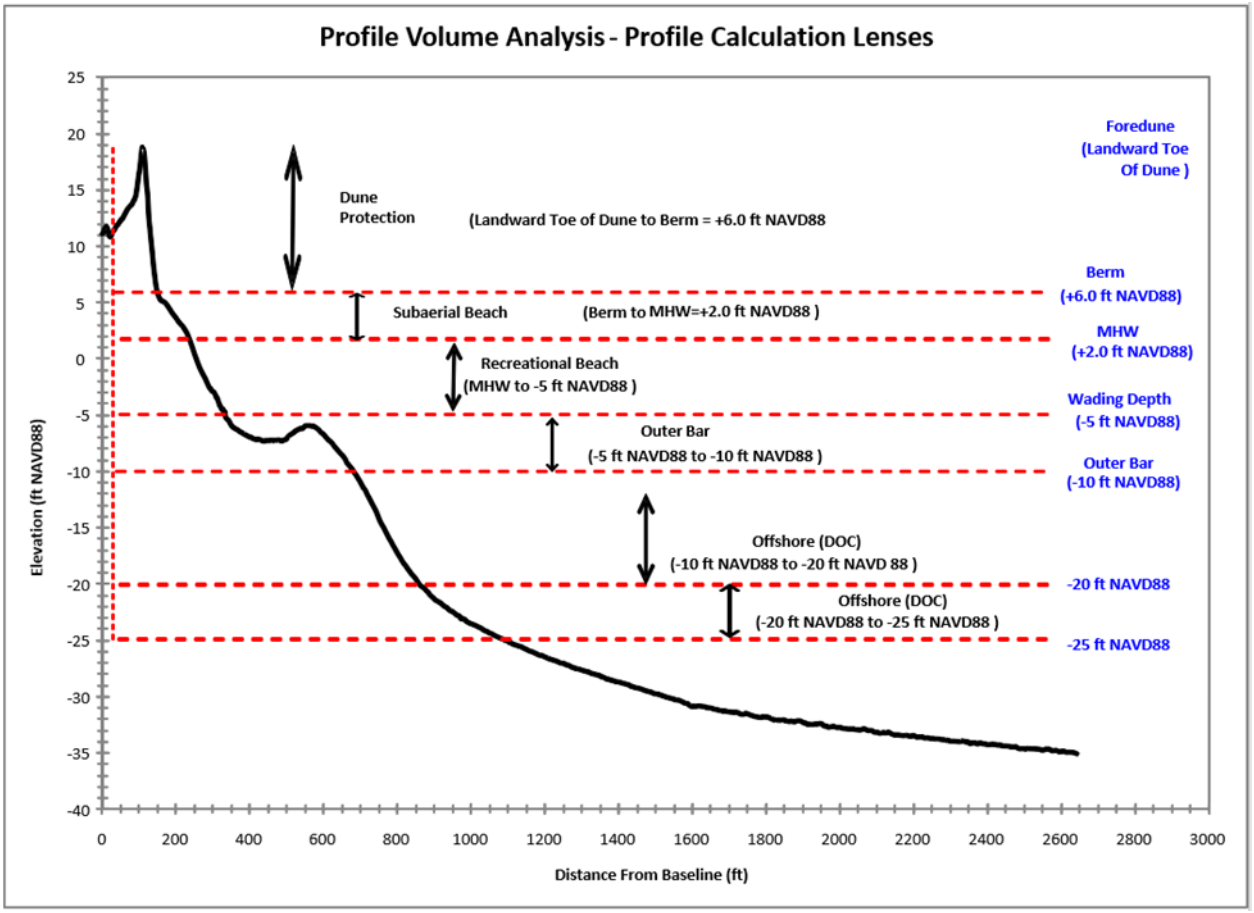


Figure 3. Profile Volume Calculation Lenses

As with the shoreline change, the resulting values represent volume change (cubic yards (cy)/ft) over the period between surveys. In addition, the volume changes were converted to cumulative changes over the entire oceanfront/reach. This was done by applying the average end area method to the unit volume changes (cy/ft) computed at each benchmark and summing the total volume changes over the entire oceanfront/reach. The resulting value indicates the total loss or gain of material between survey periods based on the applicable profile extents. It should be noted that the uncertainty in the hydrographic portion of the survey can result in a significant volumetric change in offshore areas where the slope of the seafloor declines gradually. An uncertainty of ±0.11 ft (as commonly reported) could be applied along the portion of the profile between an elevation of -20 ft and -25 ft NAVD88. For this reason, more attention is paid to the volume change calculations at -20 ft NAVD88 and above.

The profile volume calculation lenses (**Figure 3**) were strategically chosen to help understand and track the movement of sand onshore and offshore. Volume changes calculated for portions of the profiles above +6.0 ft NAVD88 and MHW are representative of changes in the amount of material in the dune system and on the subaerial beach. These areas are highly influenced by the impact of storm activity. Volume comparisons for portions of the profiles above -5 ft NAVD88,

which is an approximate wading depth, are representative of changes in the portion of the beach used for recreation. Volume comparisons above -10 ft NAVD88 help to track sand movement to and from the outer sand bar, encompassing the extent of renourishment activities. Wave energy from storms is expected to be absorbed by the profile out to -10 ft NAVD88, making it an important indicator of storm protection. Volume comparisons above -20 ft NAVD88 provide general estimates of the total volumetric change along the respective profile out to the DOC. Significant changes in the profile shape should not occur seaward of the DOC, currently estimated between -20 ft and -25 ft NAVD88. The calculations also provide a means to track the movement of sand offshore and quantify total gains and losses in the entire beach system.

Discussion of Periodic Surveying Evaluation Results

This section will discuss recent events (i.e. beneficial placement, storms, etc.) within the reporting time period which have likely impacted the North Myrtle Beach annual shoreline and volume change trends. Profile comparison plots for the 2022 and 2023 surveys at each benchmark are presented in **Appendix A**. Finally, the computed shoreline changes and volume changes at each individual benchmark between the survey period are tabulated in **Appendix B**.

Key Events During the Reporting Period

Beach changes are greatly influenced by natural (i.e. storms) and engineering processes (i.e. sand placements). This section describes key events that occurred during the 2022 – 2023 reporting period that likely had an impact on shoreline change as well as profile volume gains and losses.

Storm Events

Hurricane Ian impacted the study area two days after the 2022 survey was collected. Therefore some of the volume losses can be attributed to Hurricane Ian and the continued recovery.

Hurricane Idalia impacted the study area on August 31, 2023 so any influences from this storm are not reflected in the 2023 survey which was collected on August 21, 2023.

To observe storm effects for North Myrtle Beach and quantify the wave climate for the region, wave data was obtained from the National Data Buoy Center (NDBC). Sunset Beach, NC Station SSBN7 was analyzed for the presence of storm events within the survey timeframe. The location of this buoy is shown in **Figure 4**.

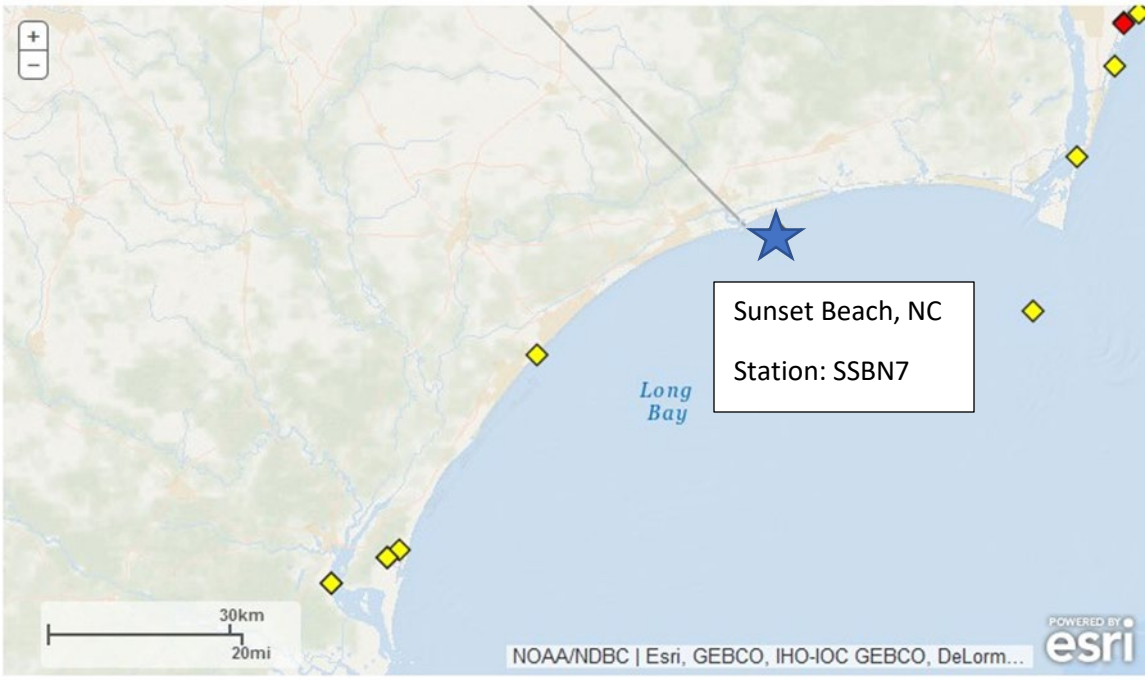


Figure 4. Sunset Beach, NC Buoy Location

Figure 5 shows the significant wave height measured at the Sunset Beach, NC buoy for the period between the 2022 and 2023 surveys. The survey period storm activity saw six (6) instances of the offshore wave heights reaching 6 – 8 ft. While Hurricane Ian reached offshore wave heights of almost 14 feet.

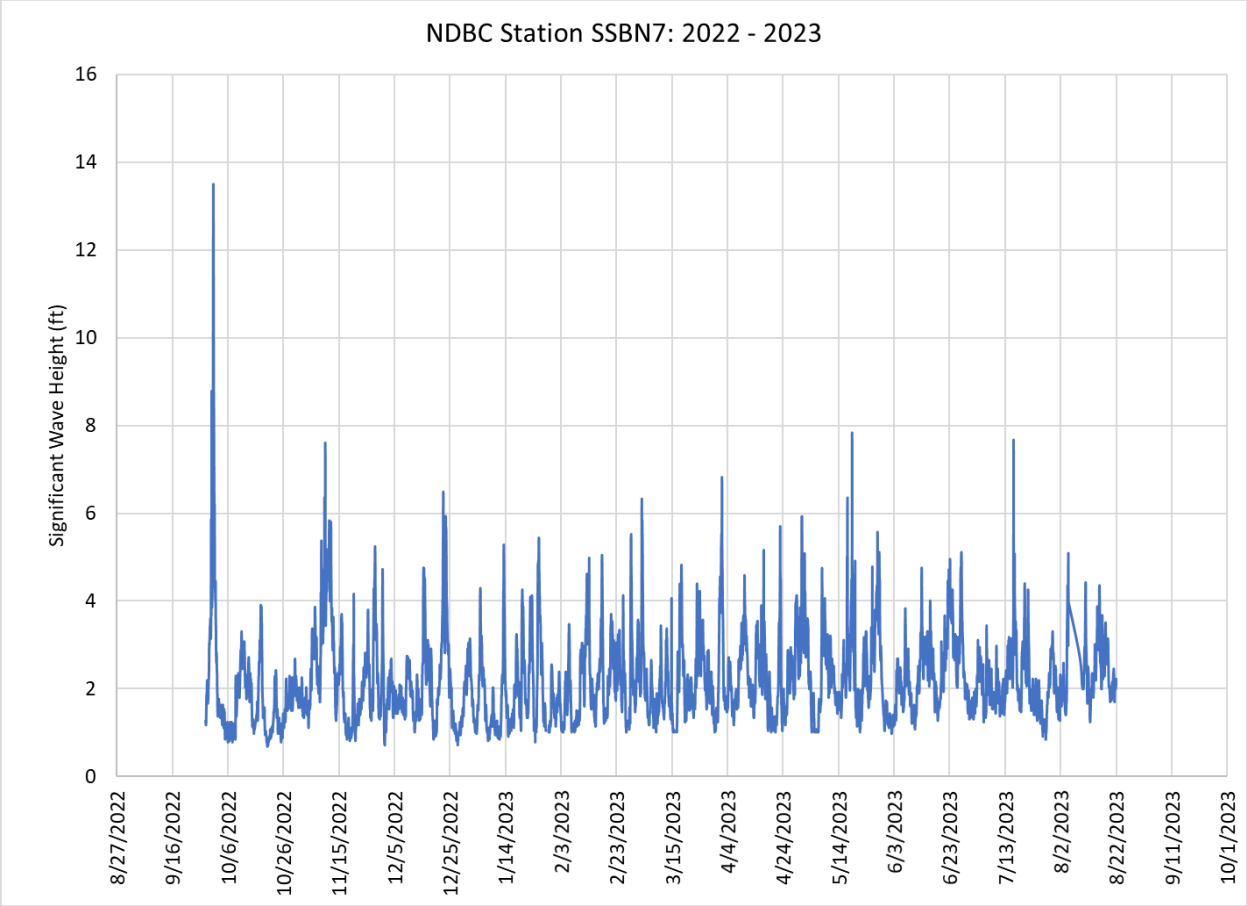


Figure 5. Significant Wave Height (9/2022 - 8/2023)

Sand Placement Events

The entire North Myrtle Beach Oceanfront is included of Reach 1 of the USACE Myrtle Beach Storm Damage Reduction Project. The most recent nourishment event took place in June 2019 (as a result of Hurricane Florence) and covered the southwest and northeast ends of North Myrtle Beach, specifically Windy Hill Beach, BM 5700 - 5715, and Cherry Grove, BM 5830 - 5880. The 2019 nourishment covered approximately 2.7 miles and placed 510,000 cy. A nourishment event of Reach 1 is anticipated to occur in 2024. A history of the nourishment events for North Myrtle Beach Oceanfront is shown in **Figure 6**.

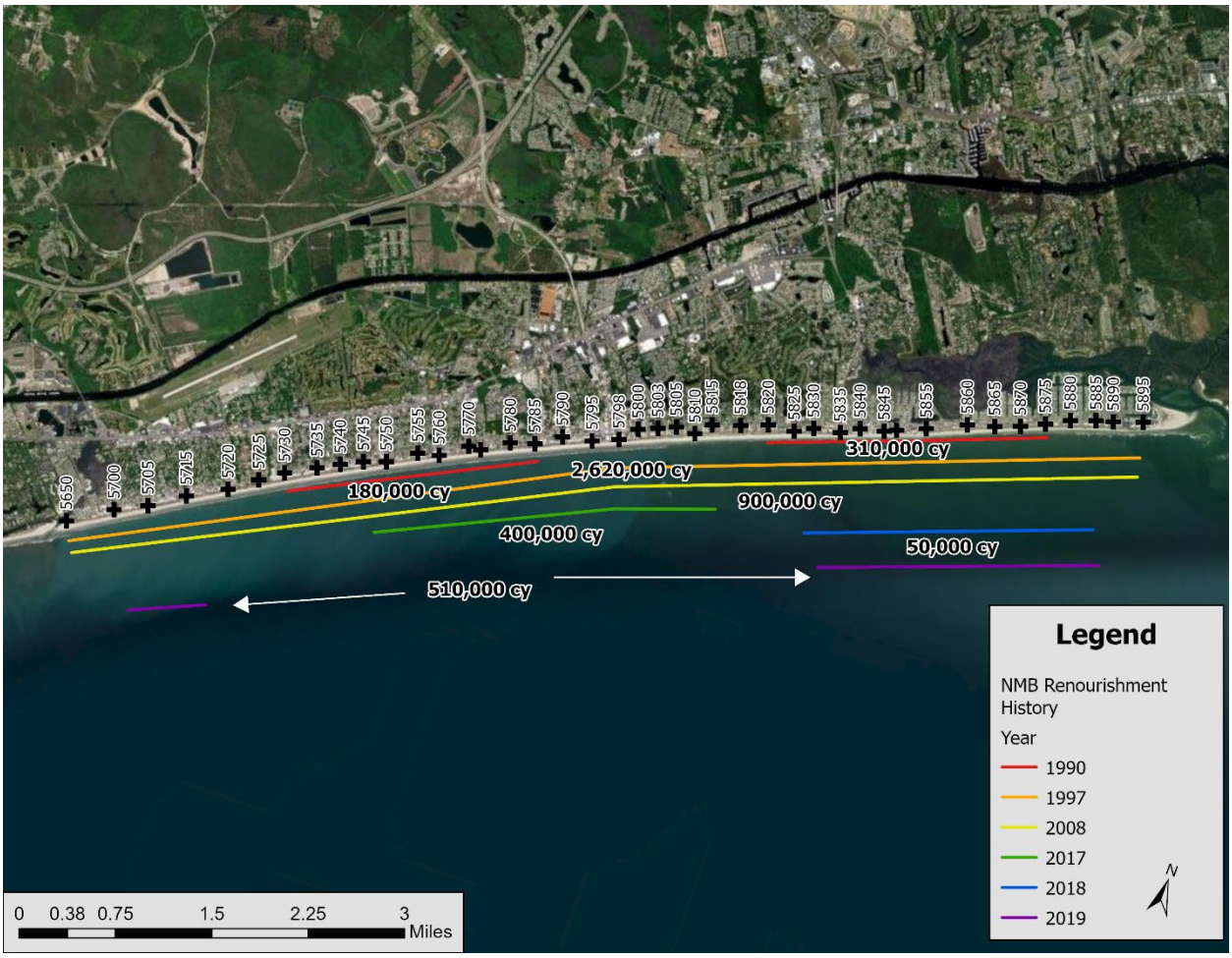


Figure 6. Nourishment History

Oceanfront Shoreline and Volume Trends

Key statistics were calculated to quantify average shoreline and volume changes for each individual shoreline reach on North Myrtle Beach: Windy Hill Beach – Crescent Beach, Ingram Beach – Ocean Drive Beach, and Cherry Grove Beach – Futch Beach as well as the North Myrtle Beach Oceanfront (Windy Hill Beach through Futch Beach) as a whole. The computed statistics include average shoreline change, average volume change, and cumulative volume change (i.e. total volume of material lost or gained along a section of shoreline). A summary of the resulting statistics for each individual survey reach (and the North Myrtle Beach - Oceanfront) are presented in **Table 3**. Evaluation of the computed statistics will consider shoreline position changes at +2.0 ft NAVD88 (MHW) as well as volume changes computed for portions of the profile above +6.0 ft NAVD88 (berm), +2.0 ft NAVD88 (MHW), above -5 ft NAVD88, above -10 ft NAVD88, above -20 ft NAVD88, and above -25 ft NAVD88 in order to better understand onshore and offshore processes. Since benchmarks are not always evenly spaced and reaches differ in length, a weighted average for unit shoreline change (ft) and unit volume change (cy/ft) were calculated

for each individual survey reach (and the North Myrtle Beach - Oceanfront) based on the length of beach that each benchmark covers.

Annual 2022 – 2023 Summary

As seen in **Table 3** along the North Myrtle Beach – Oceanfront (Windy Hill Beach to Futch Beach), there was average landward movement of the shoreline at MHW (+2.0 ft NAVD88) of -6.3 ft. This can also be observed in **Figure 7** where all the points at or below the red line (zero) indicate the shoreline eroded (moved landward). There were areas of the Oceanfront where the shoreline moved seaward (shoreline accretion) this was mainly observed in Ingram Beach (BM 5760 -5790). Most of the shoreline erosion was between the depths of 0 to -20 ft and was experienced across the entire North Myrtle Beach - Oceanfront. The outliers in this range were in Cherry Gove Beach – Futch Beach. This shoreline loss resulted in a corresponding loss of material above MHW of -2.9 cy/ft.

The North Myrtle Beach – Oceanfront lost material at all elevations, almost no profiles saw a gain at any elevation. The most pronounced volume changes occurred in the Cherry Grove Beach – Futch Beach reach which reported the largest volume losses across the Oceanfront at all elevations. With the exception of Cherry Grove Beach – Futch Beach, the rest of the volume losses were fairly uniform across the Oceanfront with other reaches reporting similar sized losses. These volume changes can be observed in **Figure 8** where points below the red line (zero) indicate the volume loss (erosion) and points above the red line indicate volume gain (accretion), when compared to the previous year survey.

Across the North Myrtle Beach – Oceanfront the average change above +6 ft NAVD88 was -1.6 cy/ft, meaning there was minor losses to the upper berm and dune portion of the beach. This does not mean sufficient dune protection is in place across the beach, just that losses were minor. The dune in areas from BM 5705 – 5760 (Windy Hill Beach, Atlantic Beach, and Crescent Beach) appears to either have lost a portion of the front of the dune or a more significant portion of the dune is now gone. This dune loss trend was also observed in BM 5885 – 5895 (Futch Beach).

Cumulative volume changes are shown in **Figure 9**.

Table 3.Shoreline and Volume Change Statistics for North Myrtle Beach (Sept 2022 - August 2023)

2022 vs. 2023 (Total Change)	Reach Length	avg volume change above +6 ft NAVD88	cumulative volume change above +6 ft NAVD88	avg shoreline change @ +2.0 ft NAVD88	avg volume change above +2.0 ft NAVD88	cumulative volume change above +2.0 ft NAVD88	avg volume change above -5 ft NAVD88	cumulative volume change above -5 ft NAVD88	avg volume change above -10 ft NAVD88	cumulative volume change above -10 ft NAVD88	avg volume change above -20 ft NAVD88	cumulative volume change above -20 ft NAVD88	avg volume change above -25 ft NAVD88	cumulative volume change above -25 ft NAVD88
Reach	ft	cy/ft	cy	ft	cy/ft	cy	cy/ft	cy	cy/ft	cy	cy/ft	cy	cy/ft	cy
Windy Hill Beach - Crescent Beach BM 5700 - 5755	14,190	-2.2	-30,898.8	-5.0	-3.8	-54,251.9	-9.0	-127,029.7	-11.5	-162,951.1	-14.4	-204,514.1	-27.5	-390,021.7
Ingram Beach - Ocean Drive Beach BM 5760 - 5825	15,994	-0.2	-3,938.3	-3.5	-0.5	-7,939.0	-1.6	-26,296.7	-4.4	-70,227.6	-7.7	-122,969.4	-19.7	-315,392.1
Cherry Grove Beach Futch Beach BM 5830 -5890	13,574	-2.5	-33,918.9	-11.0	-4.7	-63,541.4	-11.3	-153,493.5	-17.8	-241,592.0	-28.7	-389,479.8	-51.5	-698,532.8
	Reach Length	weighted avg	total	weighted avg	weighted avg	total	weighted avg	total	weighted avg	total	weighted avg	total	weighted avg	total
North Myrtle Beach Oceanfront* BM 5700 - 5890	43,758	-1.6	-68,756.0	-6.3	-2.9	-125,732.3	-7.0	-306,819.9	-10.8	-474,770.7	-16.4	-716,963.3	-32.1	-1,403,946.6
*North Myrtle Beach Oceanfront does not include White Point Swash or Hog Inlet														

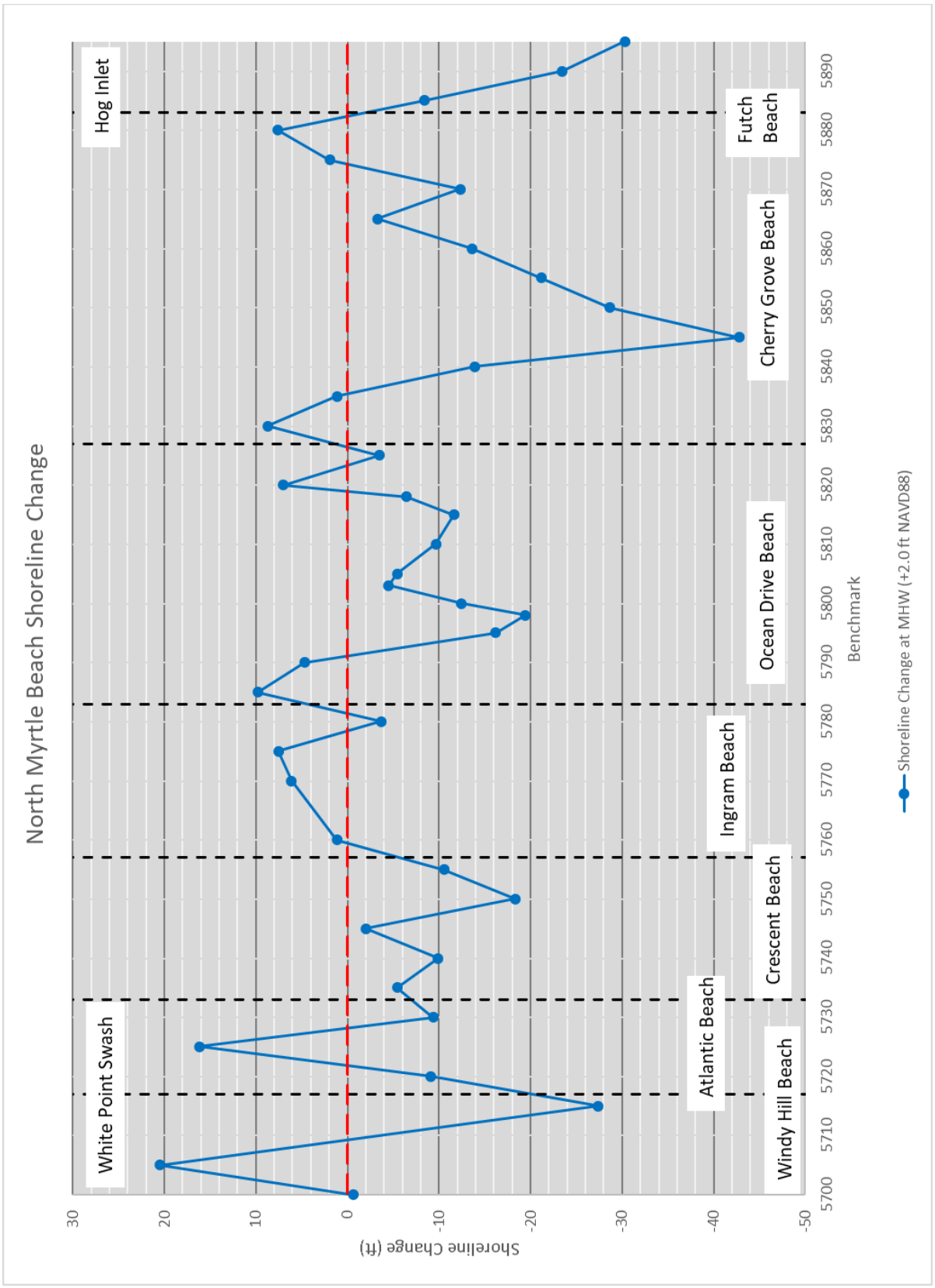


Figure 7. North Myrtle Beach Shoreline Change (2022 - 2023)

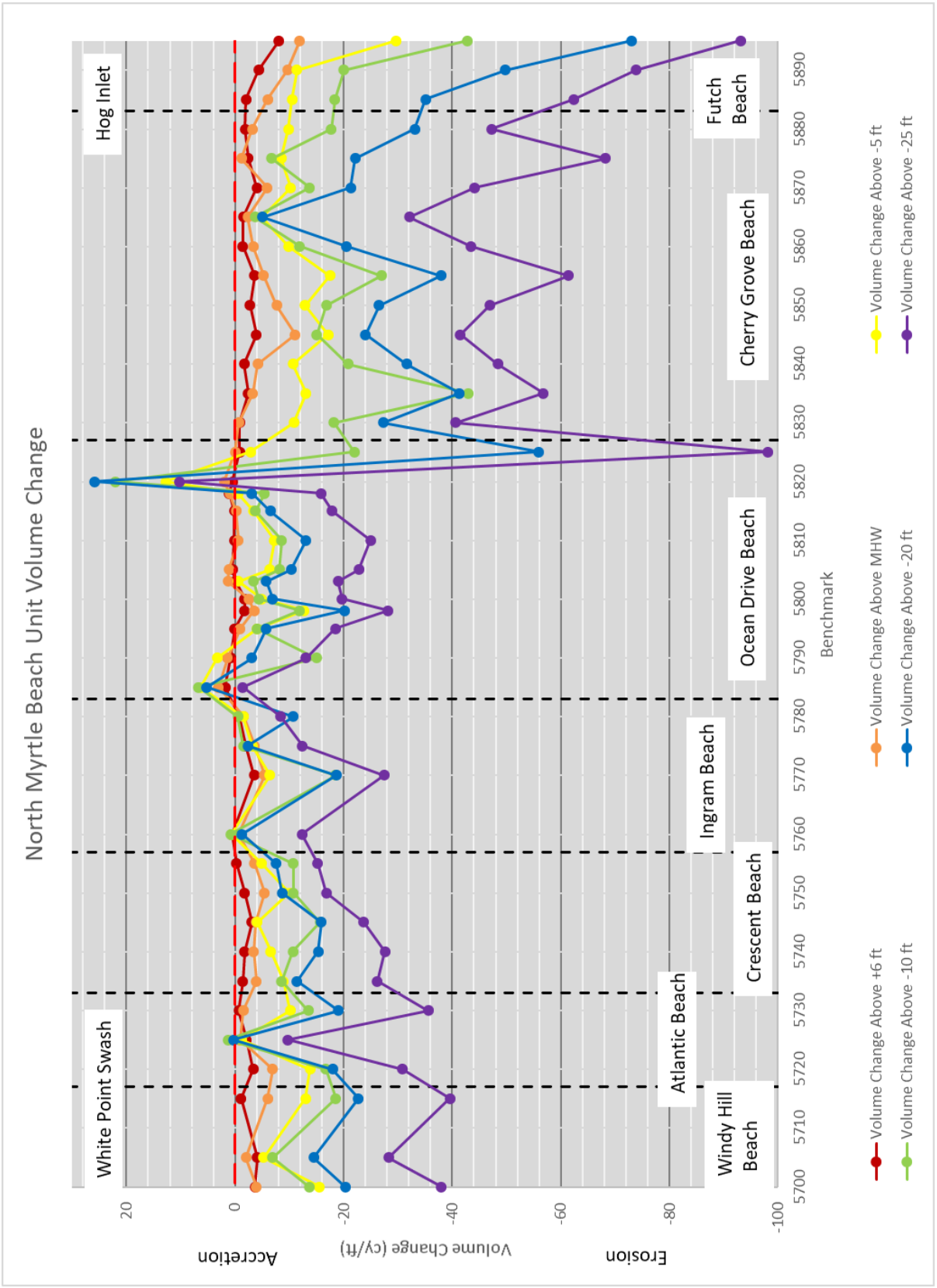


Figure 8. North Myrtle Beach Volume Change (2022 - 2023)

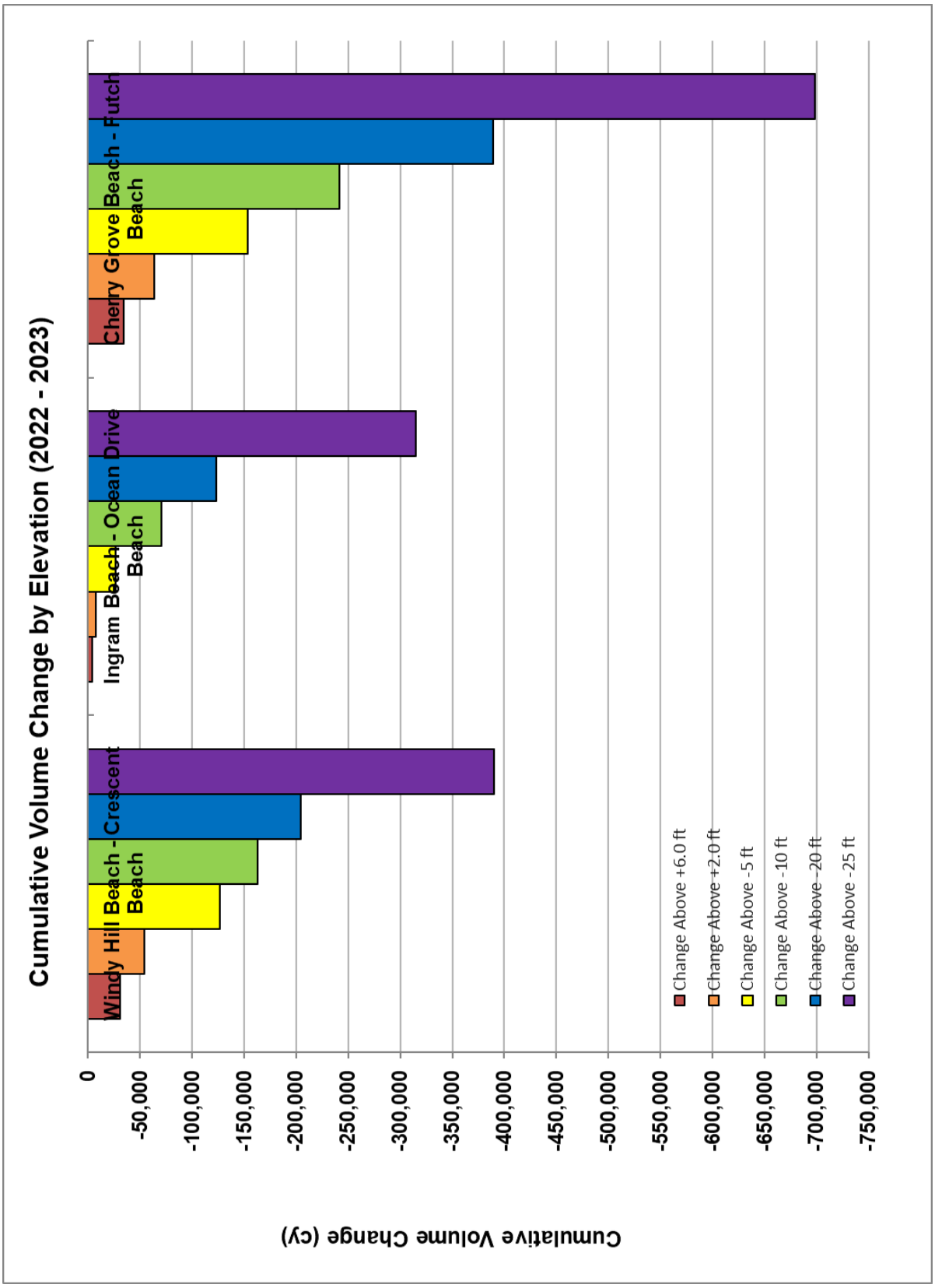


Figure 9. North Myrtle Beach Cumulative Volume Change (2022-2023)

Windy Hill Beach – Crescent Beach

The Windy Hill Beach – Crescent Beach survey analysis extends approximately 14,000 ft from the southwestern city limits at White Point Swash (BM 5650 excluded from analysis) to 15th Avenue South and contains eleven (11) survey benchmarks (BM 5700 – 5755). In 2019 between BM 5700 – 5715 (Windy Hill Beach) almost 1 mile was nourished, the volume amount placed in this area is unknown. In total between Windy Hill Beach and Cherry Grove Beach 500,000 cy was placed.

Windy Hill Beach – Crescent Beach experienced an average shoreline loss of -5.0 ft (see **Table 3** and **Figure 7**) which correlated with a minor volume loss of -2.2 cy/ft. The volume losses experienced at all elevations and profiles (except BM 5725) in this reach can be observed in **Figure 8**. A typical profile for Windy Hill Beach – Crescent Beach is shown in **Figure 10** below, all profiles can be found in **Appendix A**. For the entire North Myrtle Beach – Oceanfront, this reach experienced the second highest volume losses above all elevations. The general dune loss from this reach can be observed in the typical profile below. This section of the beach experienced increasing volume loss above +6.0 ft NAVD88 to -25 ft NAVD88 indicating that material was exiting the system. This trend of increasing volume loss with depth is easily visualized in the cumulative volume change shown in **Figure 9**. As noted in earlier sections there is less survey accuracy is obtained at depths of -25 ft NAVD88 so not as much significance is attributed to these volume numbers.

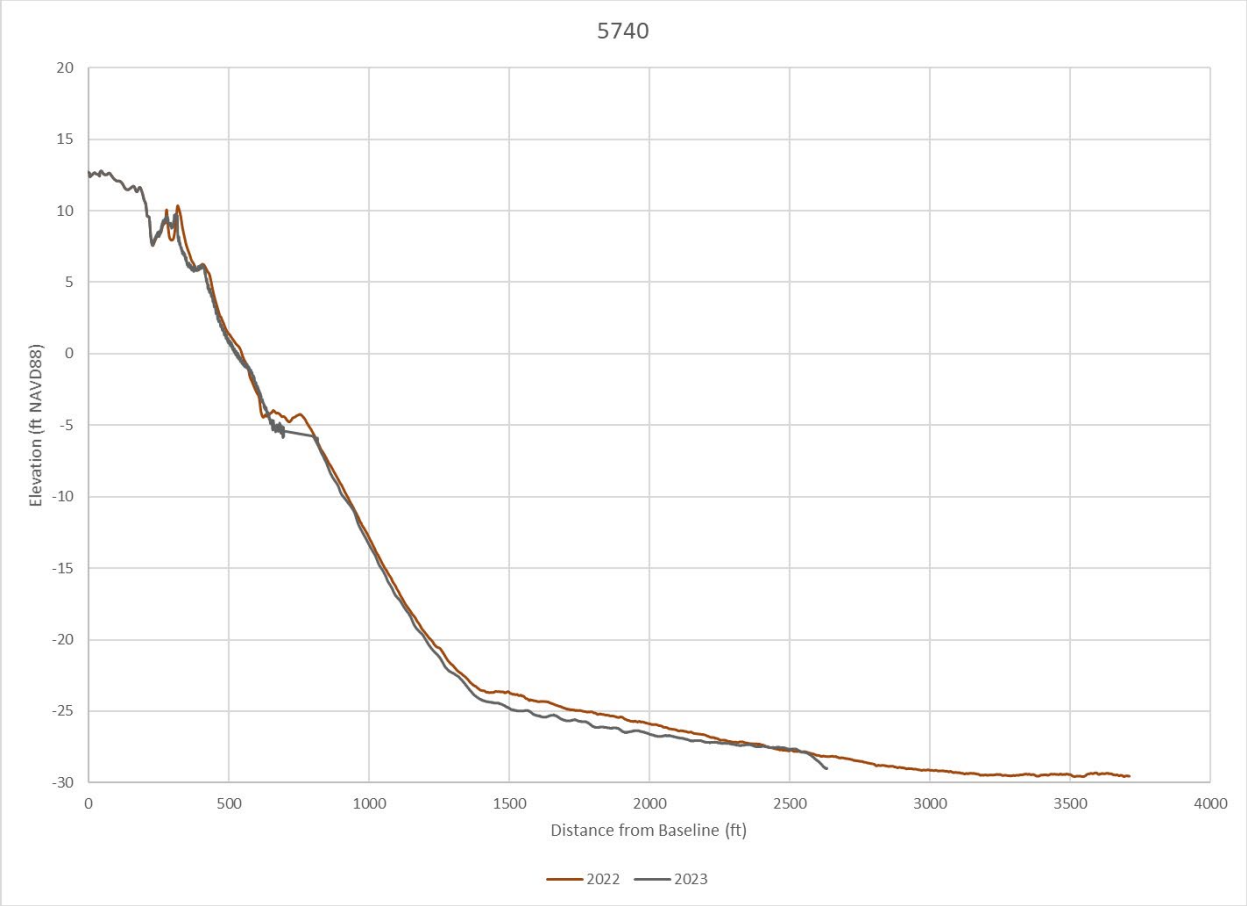


Figure 10. Windy Hill Beach - Crescent Beach Typical Profile

Ingram Beach – Ocean Drive Beach

The Ingram Beach – Ocean Drive Beach survey analysis extends approximately 16,000 ft from the 15th Avenue South to Shorehaven Drive and contains sixteen (16) survey benchmarks (BM 5760 – 5825). It is not documented that this portion of the beach received any nourishment in the 2019 event. However this area did receive nourishment as recently as 2017, see **Figure 6**.

Ingram Beach – Ocean Drive Beach experienced an average shoreline loss of -3.5 ft (see **Table 3** and **Figure 7**) this was the smallest average landward movement of the shoreline across the oceanfront. This shoreline loss correlated with a volume loss of -0.2 cy/ft above MHW. A typical profile for Ingram Beach – Ocean Drive Beach is shown in **Figure 11** below, all profiles can be found in **Appendix A**. There were no average volume gains reported at any elevation for this reach, this does not mean individual profiles did not gain material at certain elevations as observed in **Figure 8**. This section of the North Myrtle Beach – Oceanfront also experienced increasing volume loss from +6.0 ft NAVD88 to -25.0 ft NAVD88 indicating that some material was entirely lost within the system. This trend of increasing volume loss with increasing depth is easily visualized in the cumulative volume change shown in **Figure 9**. As noted in earlier sections

there is less survey accuracy is obtained at depths of -25 ft NAVD88 so not as much significance is attributed to these volume numbers.

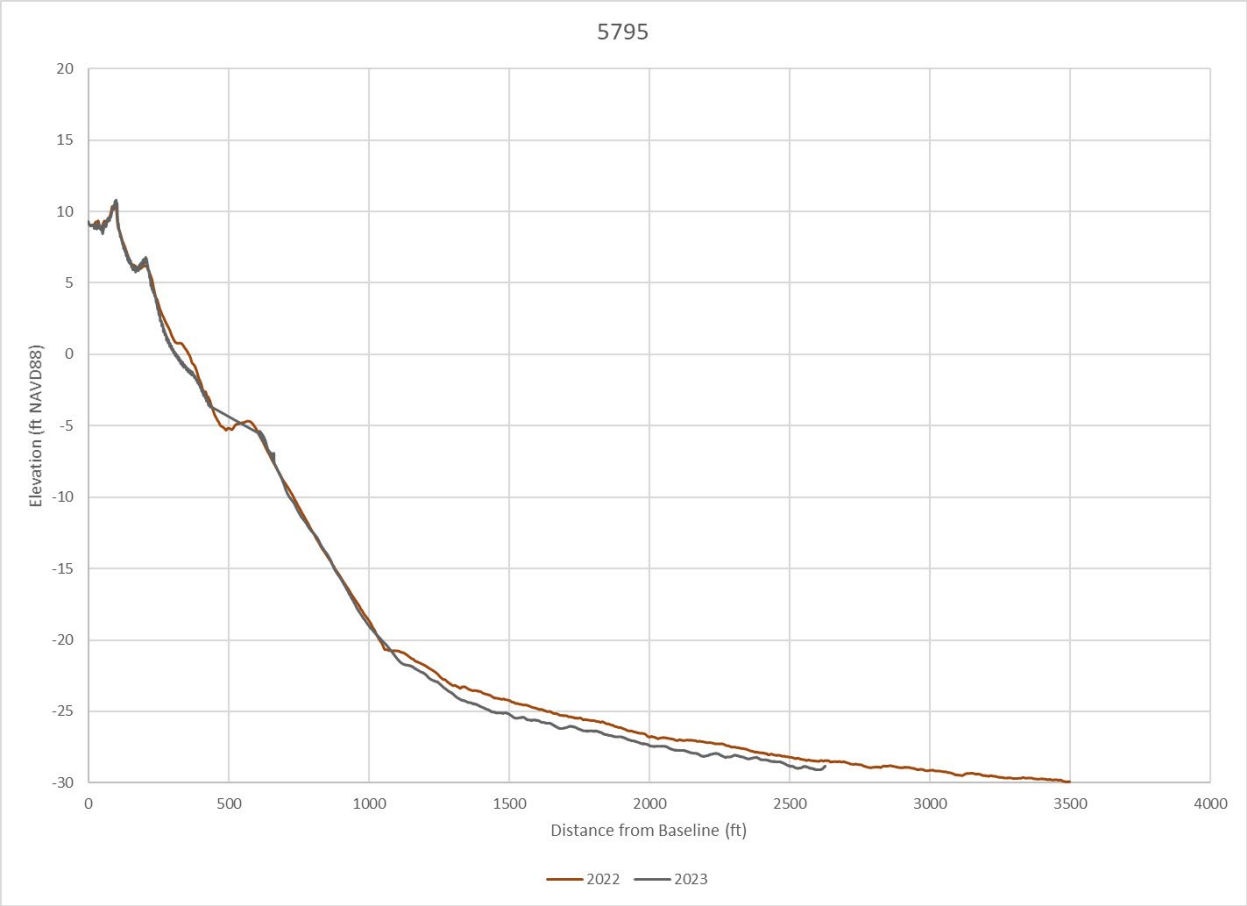


Figure 11. Ingram Beach - Ocean Drive Beach Typical Profile

Cherry Grove Beach – Futch Beach

The Cherry Grove Beach – Futch Beach survey reach extends approximately 13,500 ft from Shorehaven Drive to Hog Inlet (BM 5895 excluded from analysis) and contains thirteen (13) survey benchmarks (BM 5830 – 5890). In 2019 between BM 5830 – 5880 (Cherry Grove Beach) almost 2 miles were nourished, the volume amount placed in this area is unknown. In total between Windy Hill Beach and Cherry Grove Beach approximately 510,000 cy was placed.

Cherry Grove Beach – Futch Beach experienced an average shoreline loss of -11.0 ft (see **Table 3** and **Figure 7**), this was the highest across the Oceanfront. This shoreline loss correlated with a volume loss of -4.7 cy/ft above MHW. A typical profile for Cherry Grove Beach – Futch Beach is shown in **Figure 12** below, all profiles can be found in **Appendix A**. This section of the North Myrtle Beach – Oceanfront experienced an average volume loss above +6 ft NAVD88 at -2.5 cy/ft. Consistent with the rest of the Oceanfront, volume loss across the elevations increased with depth, the greatest being above -25 ft NAVD88. These increasing volume losses indicate that

material is leaving the system. However, as noted in earlier sections less survey accuracy is obtained at depths of -25 ft NAVD88 so not as much significance is attributed to these numbers. Given the proximity to Hog Inlet the volume trends in this area will continue to be observed for any correlations to inlet influence. The trend of increasing volume loss is easily visualized in the cumulative volume change shown in **Figure 9**.

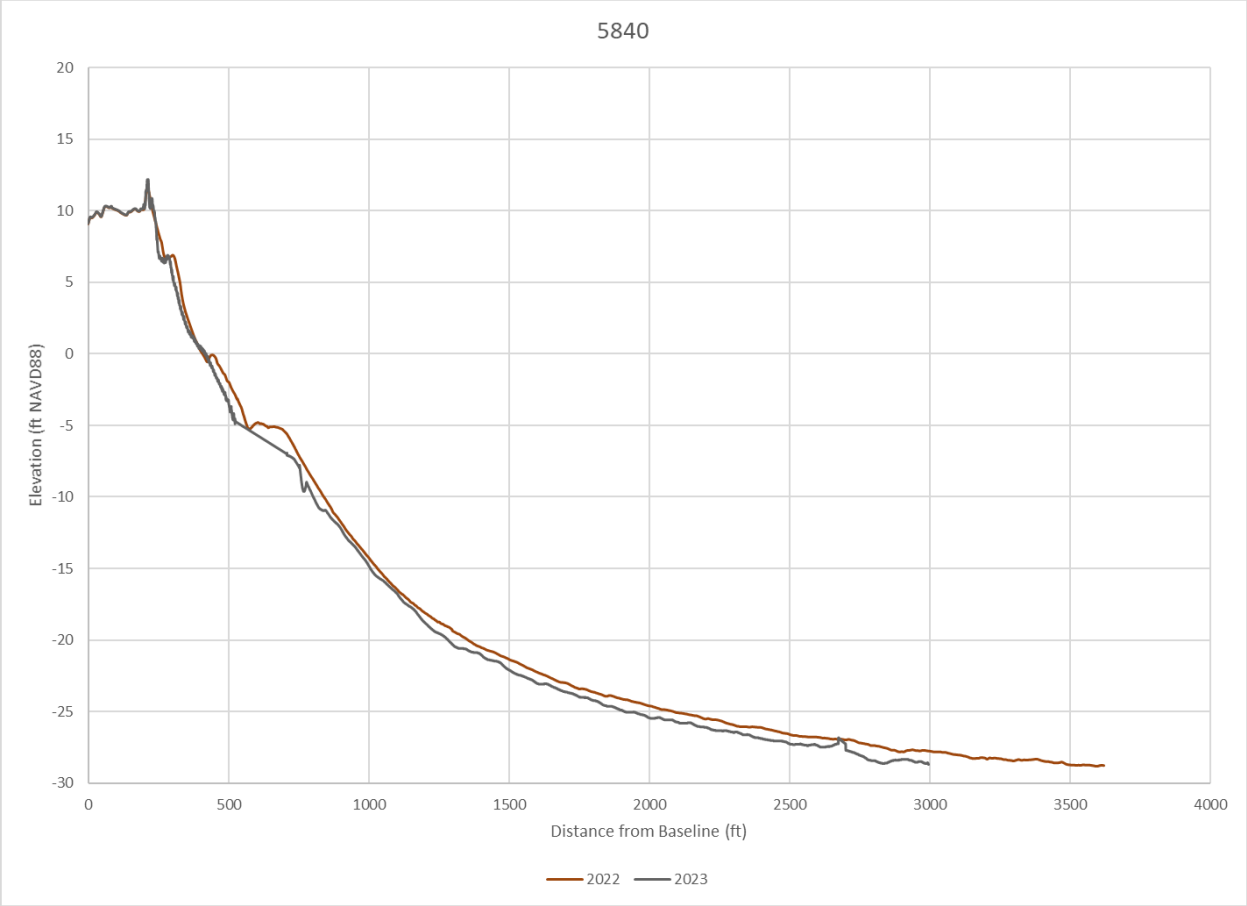
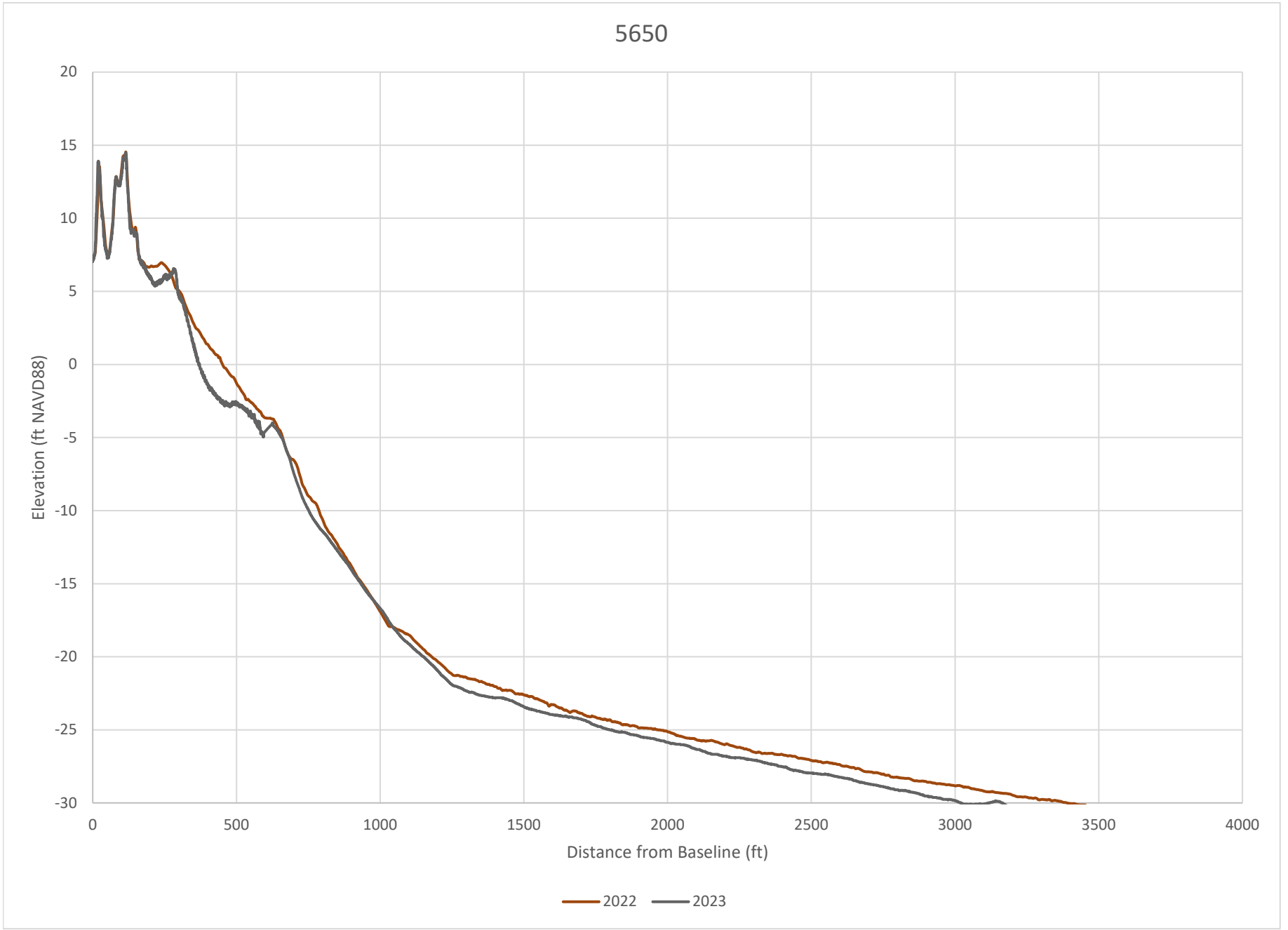


Figure 12. Cherry Grove Beach - Futch Beach Typical Profile

Appendix A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Distance from Baseline (ft)
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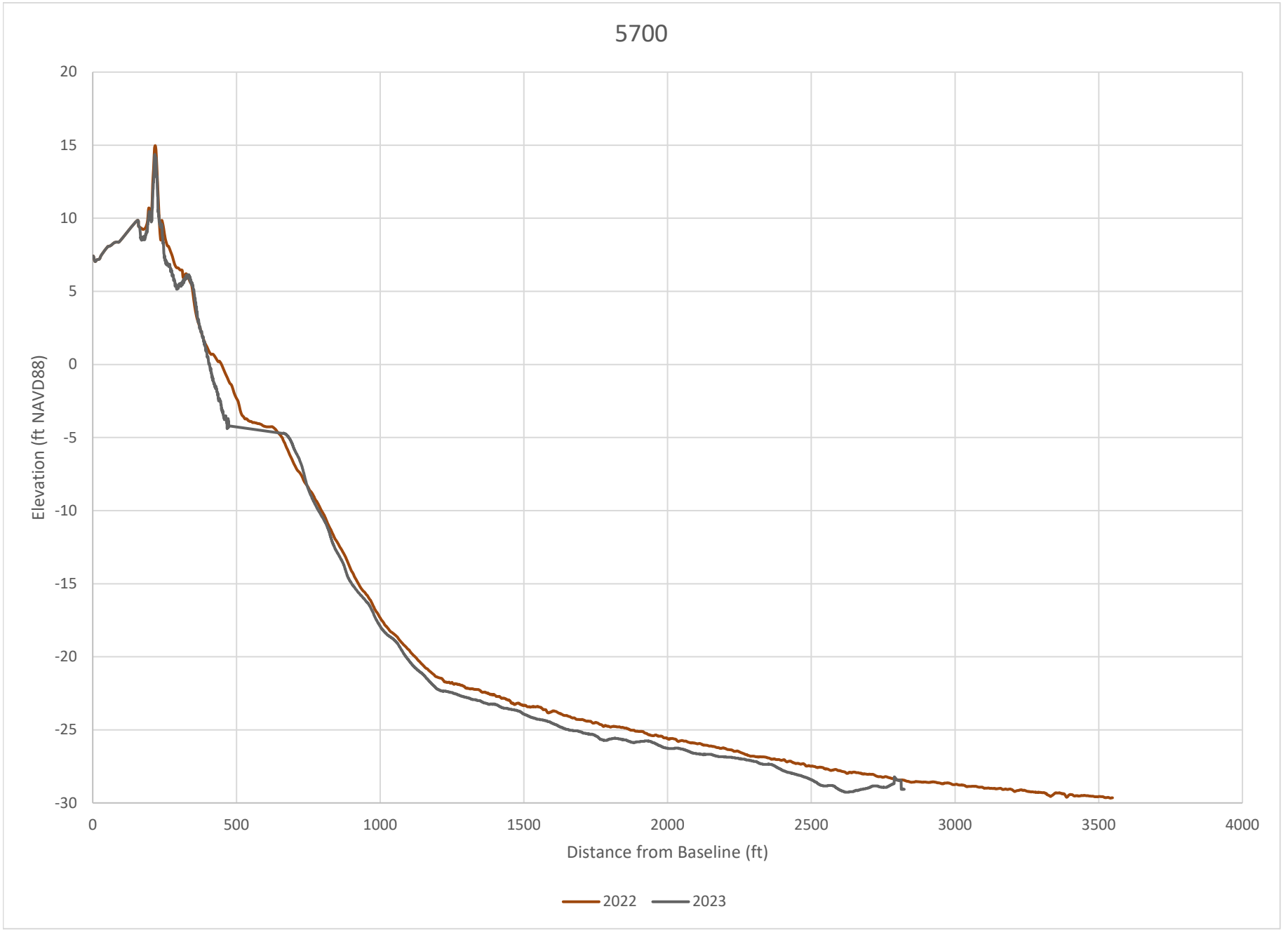
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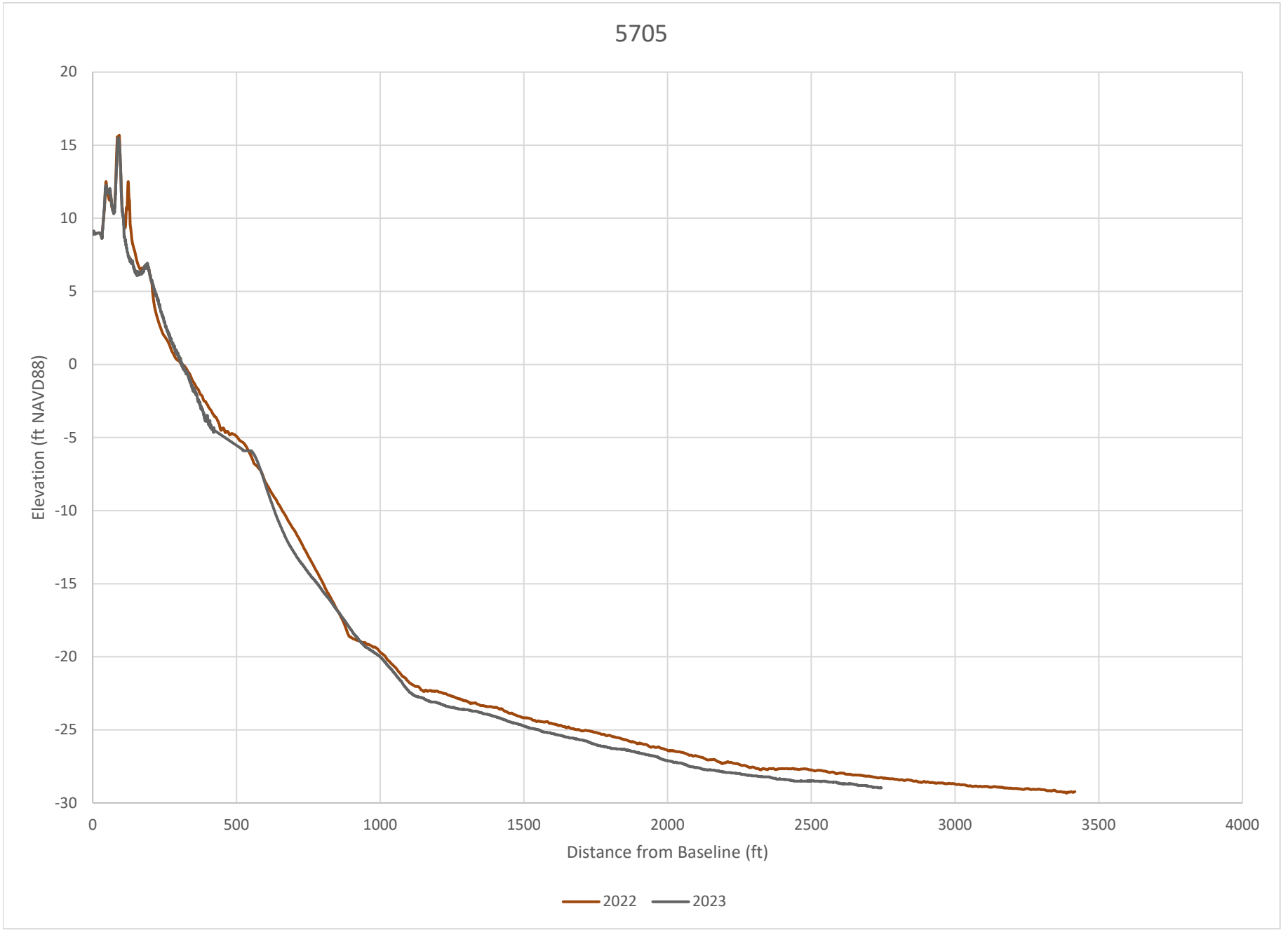
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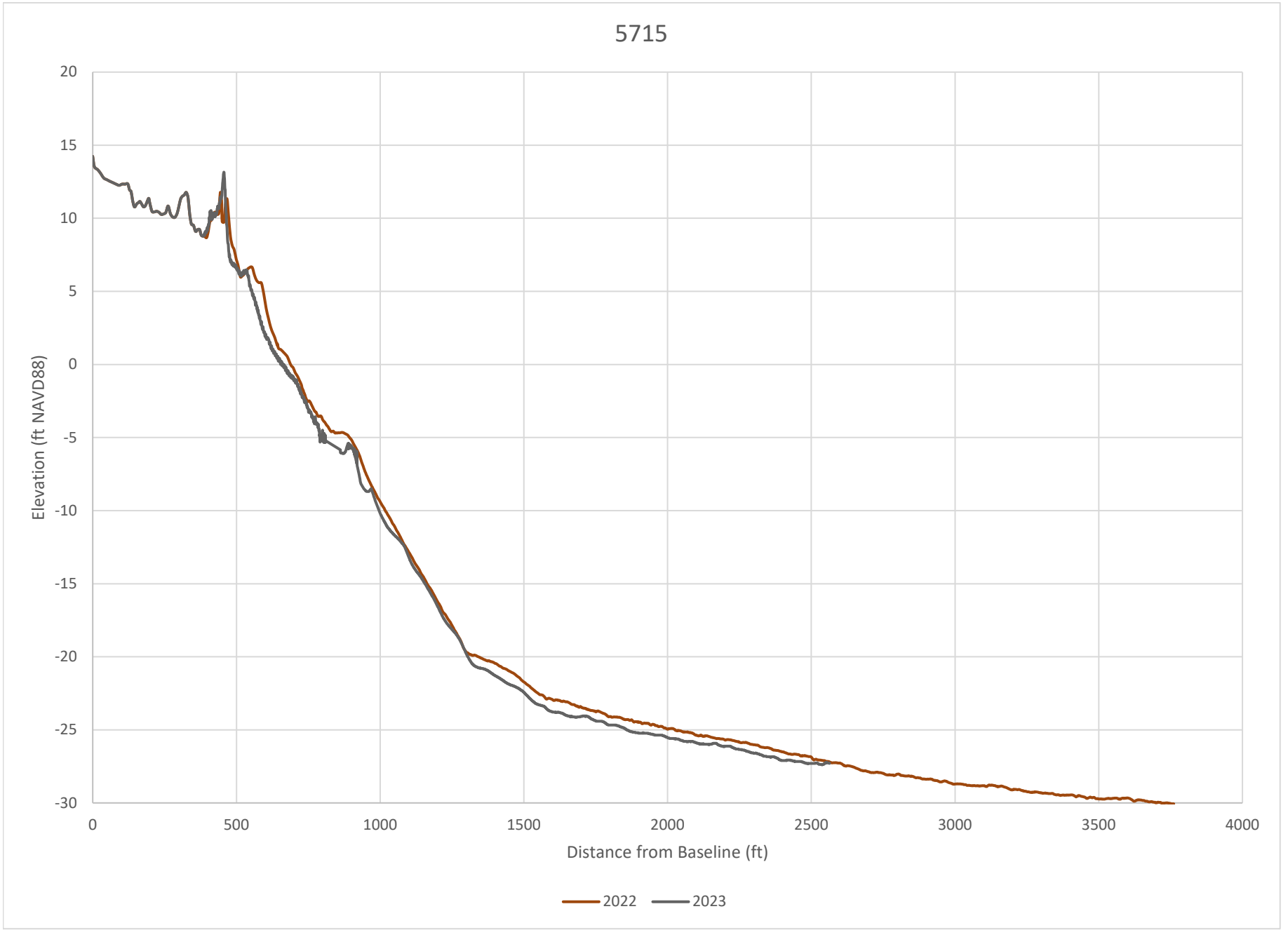
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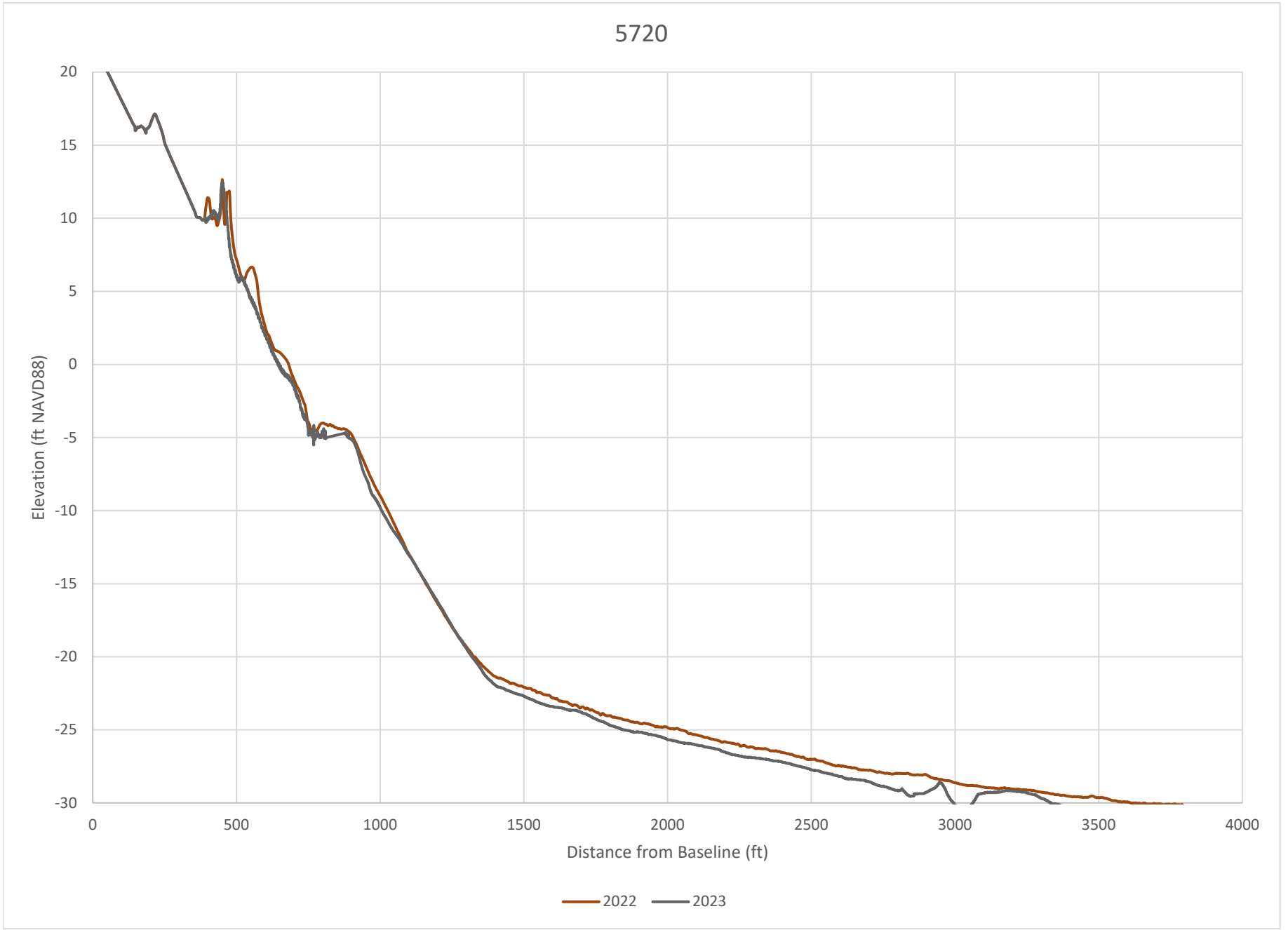
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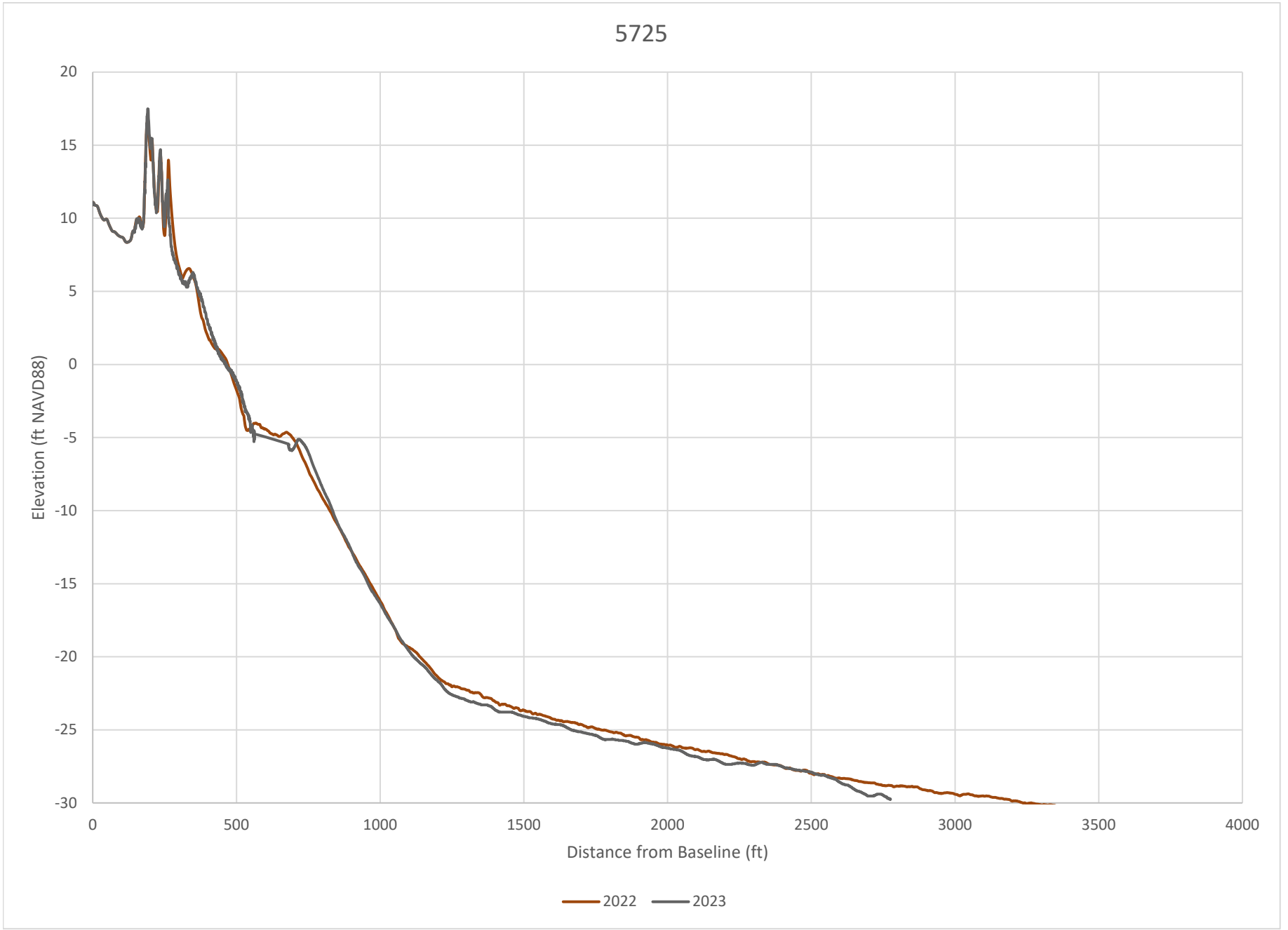
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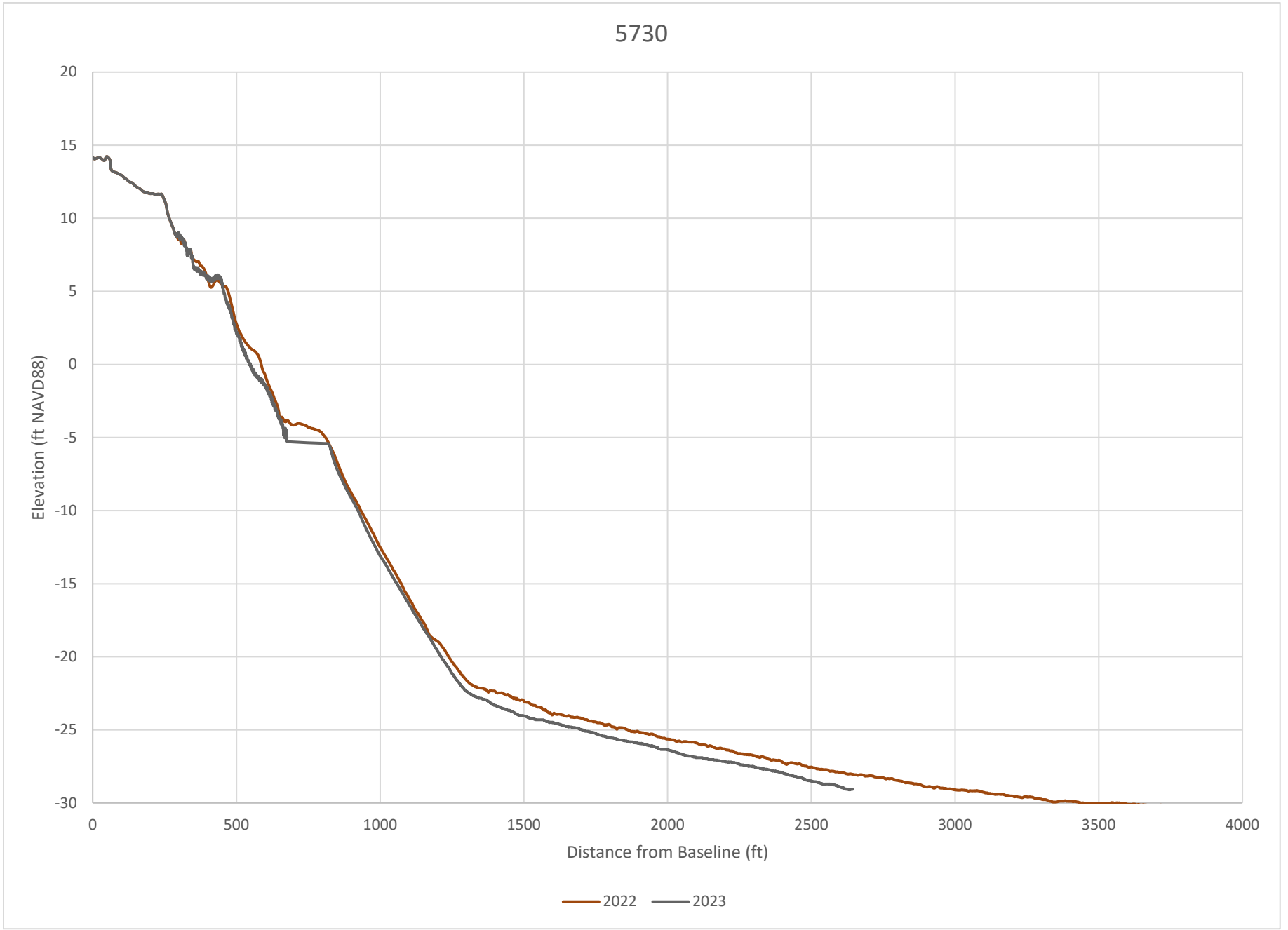
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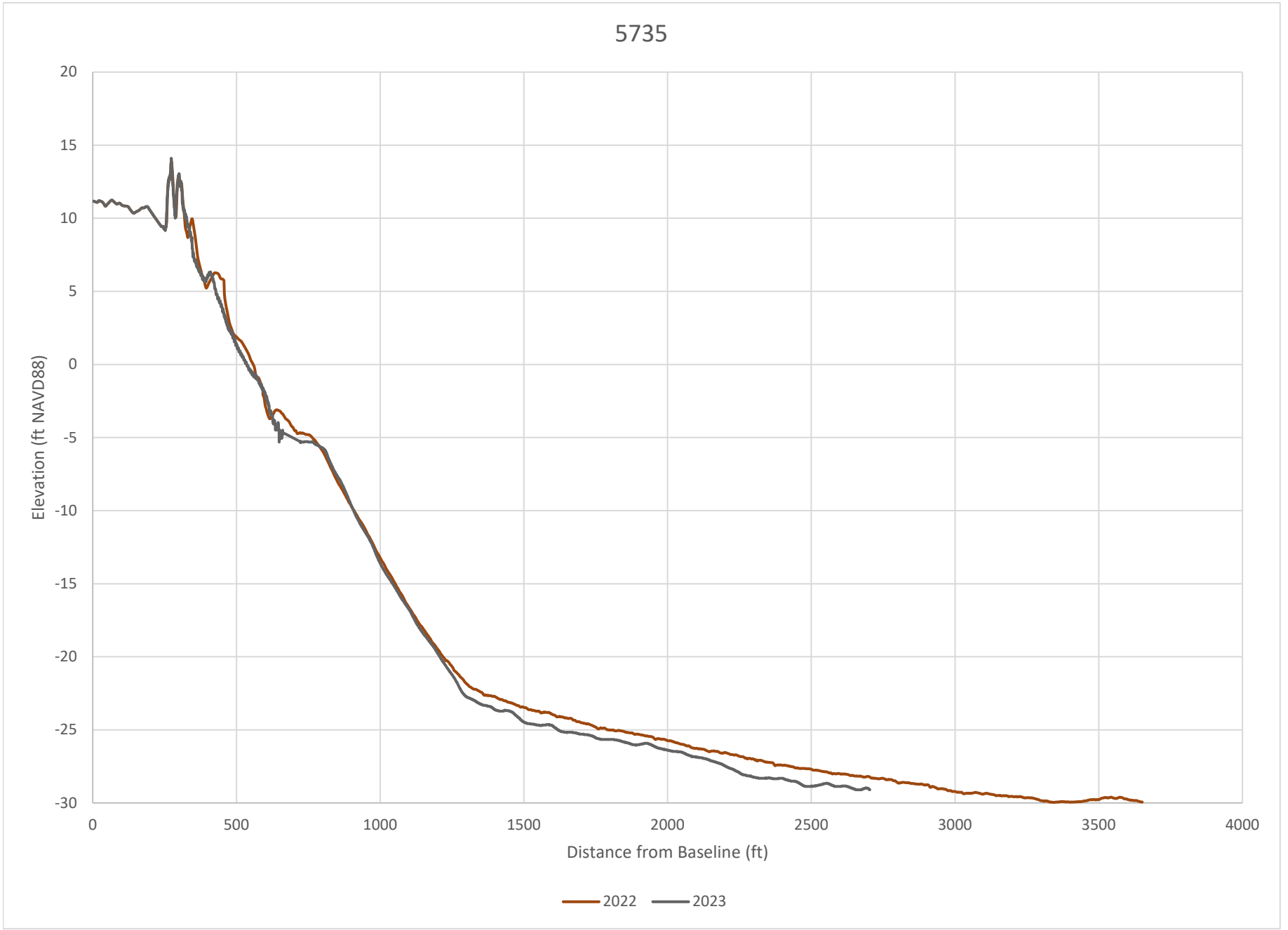
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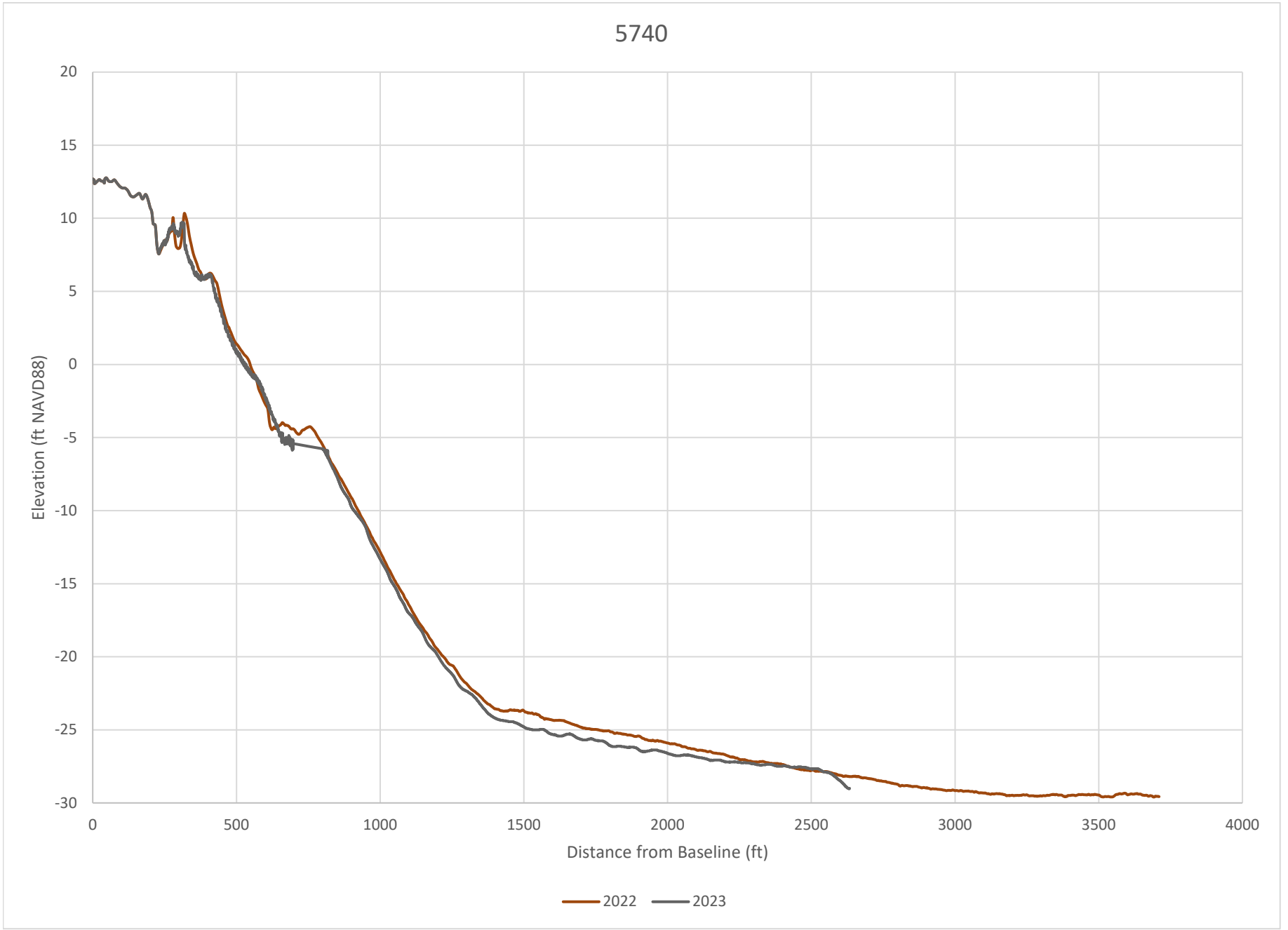
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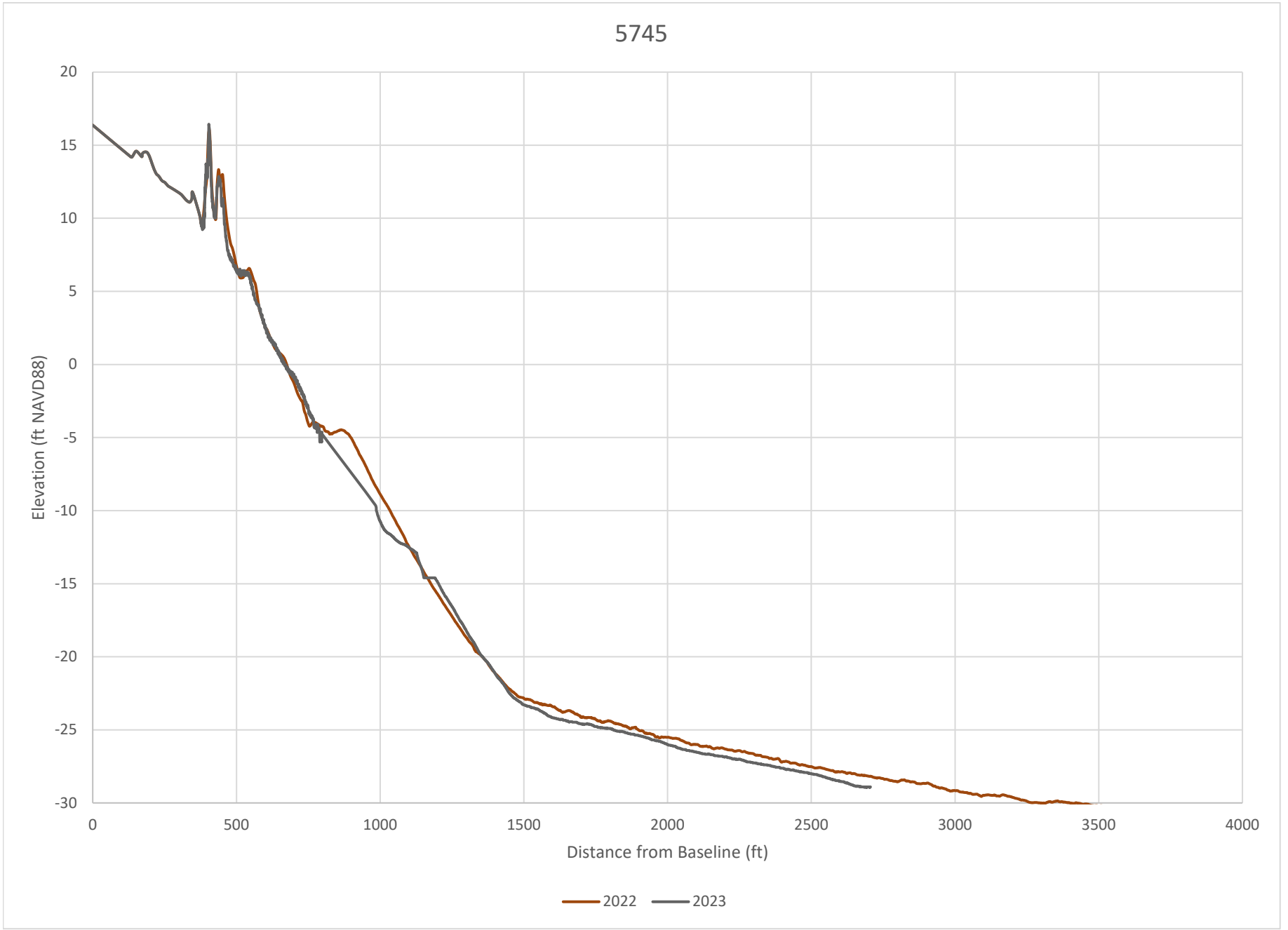
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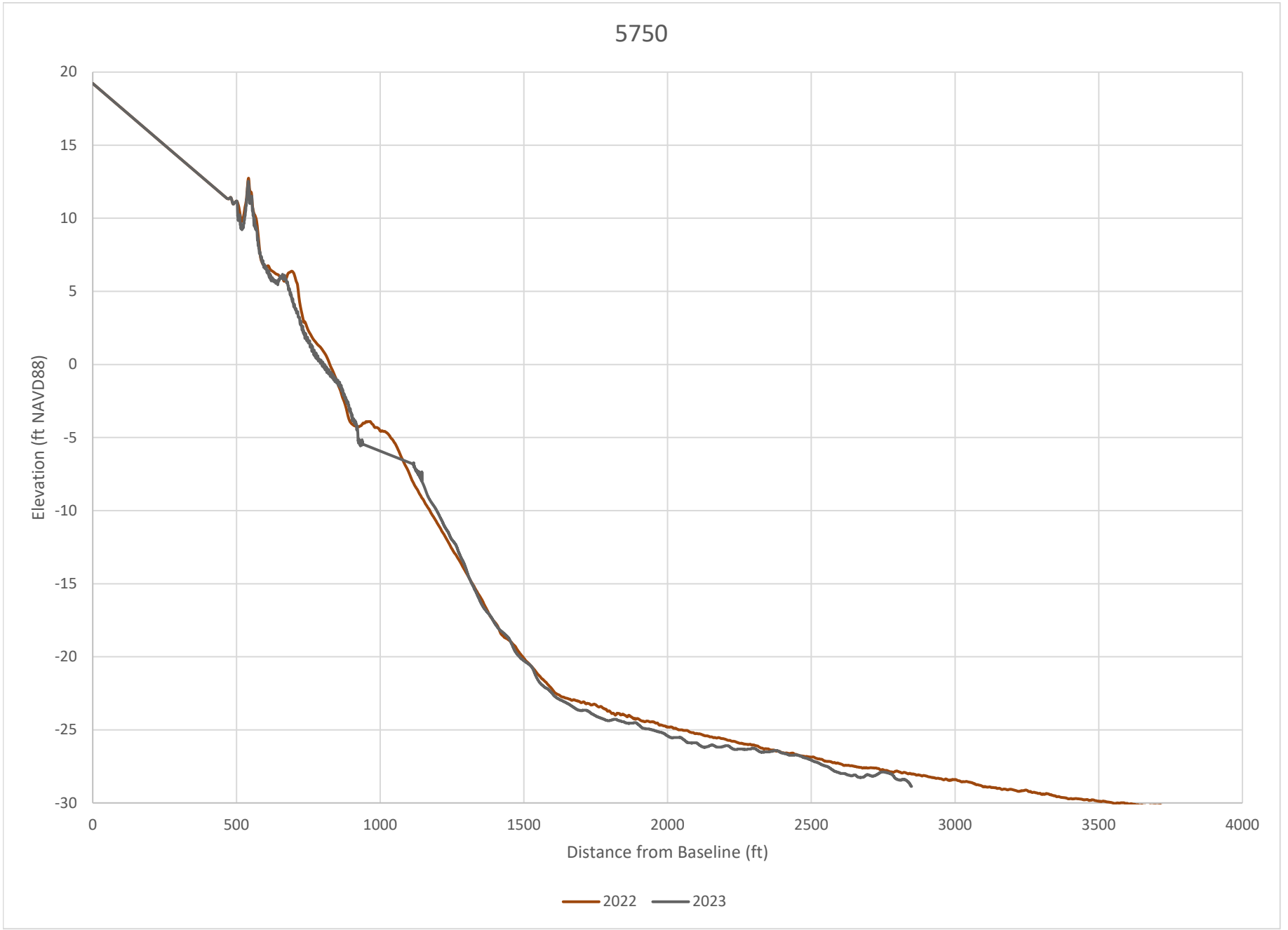
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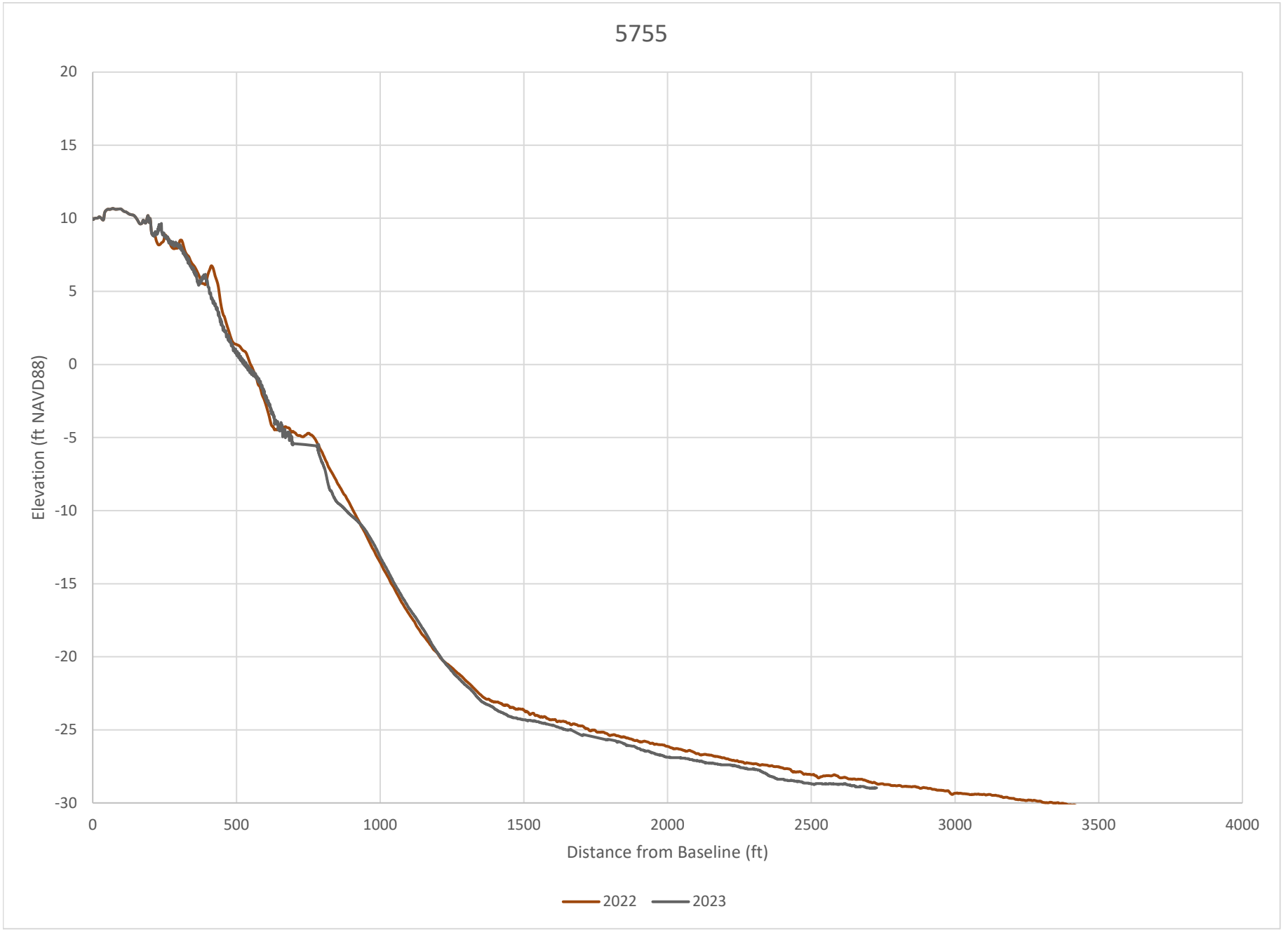
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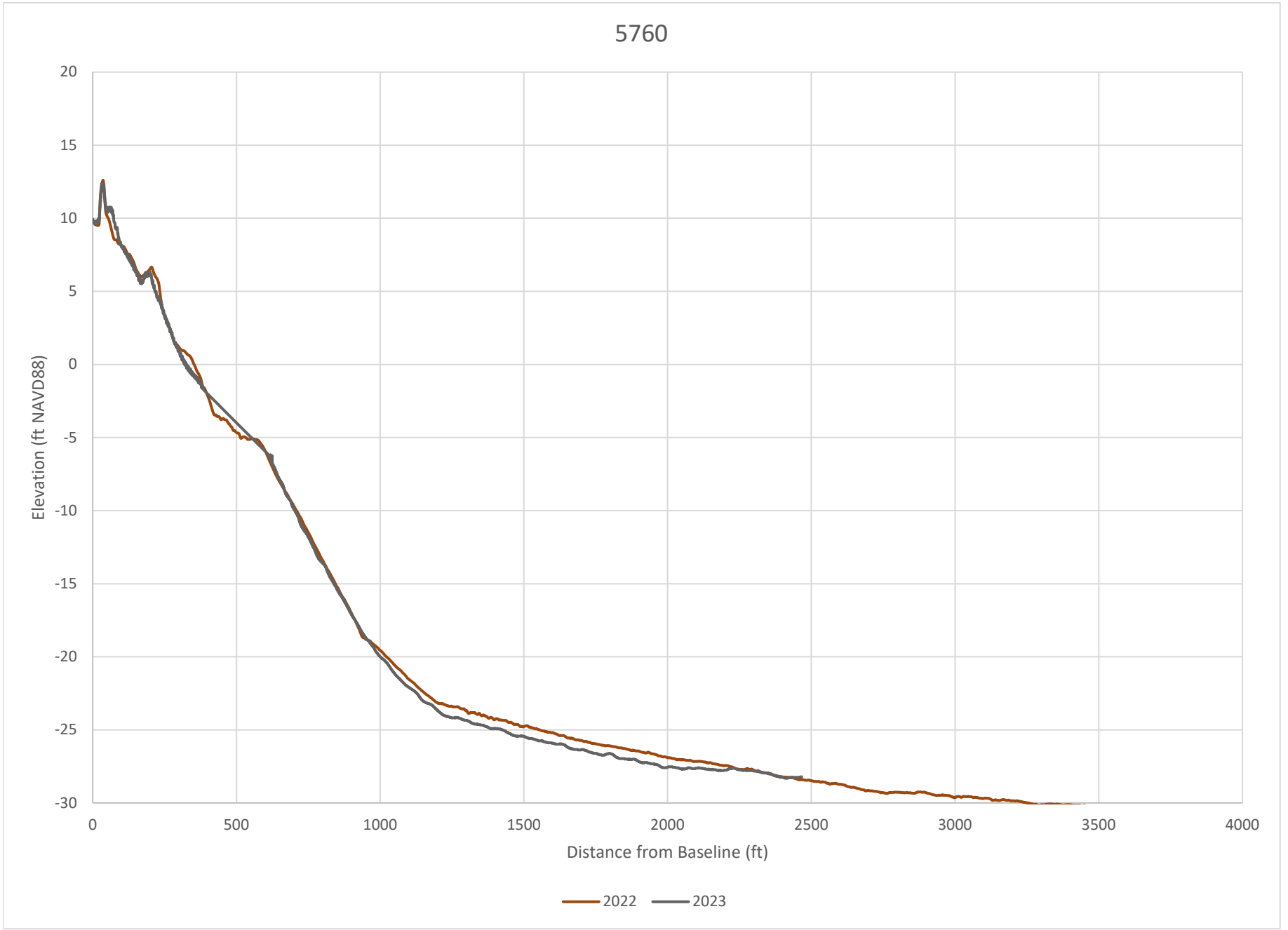
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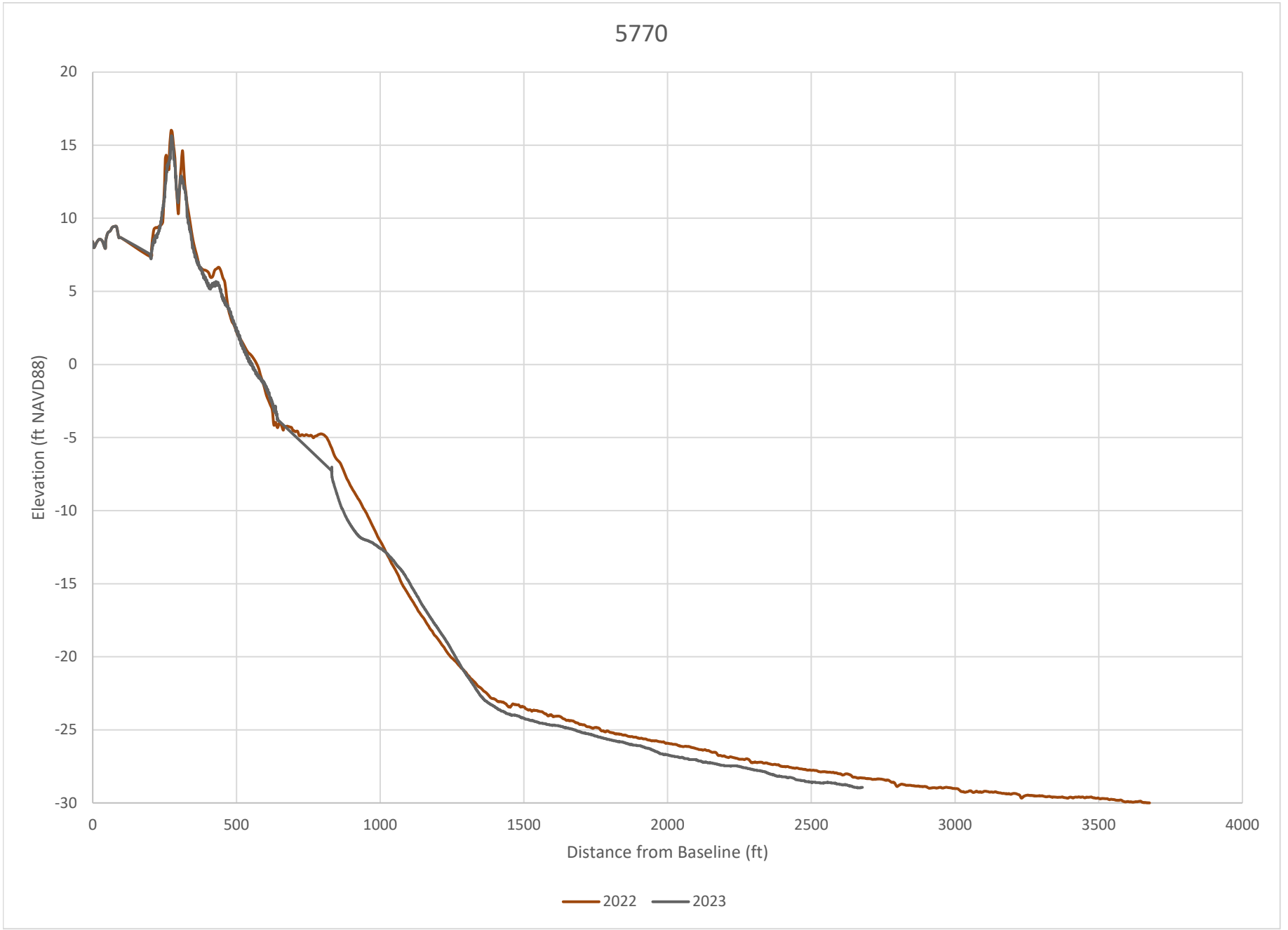
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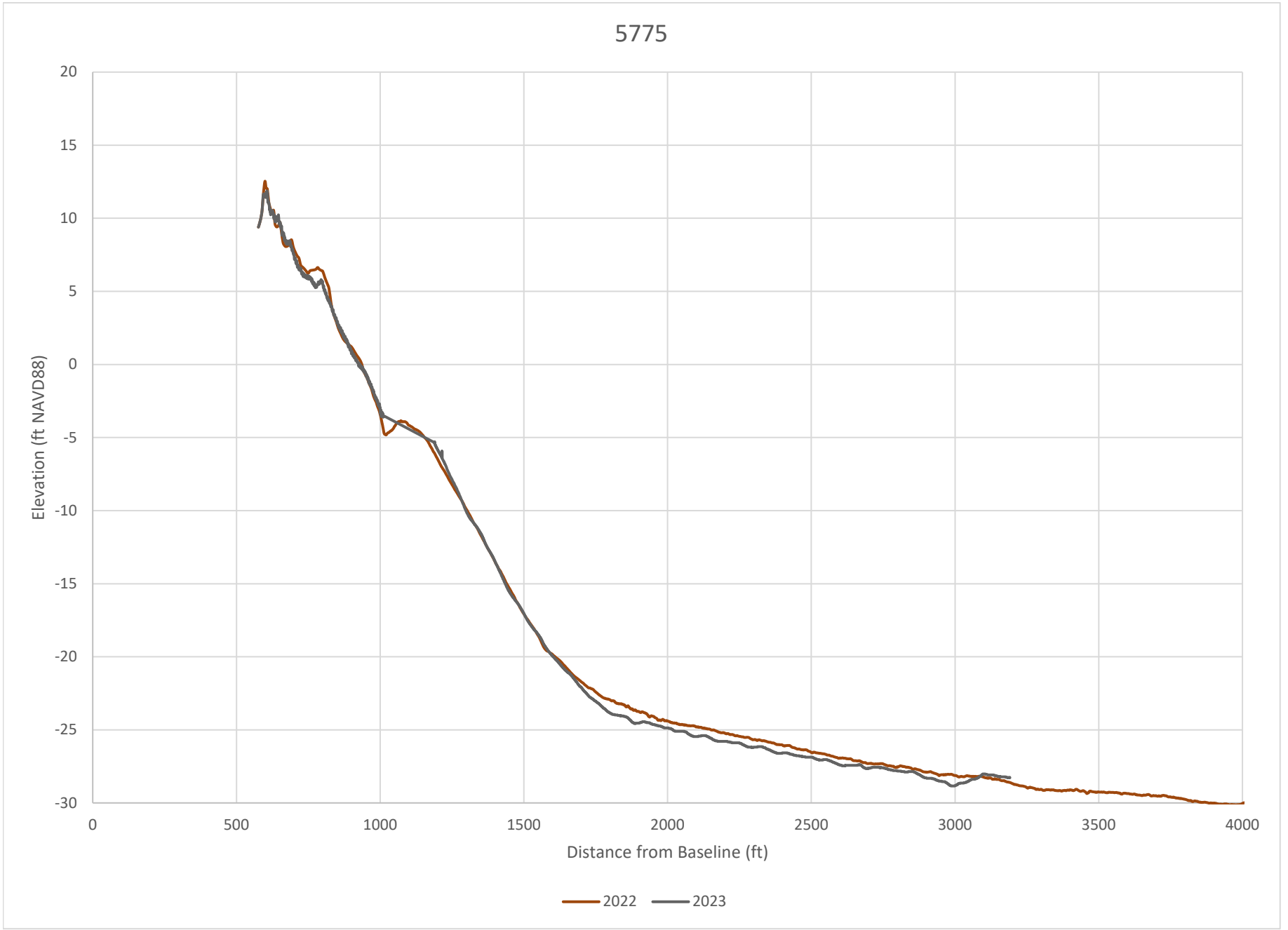
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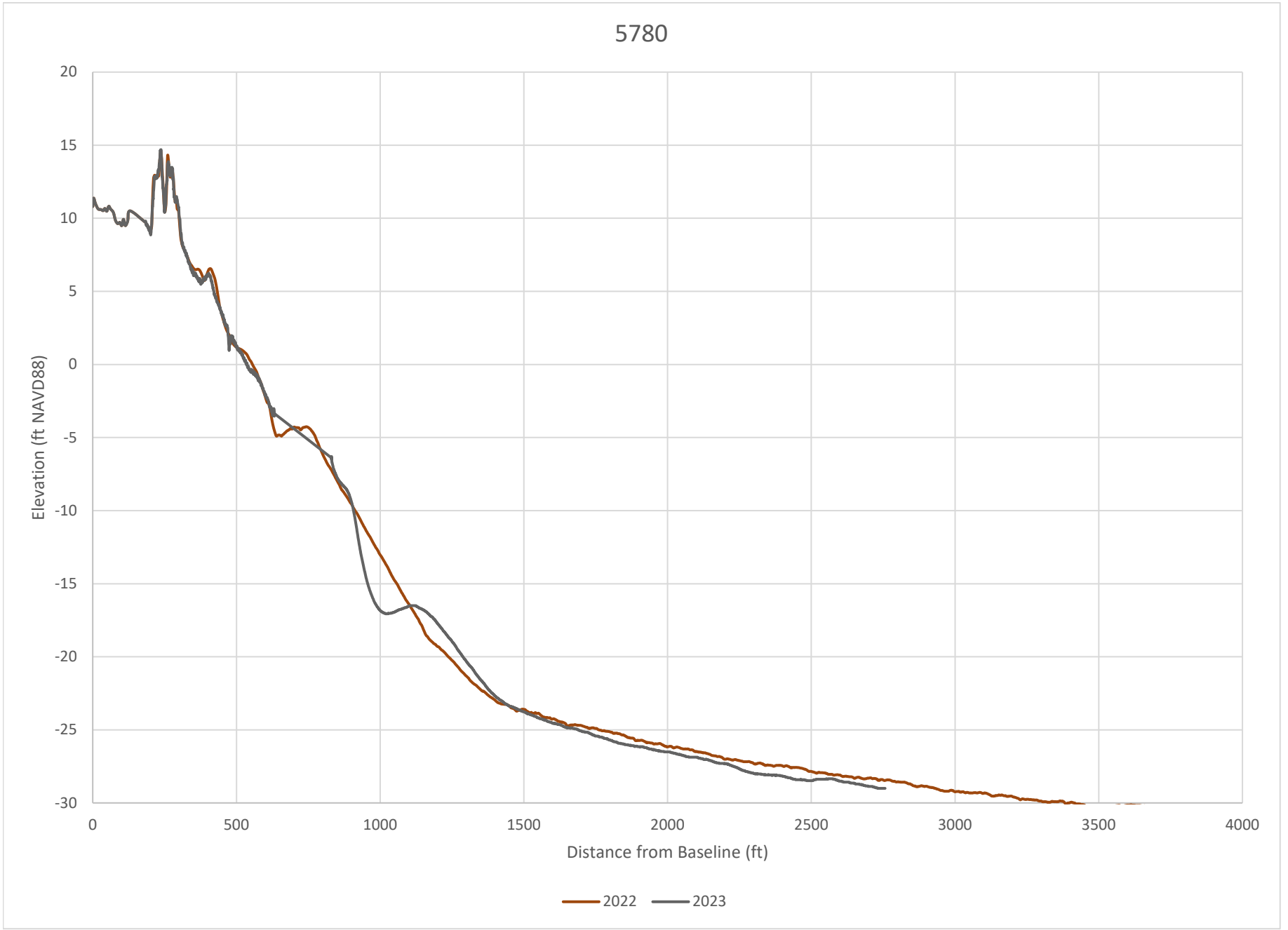
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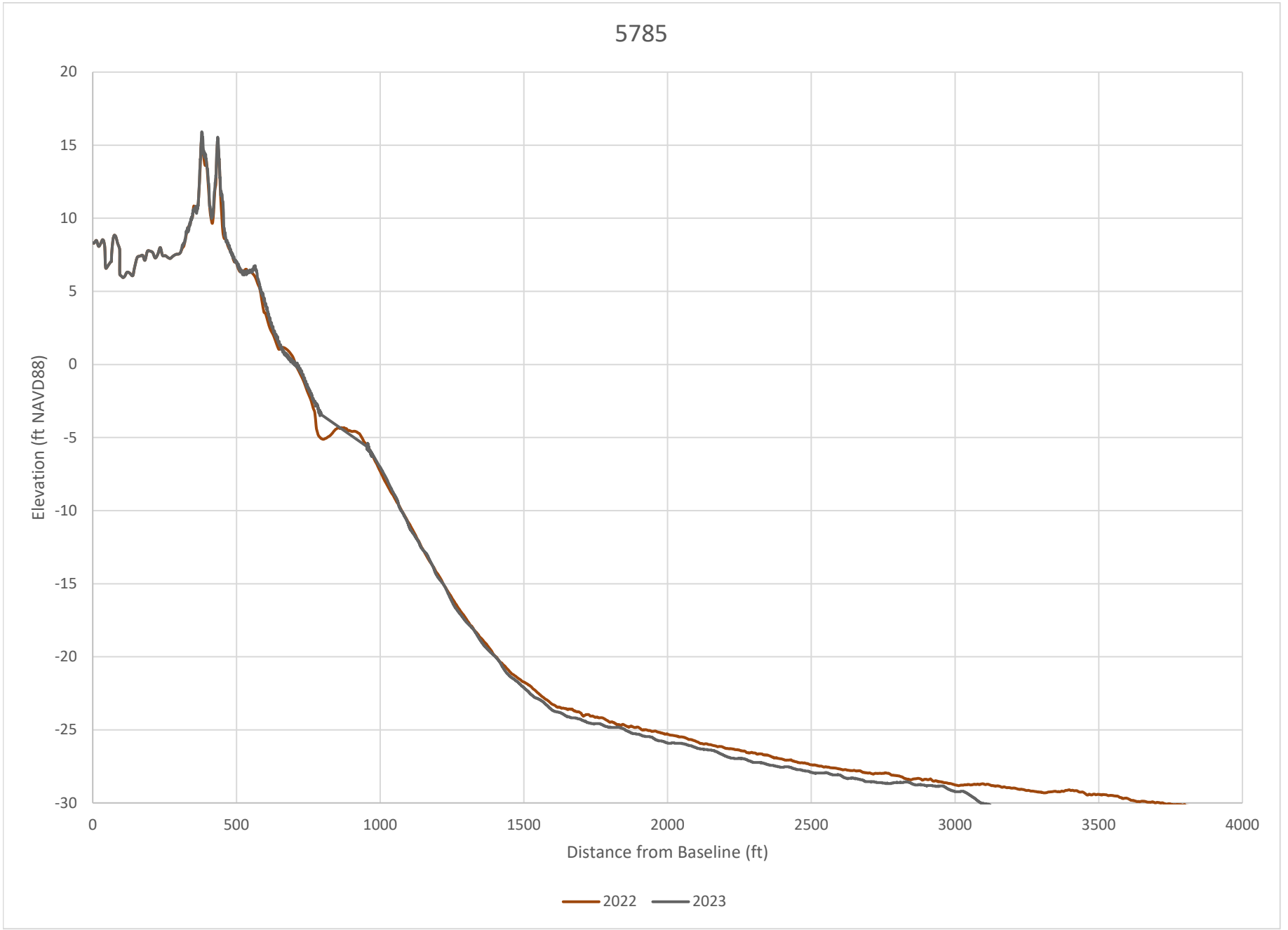
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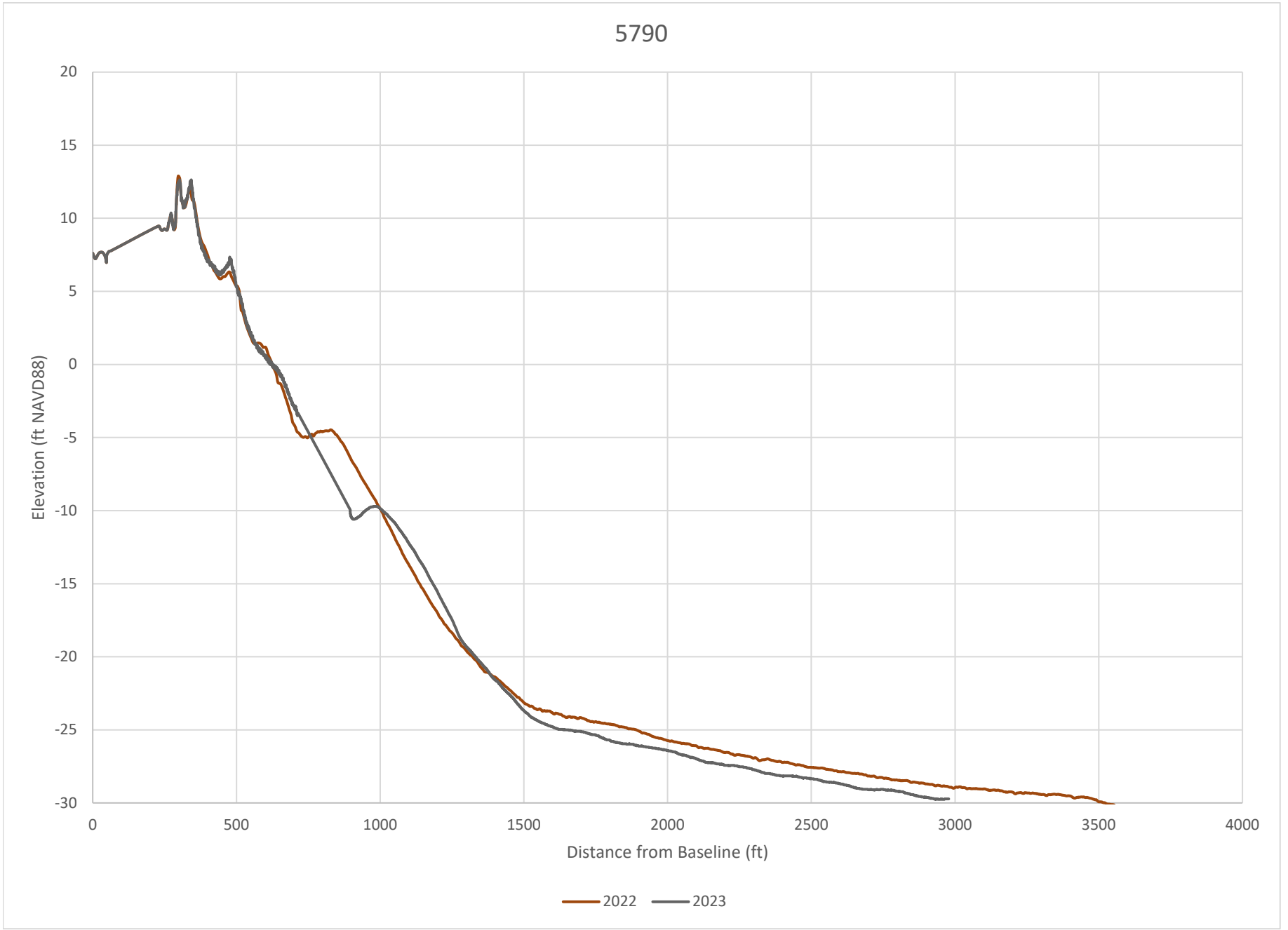
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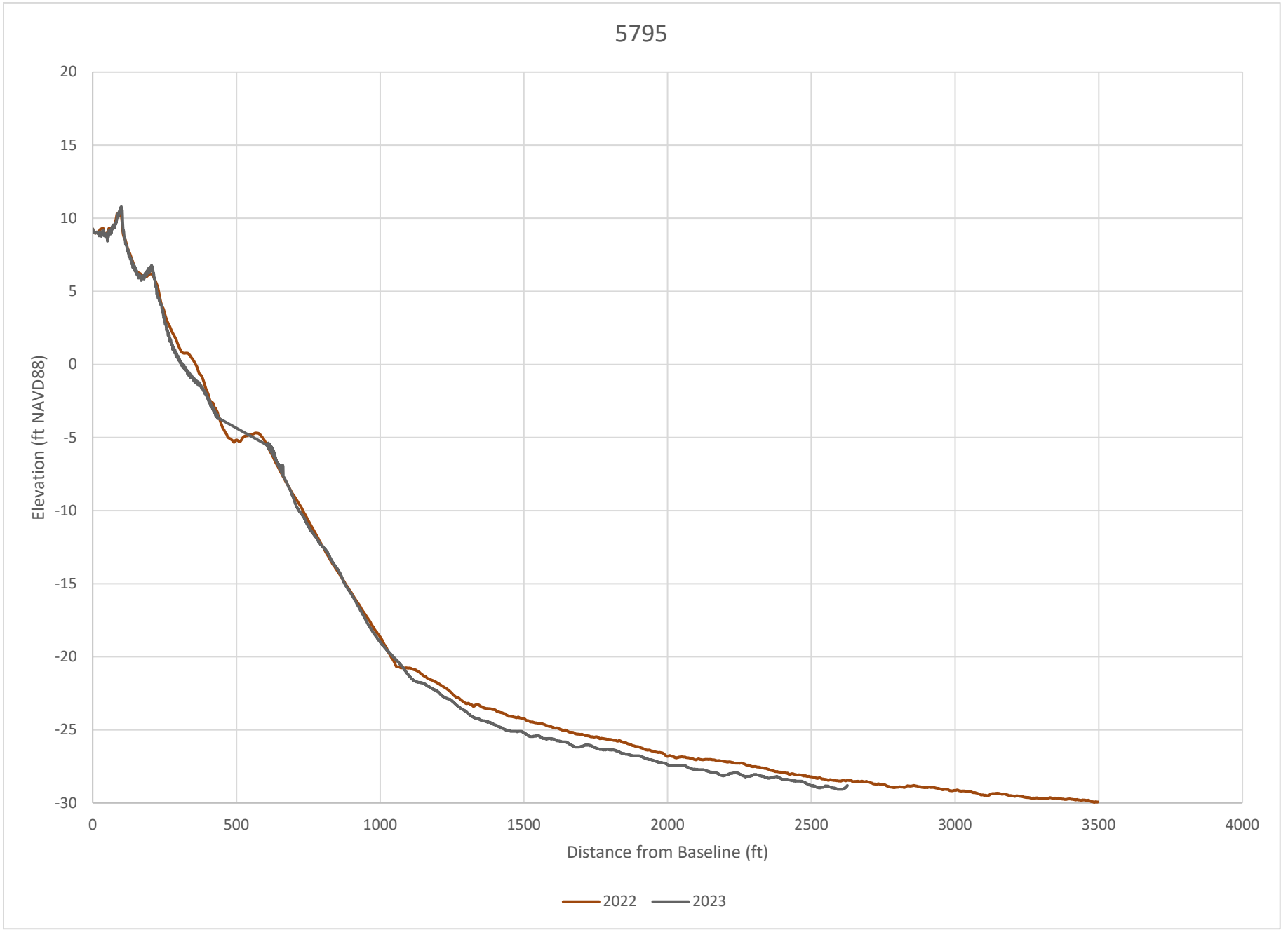
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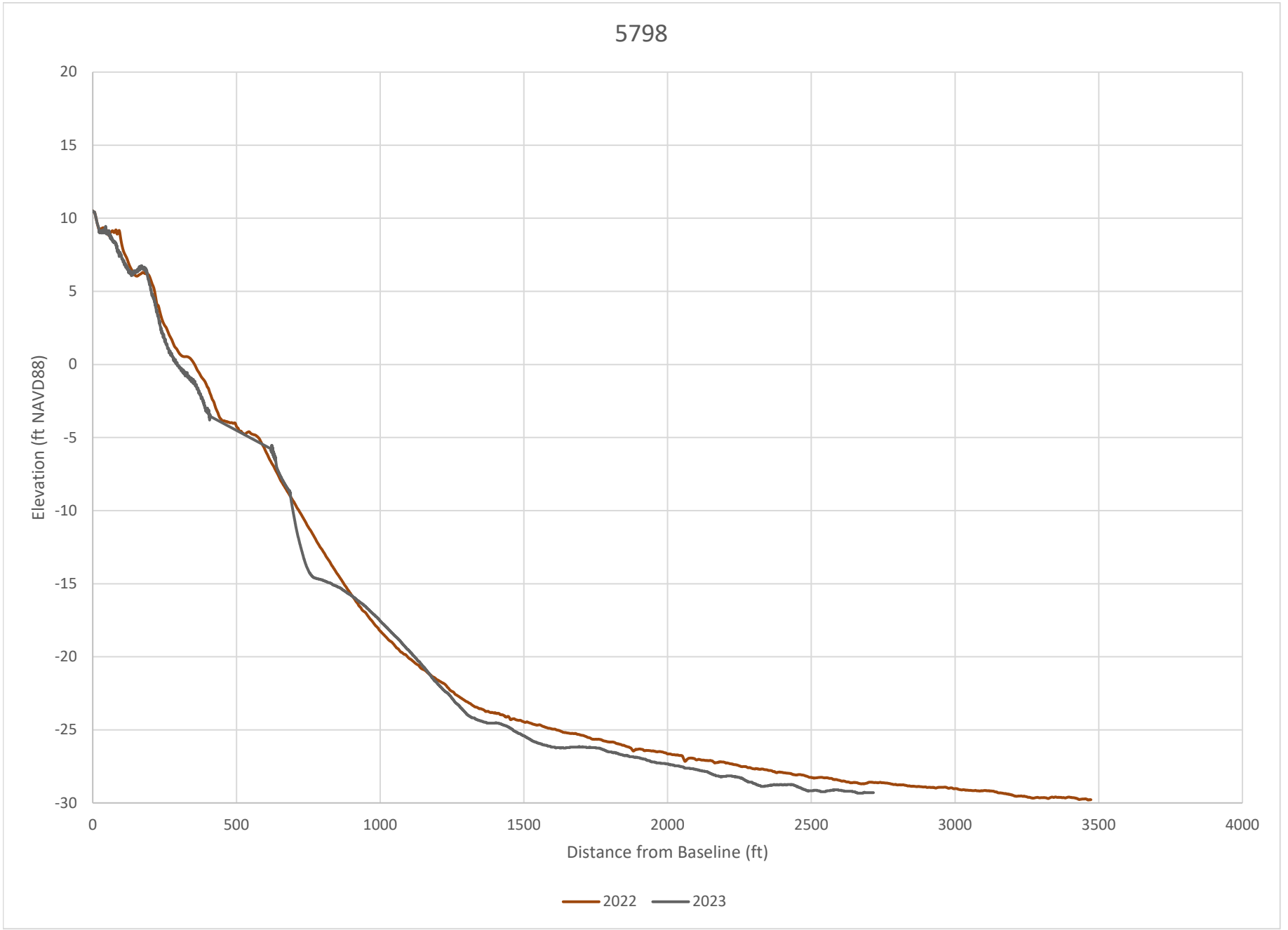
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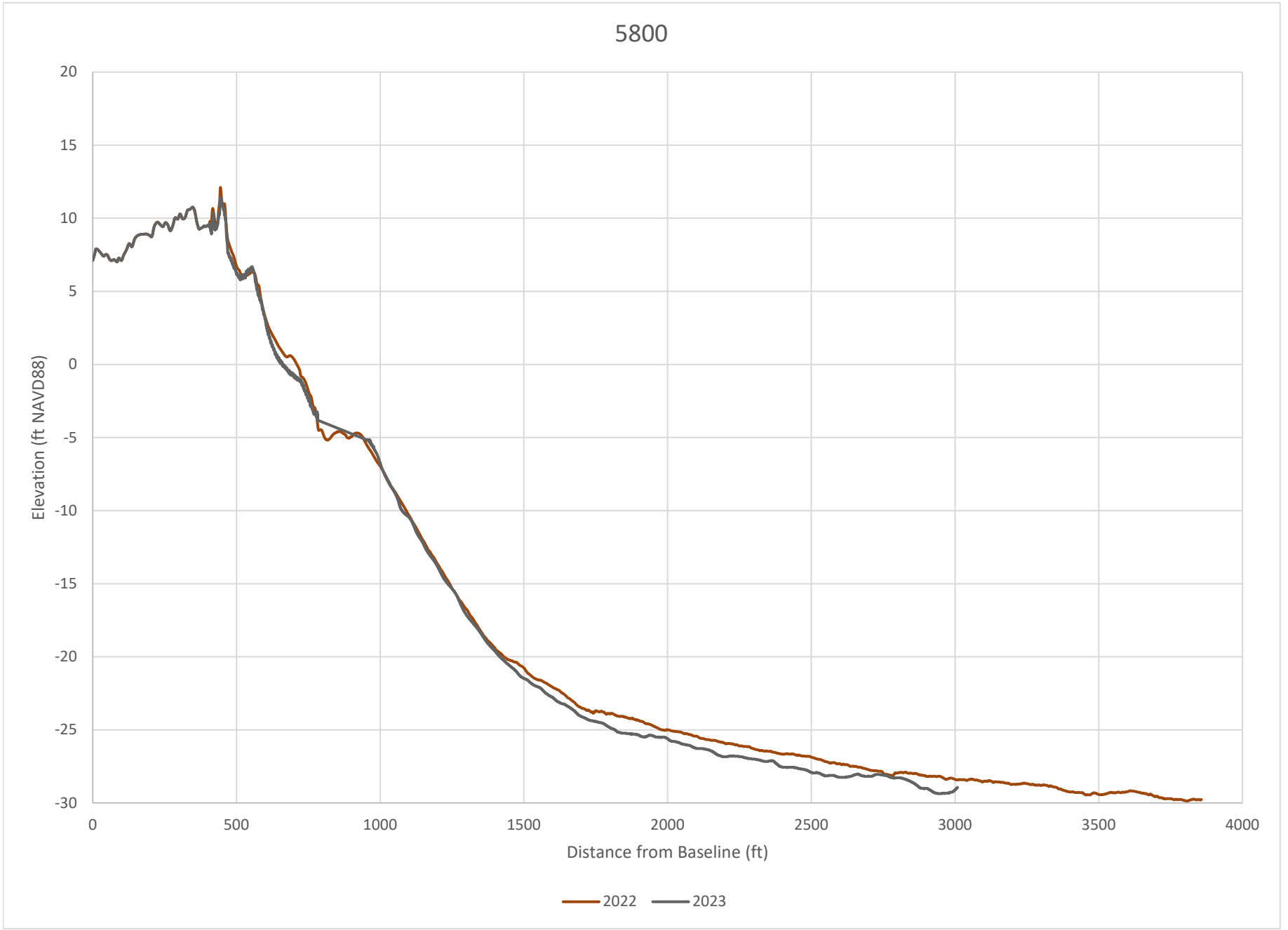
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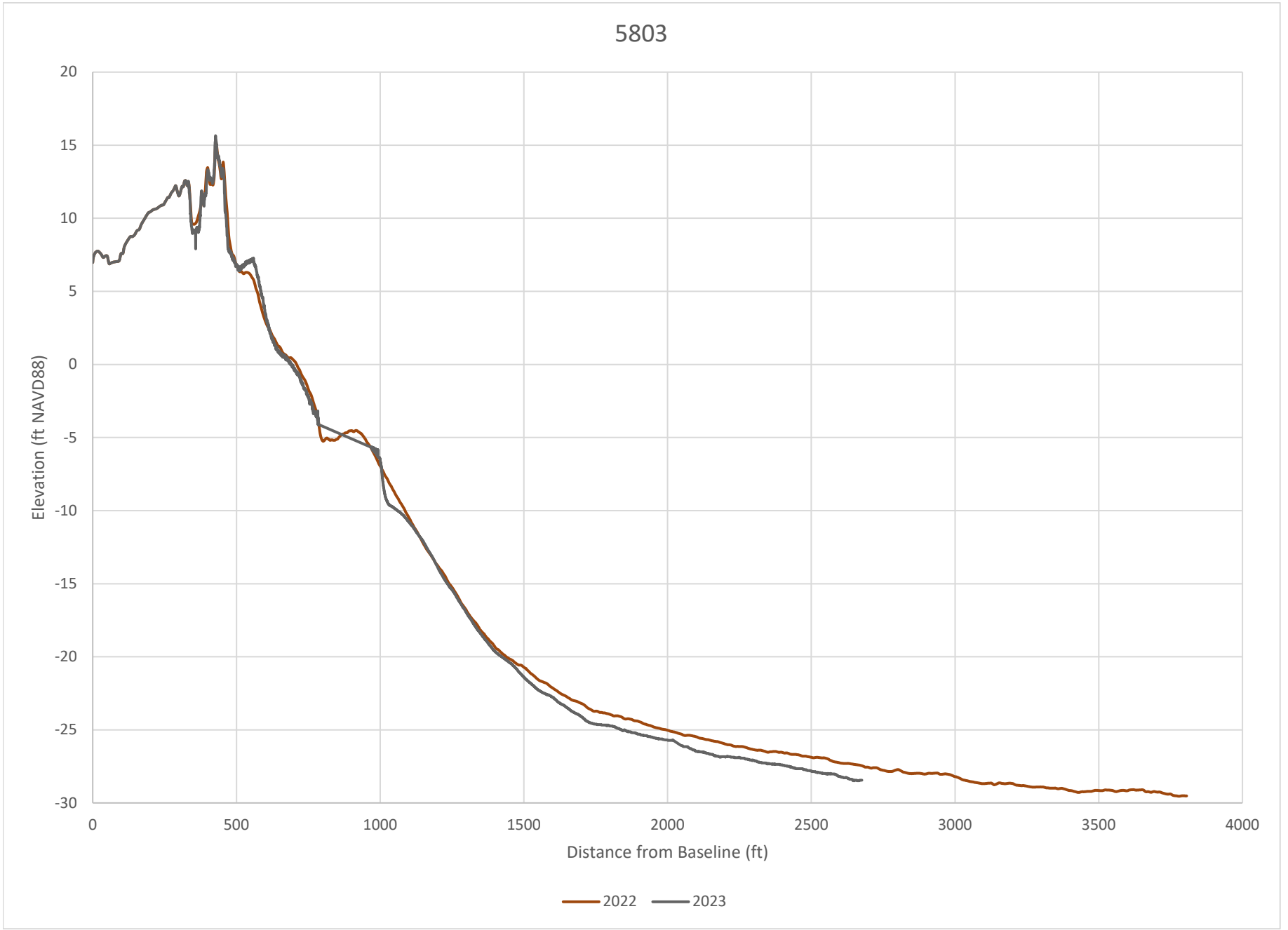
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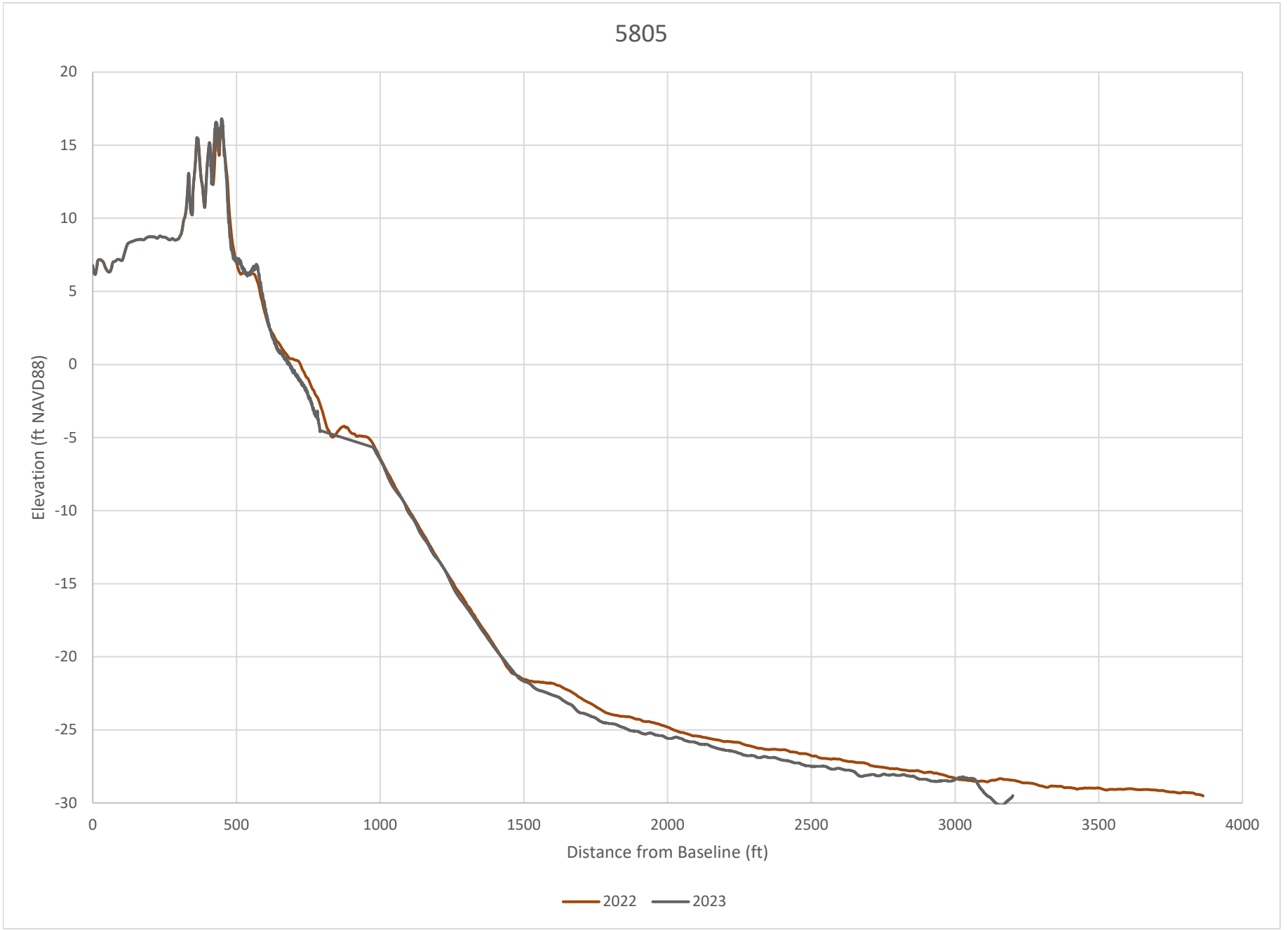
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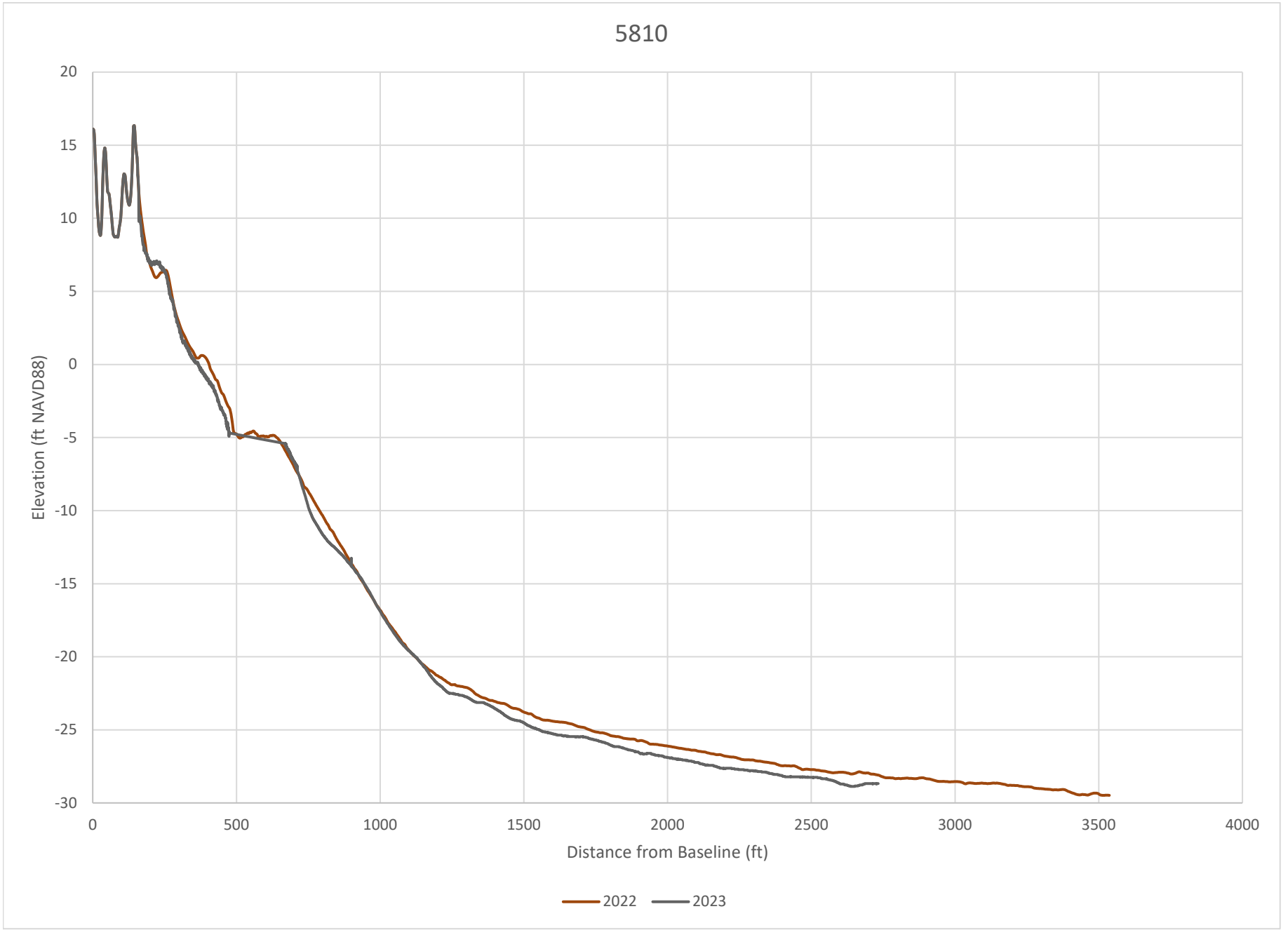
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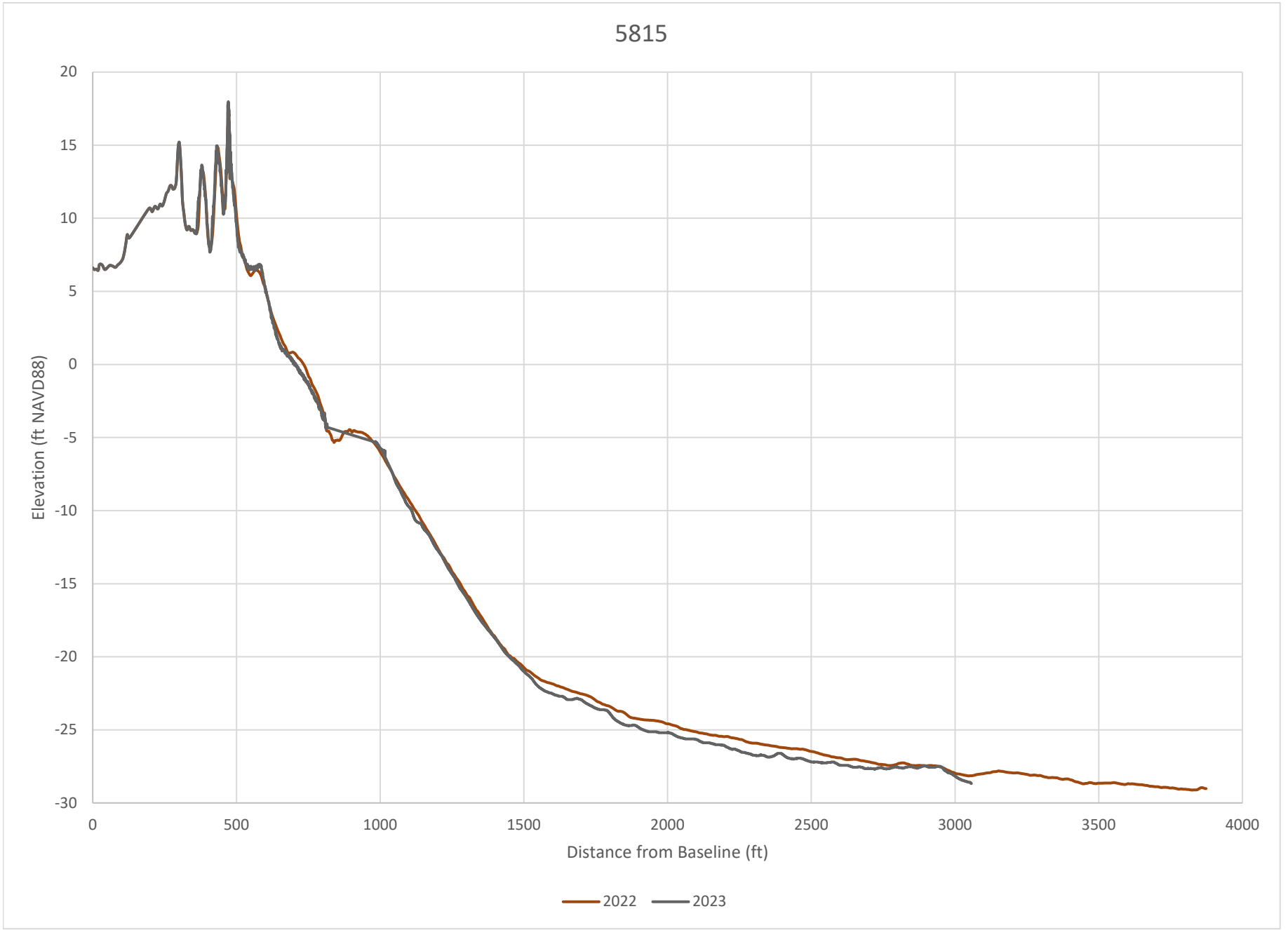
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Distance from Baseline (ft)
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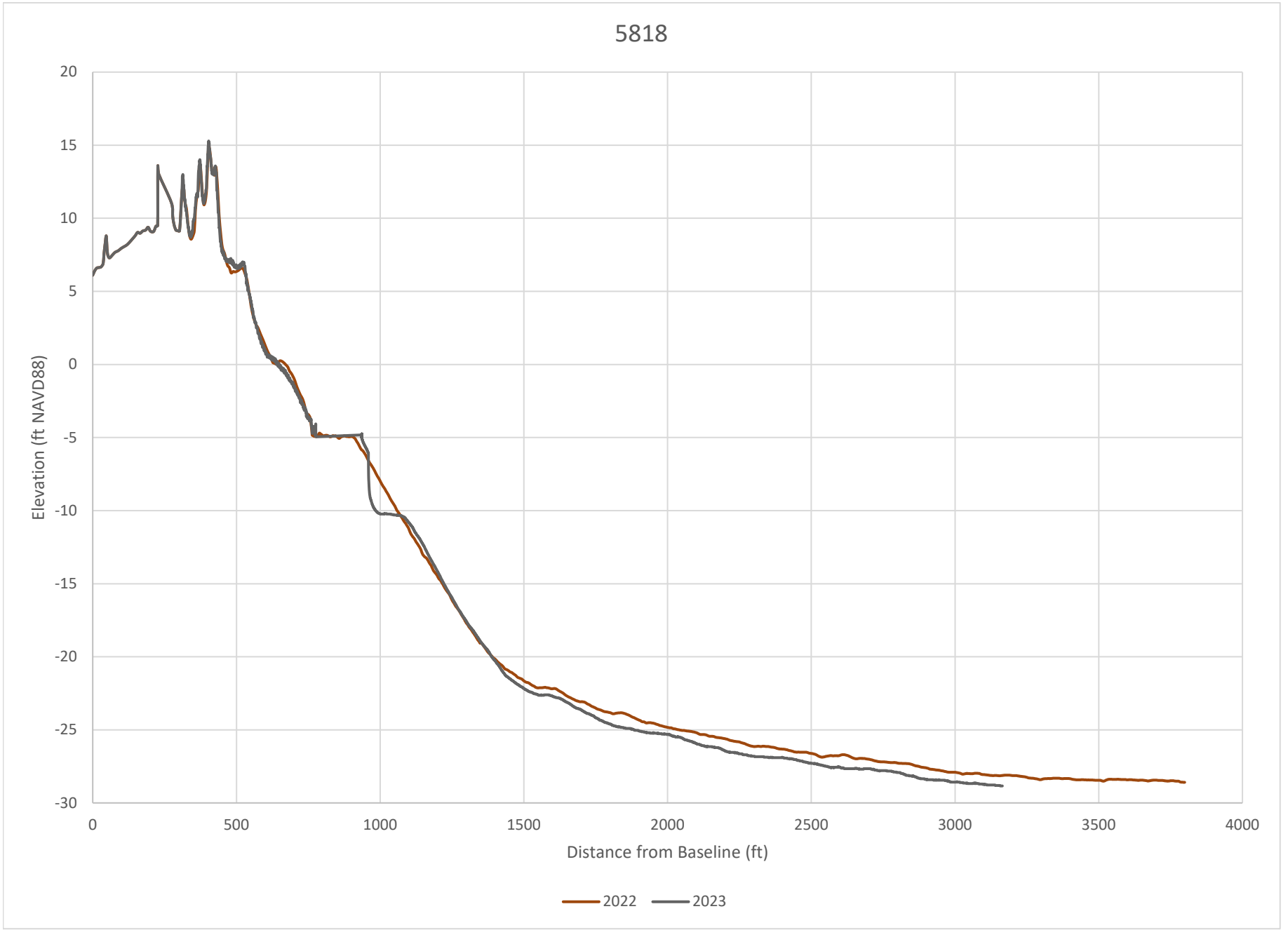
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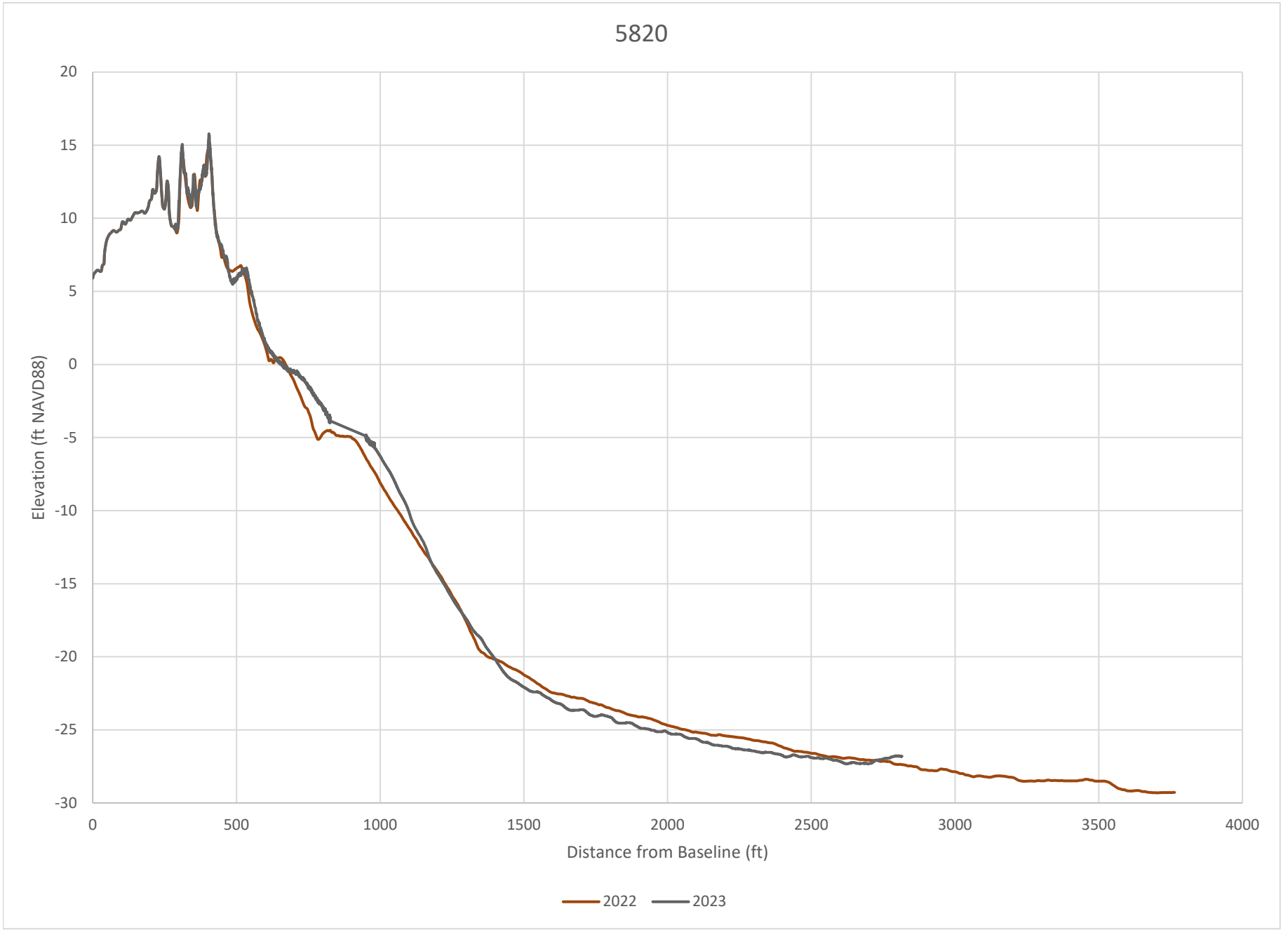
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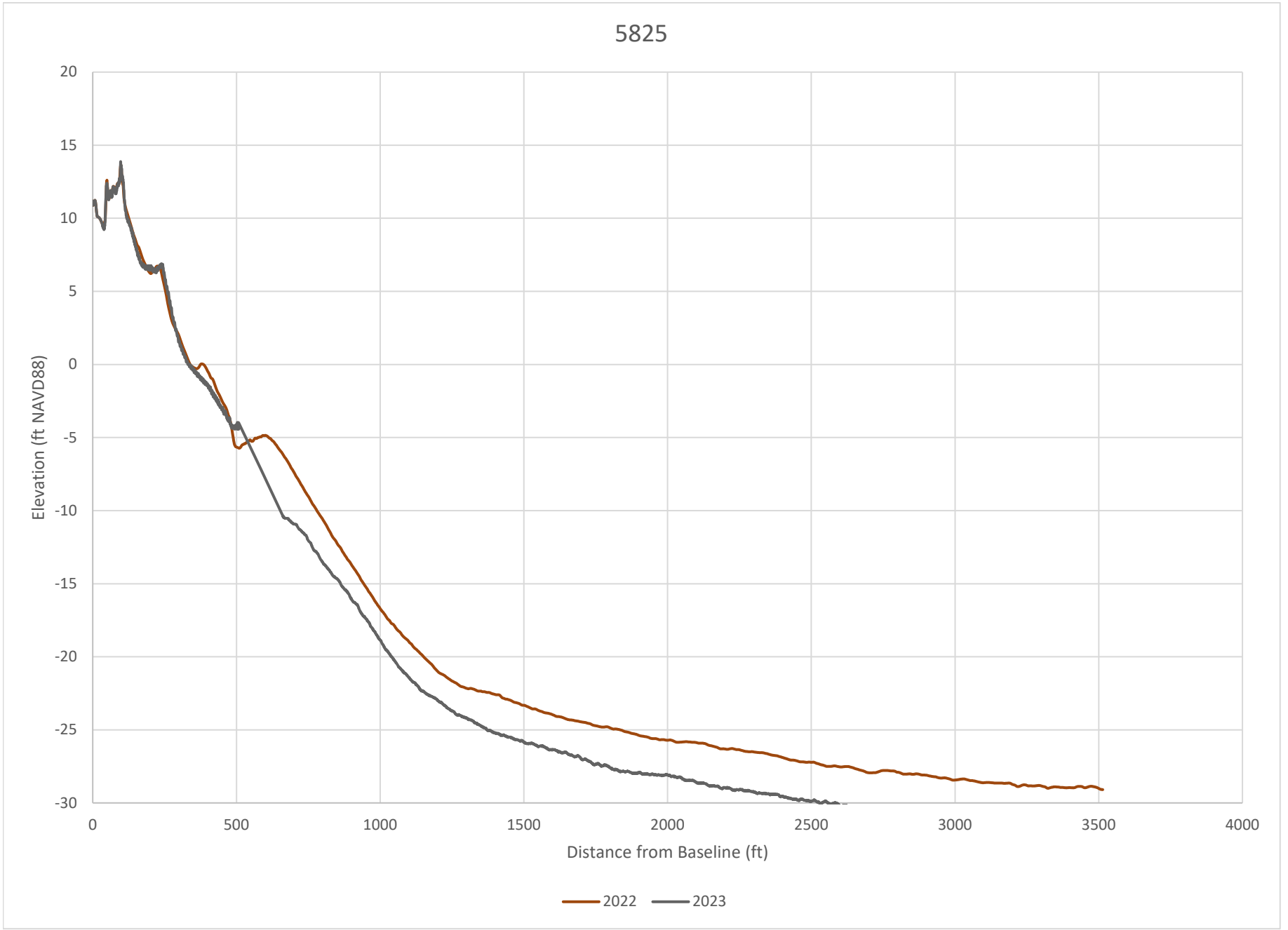
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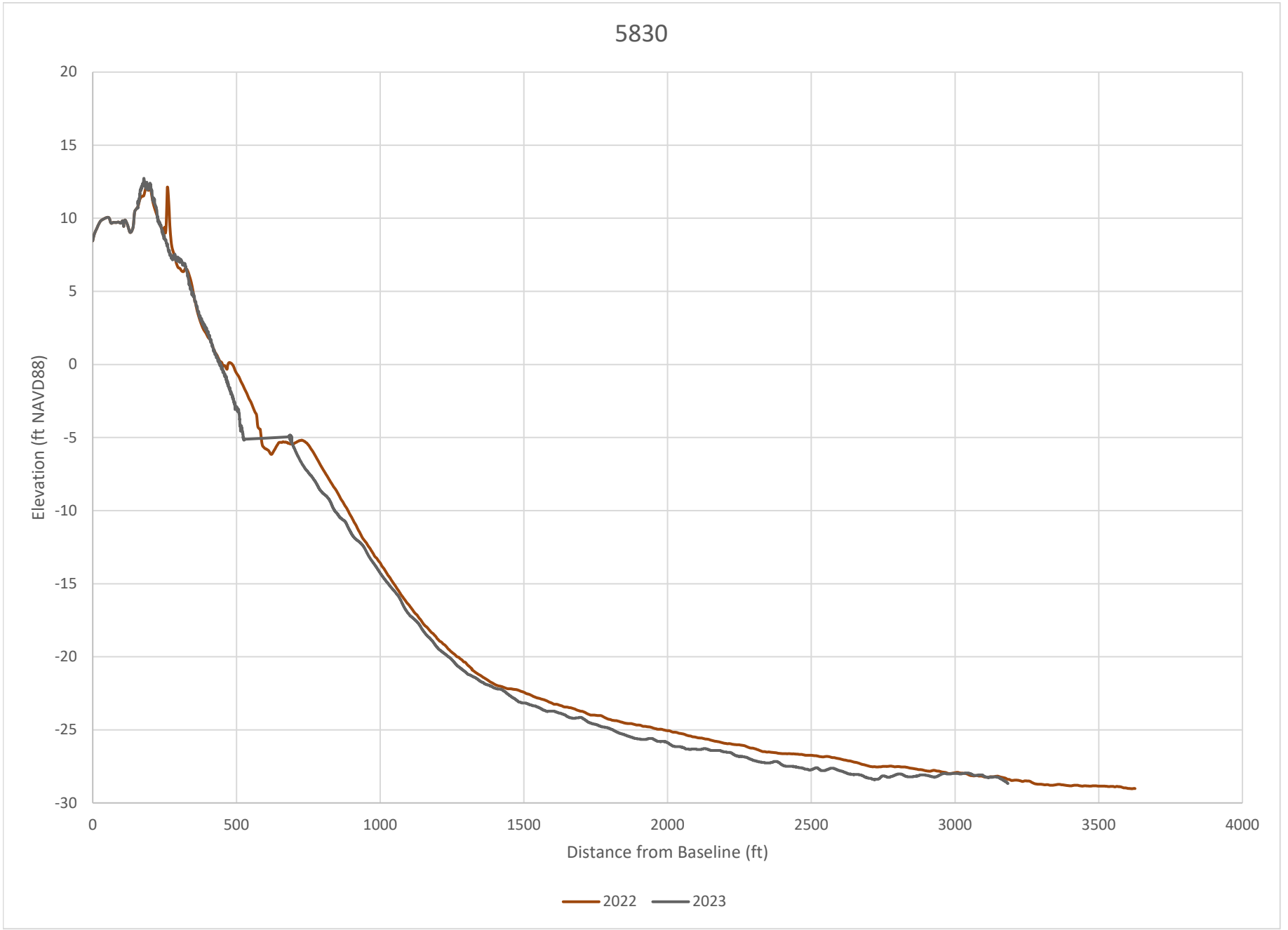
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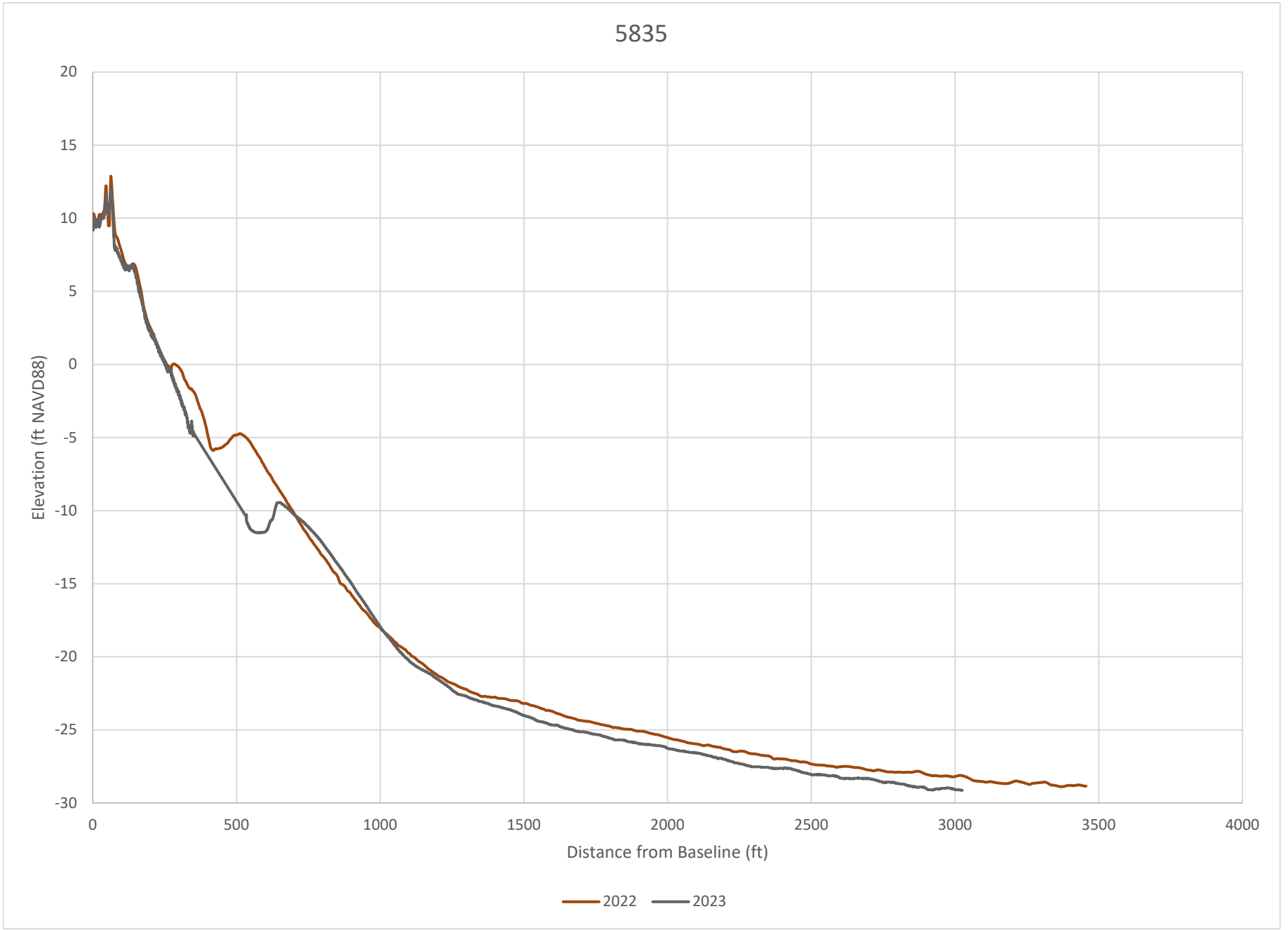
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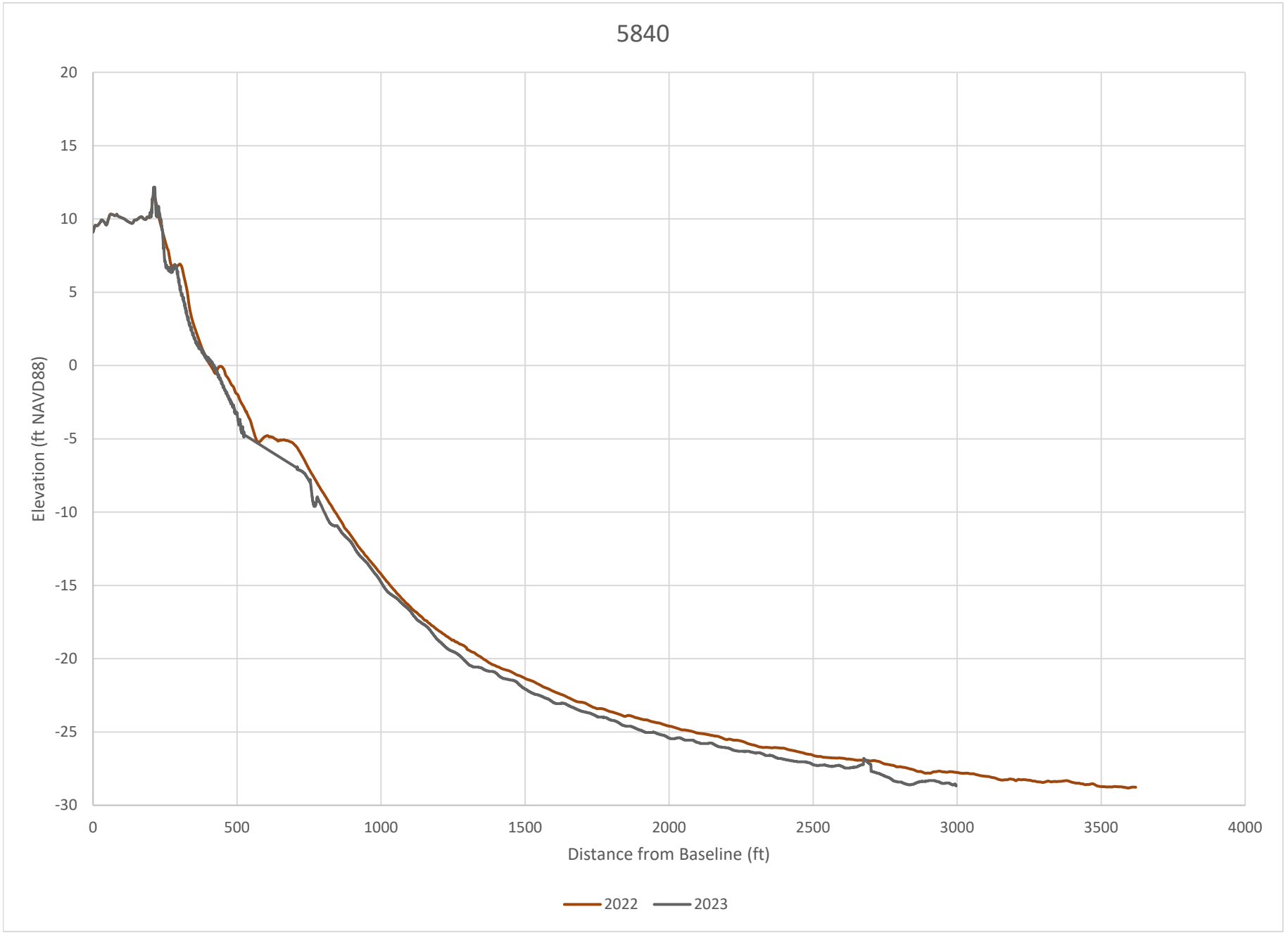
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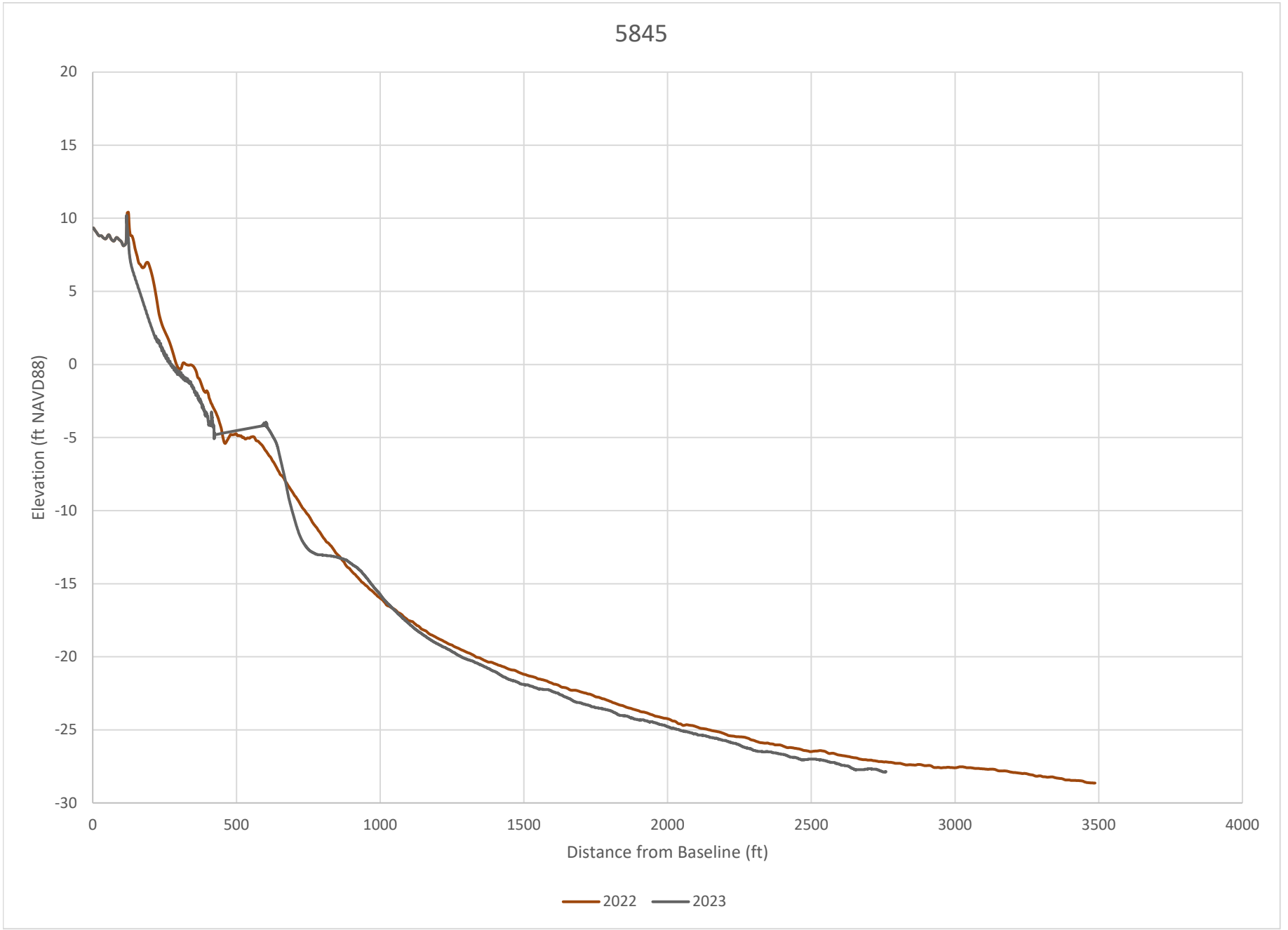
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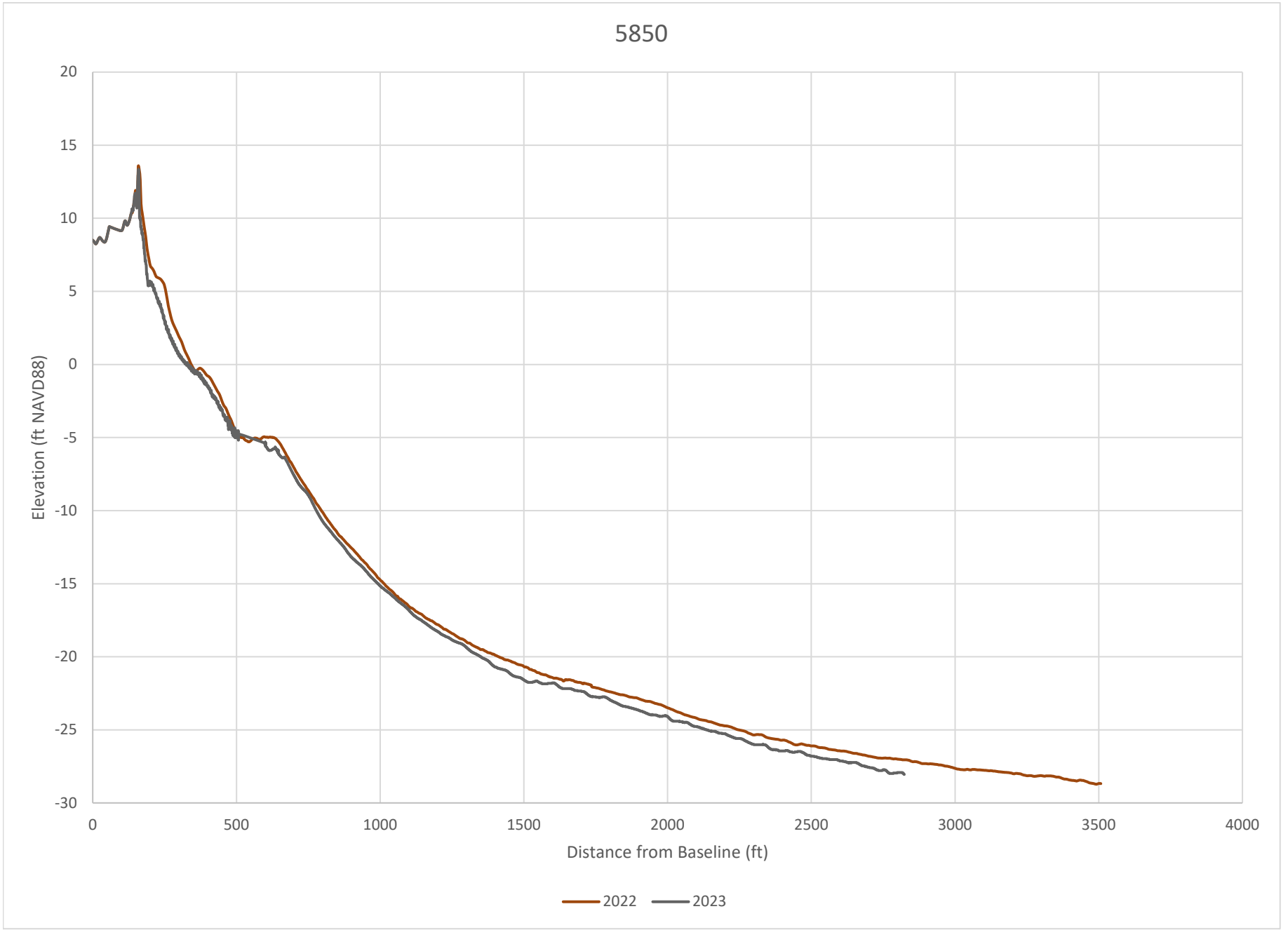
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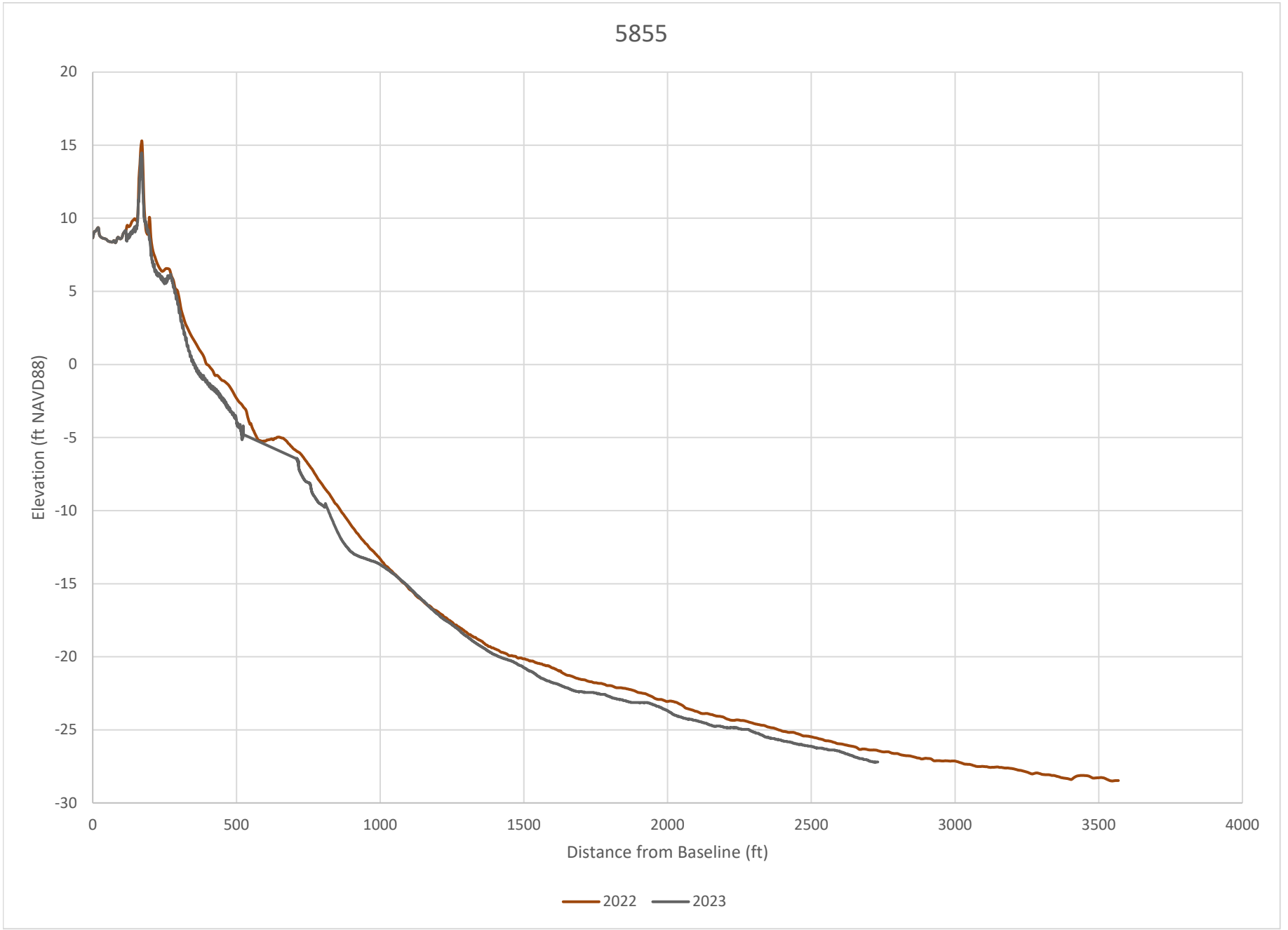
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Distance from Baseline (ft)
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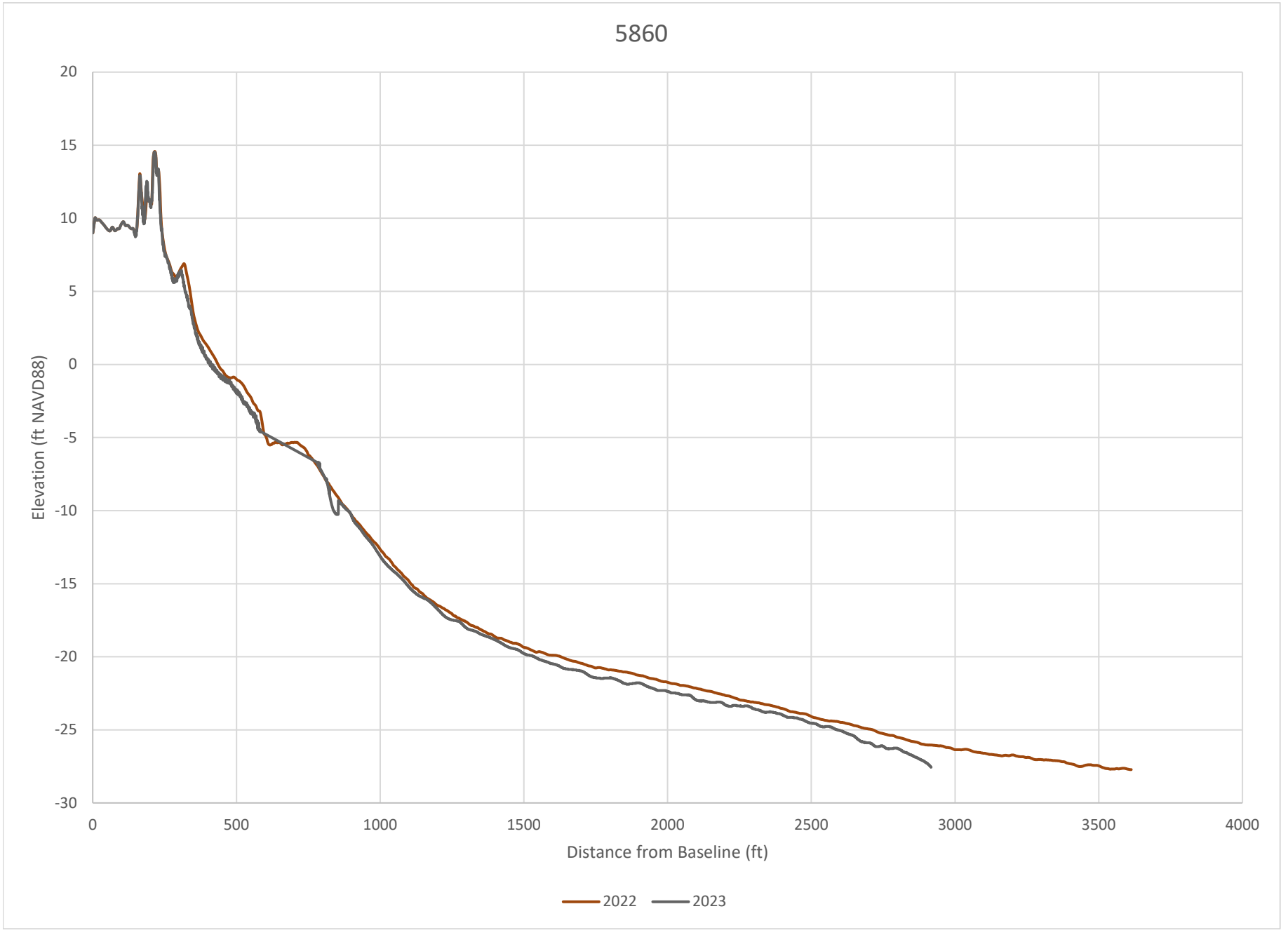
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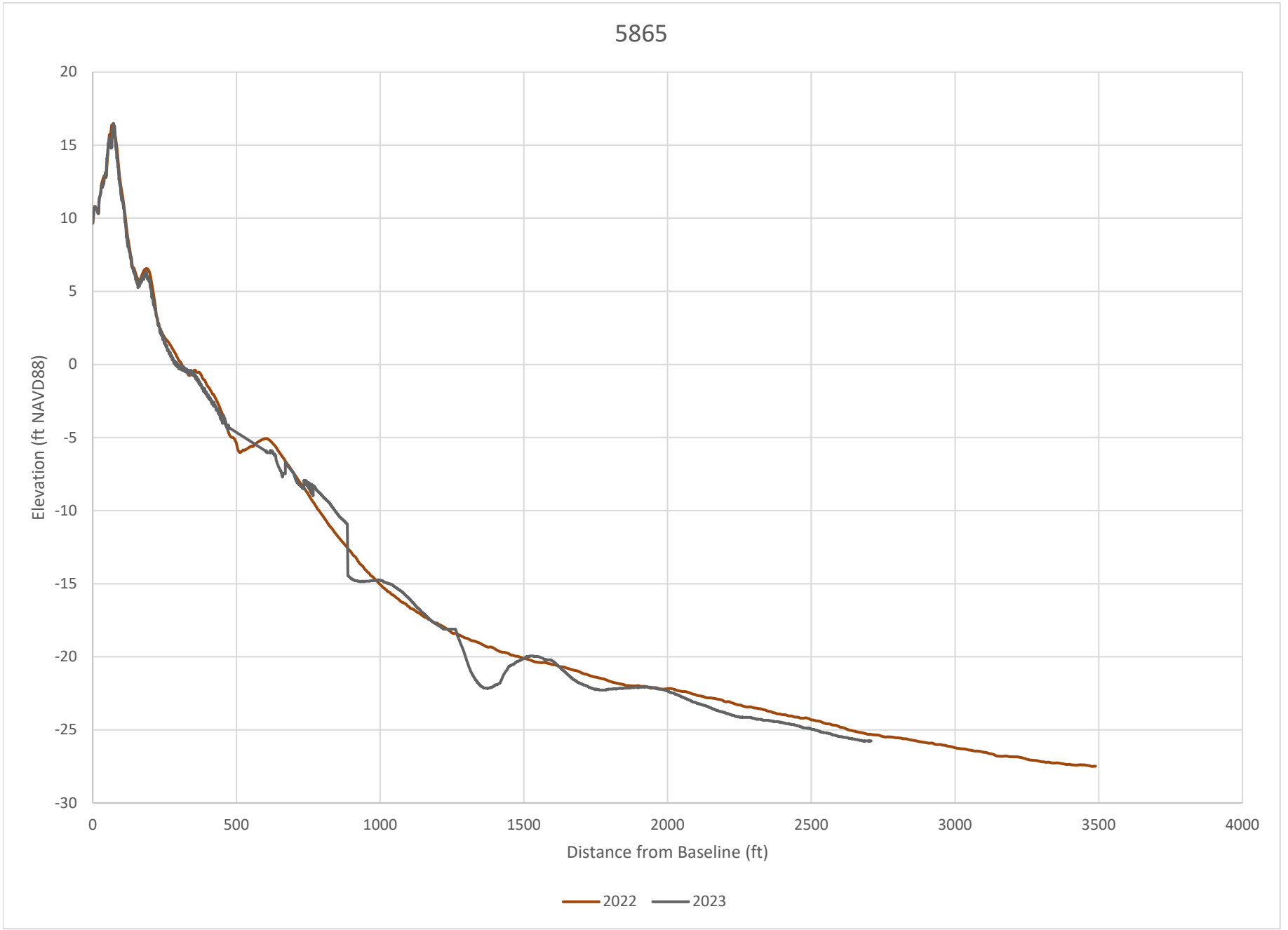
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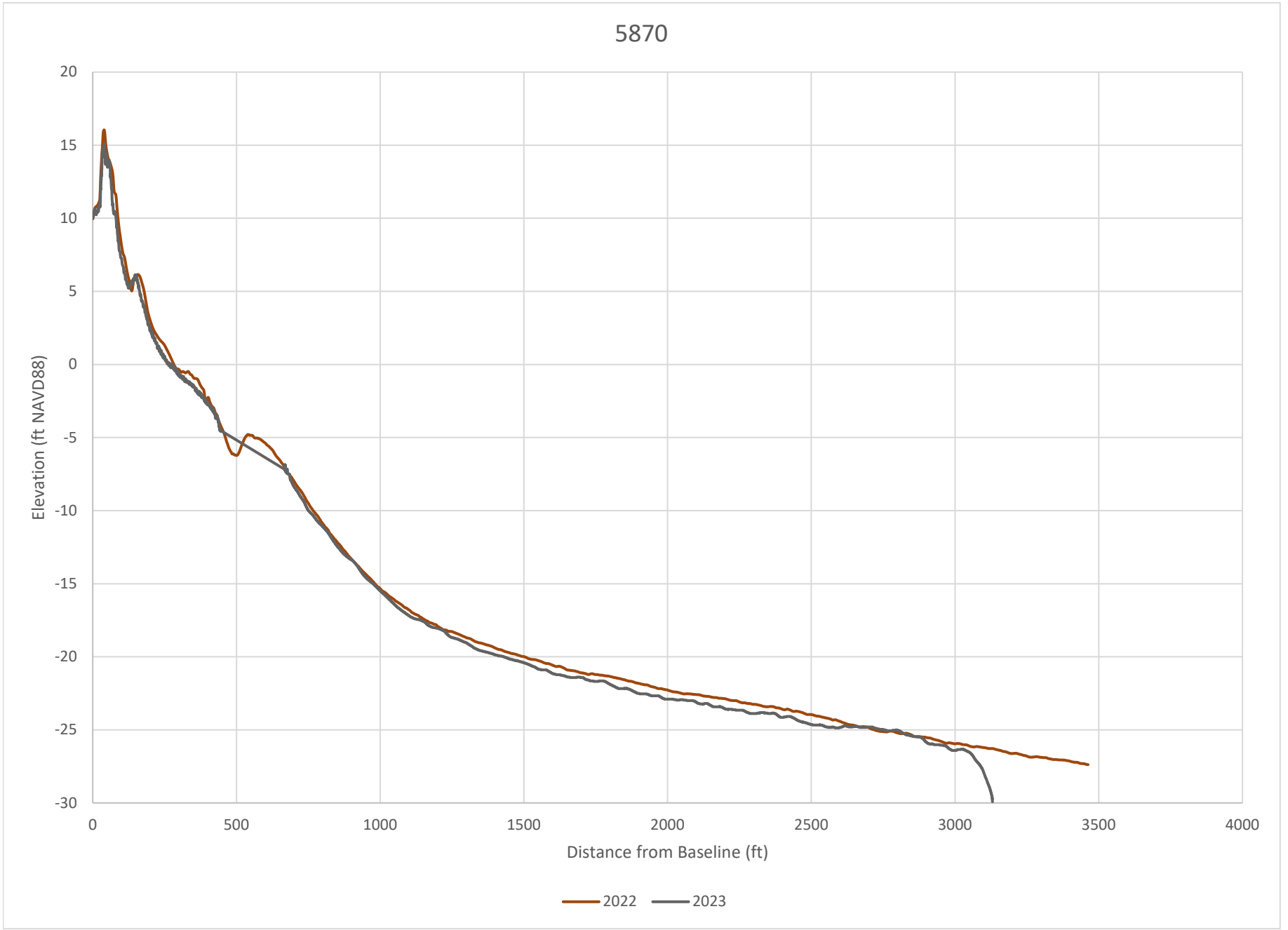
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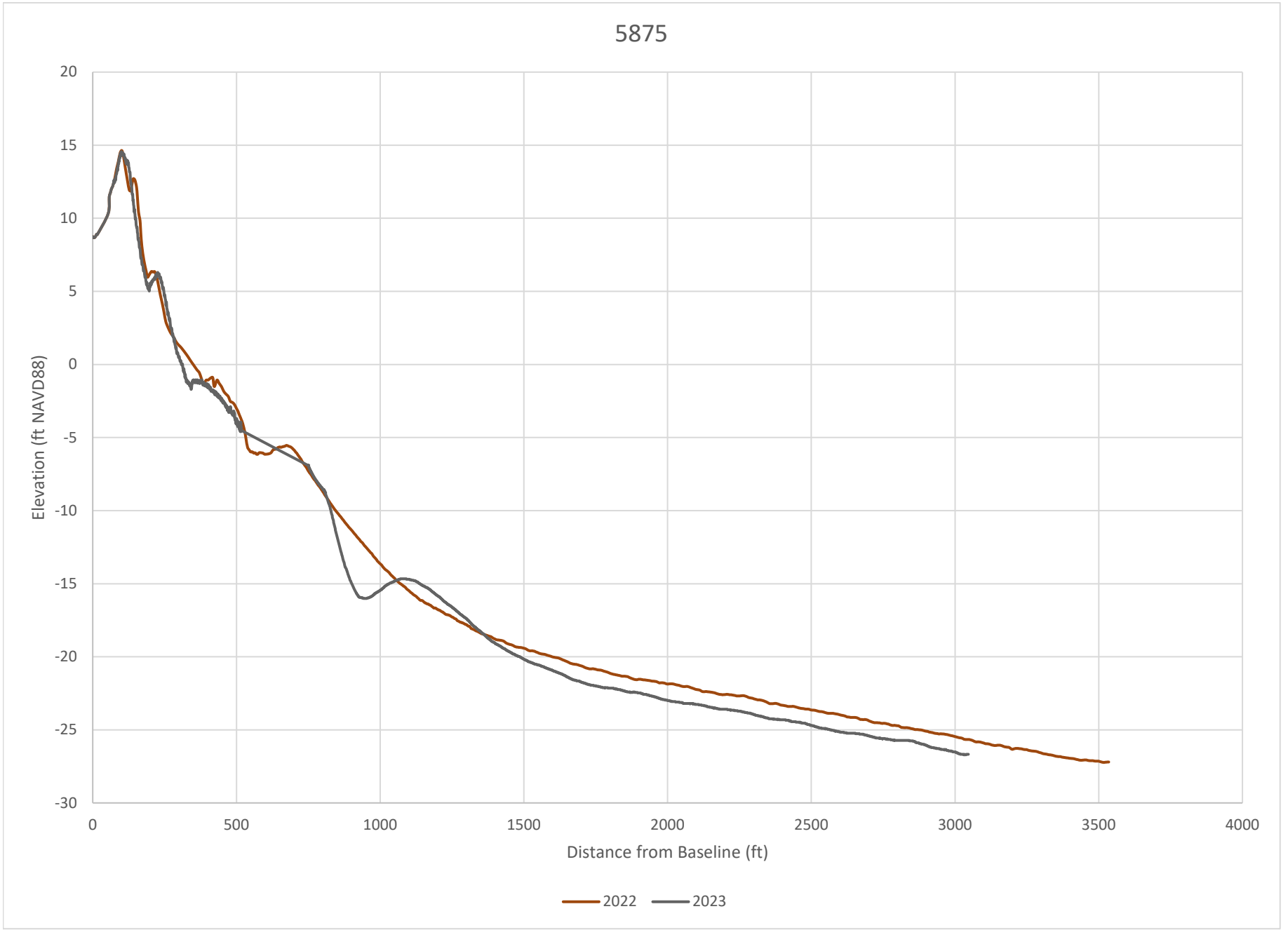
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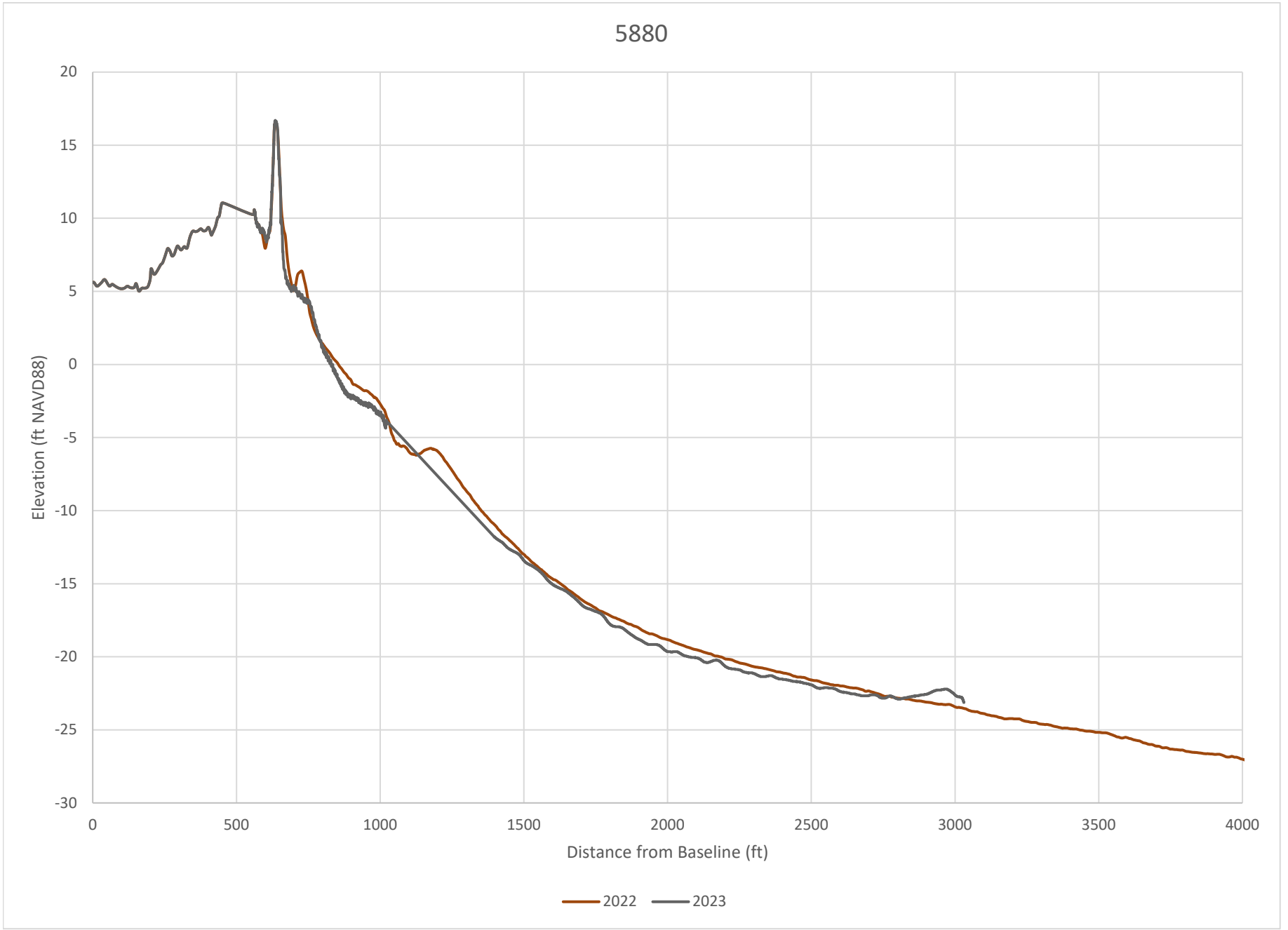
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Distance from Baseline (ft)
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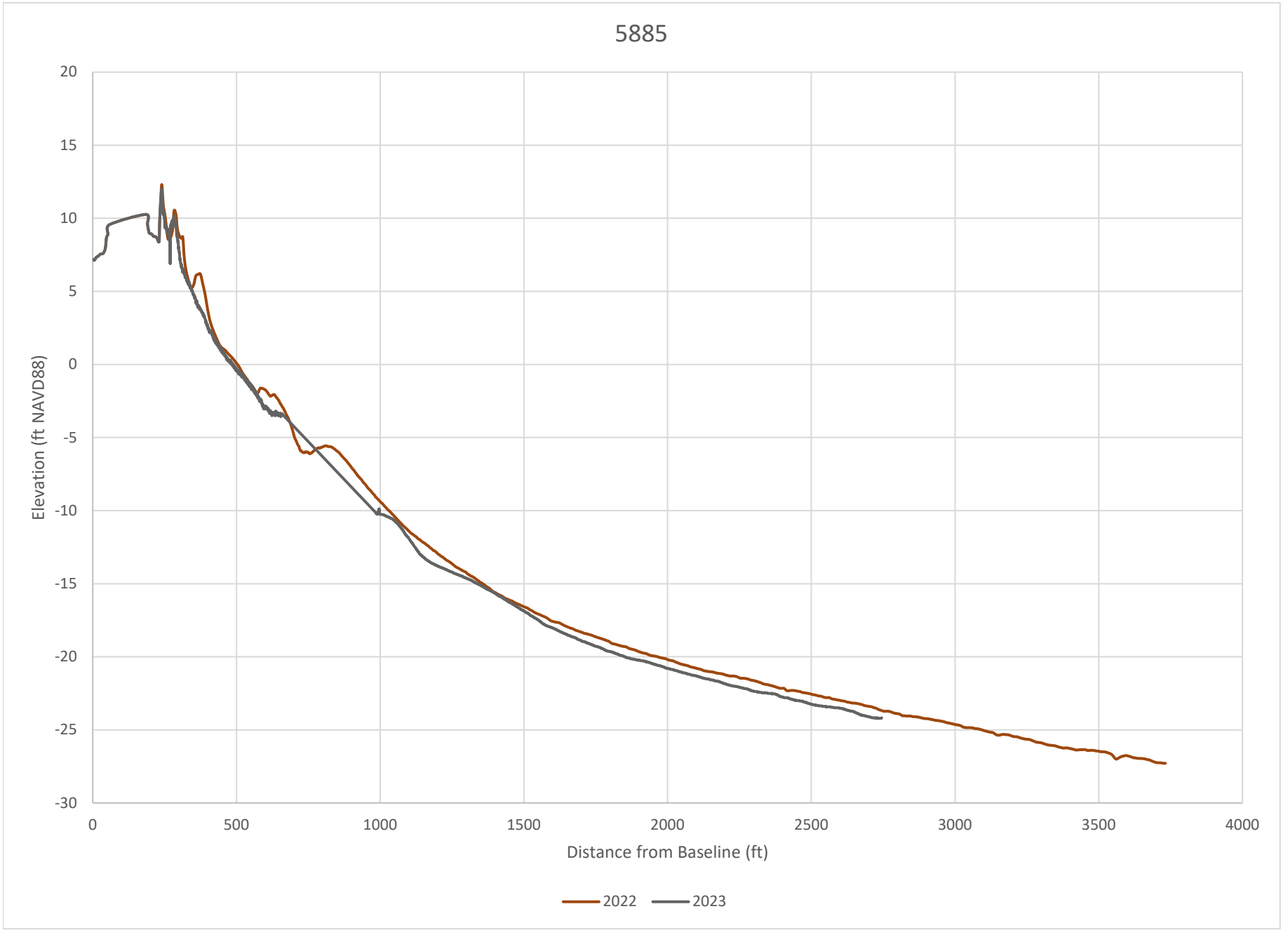
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Distance from Baseline (ft)
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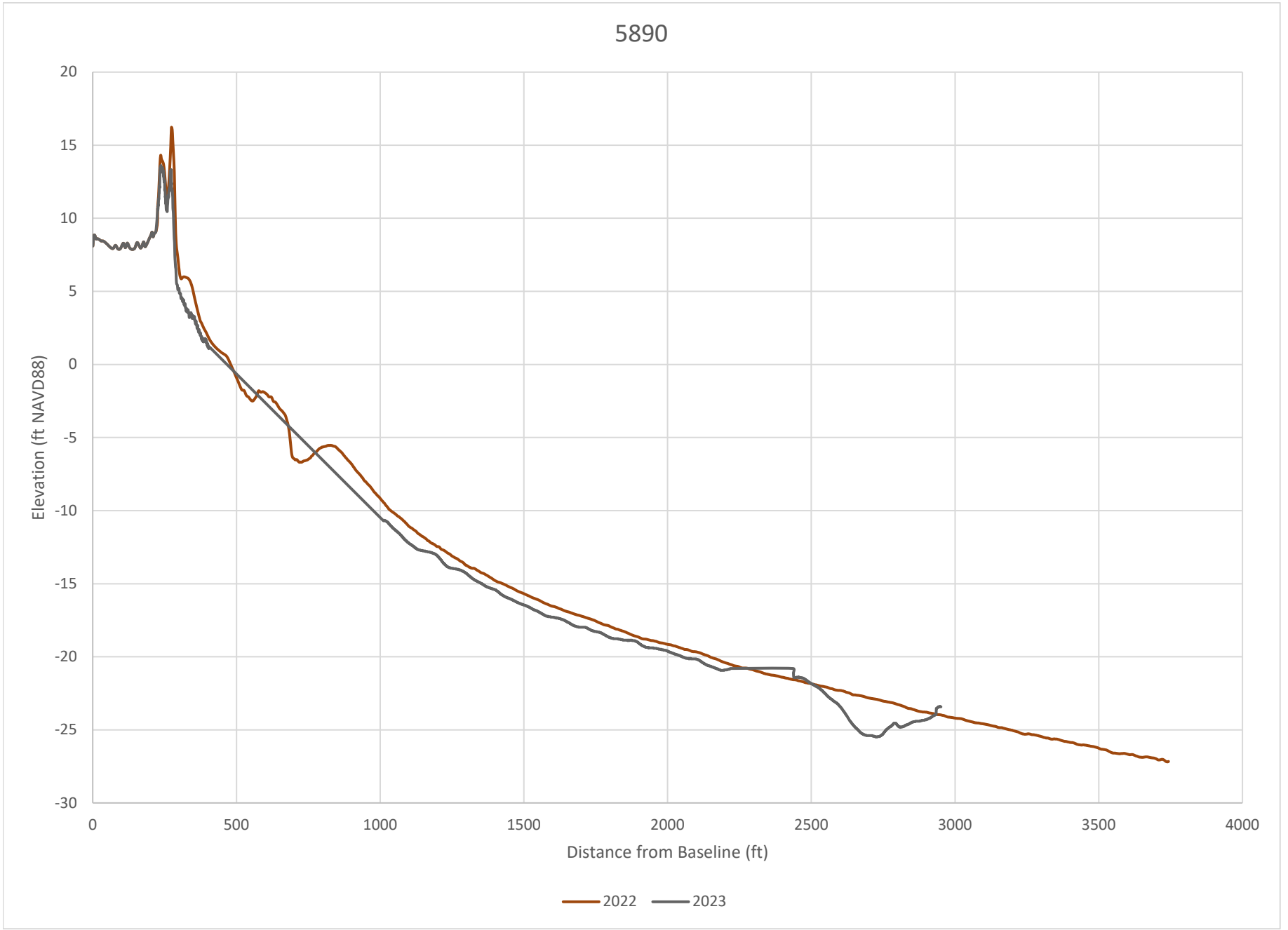
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Distance from Baseline (ft)
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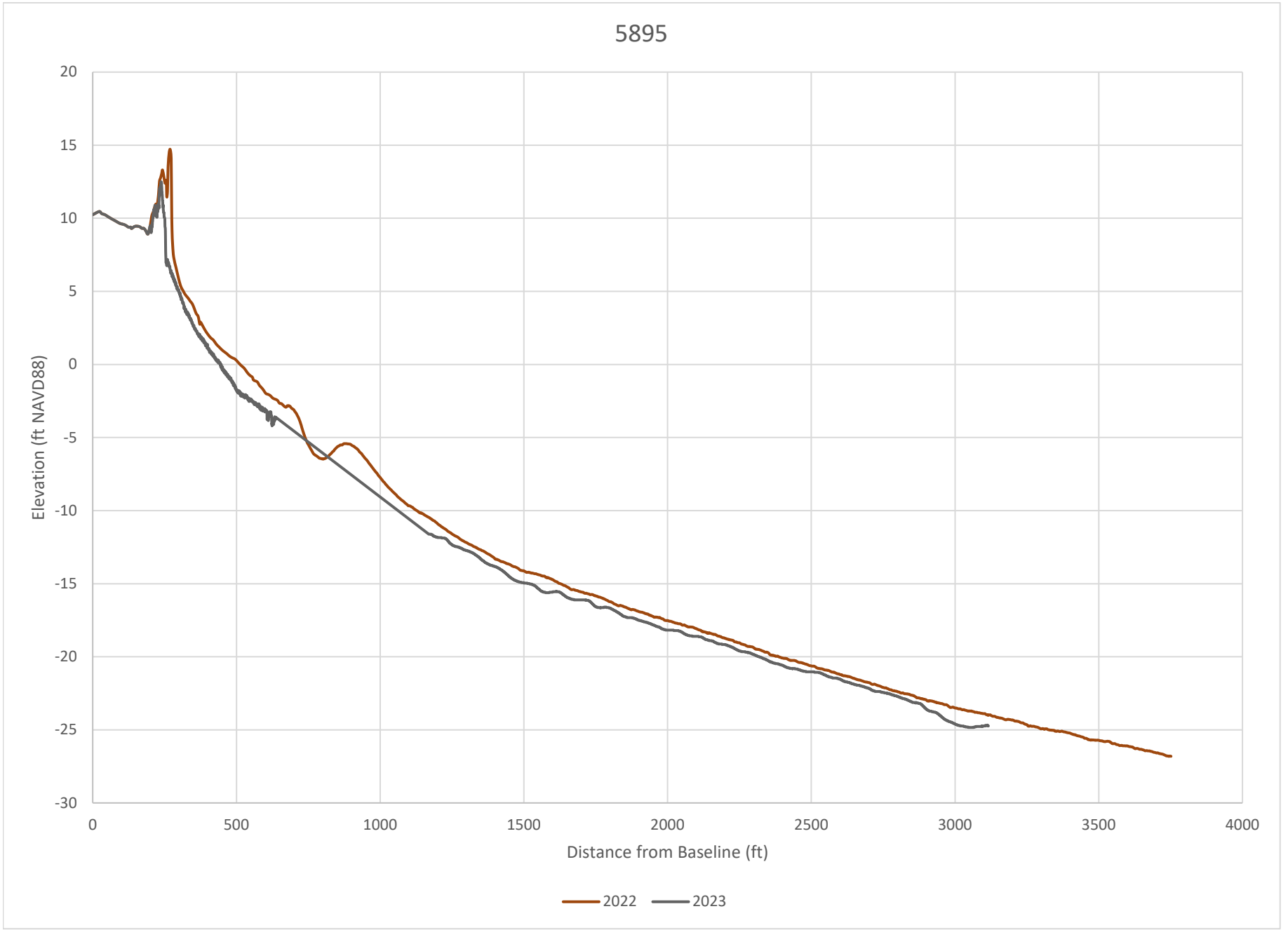
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Elevation (ft NAVD88)
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Distance from Baseline (ft)
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Appendix B

NOTES:
1. Positive changes indicate accretion or gain in volume along the profile and negative changes indicate erosion or loss of volume along the profile.
2. Shoreline Change and Volume Change is calculated for the period between surveys from September 28, 2022 to August 21, 2023.

Reach	Benchmark	Shoreline Change @ MHW (+2.0 ft NAVD88)	Above +6.0 ft NAVD88		Above MHW (+2.0 ft NAVD88)		Above -5 ft NAVD88		Above -10 ft NAVD88		Above -20 ft NAVD88		Above -25 ft NAVD88	
			2023	2022-2023	2023	2022-2023	2023	2022-2023	2023	2022-2023	2023	2022-2023	2023	2022-2023
White Point Swash	5650	-35.3	20.3	-2.9	58.9	-4.9	161.8	-22.5	282.6	-25.4	611.0	-30.1	860.6	-47.5
Windy Hill Beach	5700	-0.7	12.2	-3.6	38.0	-3.9	106.2	-15.5	208.8	-13.6	482.6	-20.3	691.7	-38.0
	5705	20.5	19.5	-4.1	49.4	-2.0	131.7	-5.2	233.0	-6.9	513.3	-14.5	727.6	-28.2
	5715	-27.4	13.8	-1.1	38.9	-6.0	118.0	-13.0	215.1	-18.5	494.1	-22.7	701.6	-39.5
Atlantic Beach	5720	-9.1	17.0	-3.3	44.5	-6.9	126.2	-13.8	232.4	-16.7	523.4	-17.9	735.3	-30.9
	5725	16.2	29.5	-2.1	65.2	-0.9	157.8	-1.1	274.8	1.3	579.9	0.4	797.1	-9.8
	5730	-9.3	73.3	-0.6	143.0	-1.5	296.6	-10.2	454.4	-13.4	847.1	-19.0	1100.0	-35.6
Crescent Beach	5735	-5.4	19.1	-1.4	48.2	-3.9	133.0	-8.9	242.5	-8.6	538.2	-11.4	740.2	-26.2
	5740	-9.9	24.9	-1.8	67.9	-3.4	177.3	-6.6	303.7	-10.6	636.8	-15.3	853.6	-27.6
	5745	-2.0	20.4	-3.1	50.2	-3.8	136.9	-4.1	234.4	-15.7	533.0	-15.9	739.9	-23.7
	5750	-18.3	10.5	-1.8	37.2	-5.4	121.6	-10.0	228.9	-10.7	528.6	-8.7	735.7	-16.8
	5755	-10.6	43.9	-0.2	106.9	-3.6	256.1	-4.9	405.2	-10.7	795.3	-7.6	1046.2	-15.2
Ingram Beach	5760	1.1	18.0	0.6	53.1	-0.6	154.6	0.6	272.9	0.8	584.6	-1.3	796.5	-12.3
	5770	6.1	29.5	-3.5	68.2	-5.4	170.7	-6.4	284.1	-18.6	611.6	-18.6	830.1	-27.4
	5775	7.5	17.9	-1.9	54.6	-3.6	158.0	-3.2	280.8	-1.5	601.9	-2.3	817.9	-12.4
	5780	-3.7	26.4	-0.7	61.6	-1.6	162.1	-1.5	281.6	-0.5	590.1	-10.7	816.6	-8.4
Ocean Drive Beach	5785	9.8	35.0	1.8	79.8	3.0	196.3	6.3	327.5	6.8	668.9	5.2	900.0	-1.4
	5790	4.7	21.1	0.8	56.7	1.4	156.0	3.3	258.0	-14.9	589.9	-3.1	806.7	-13.0
	5795	-16.2	10.7	0.1	38.4	-0.9	122.7	-4.1	235.3	-4.0	541.6	-5.7	756.4	-18.4
	5798	-19.4	12.5	-1.8	44.7	-3.5	137.4	-12.8	257.7	-11.9	576.5	-20.1	807.0	-28.2
	5800	-12.4	11.6	-1.7	39.3	-2.5	123.9	-4.9	238.2	-4.3	548.9	-6.9	769.0	-19.7
	5803	-4.5	30.3	-0.1	67.5	1.3	167.0	-0.6	288.1	-3.4	619.1	-5.7	849.1	-19.0
	5805	-5.4	48.0	0.5	92.3	1.2	202.5	-6.3	335.8	-8.2	688.4	-10.3	928.6	-22.7
	5810	-9.7	22.8	0.1	52.5	-0.6	137.0	-7.2	253.4	-8.5	569.4	-13.1	794.3	-24.9
	5815	-11.6	25.2	0.2	55.4	-0.1	143.3	-3.4	260.3	-3.7	579.8	-6.5	807.9	-17.9
	5818	-6.5	25.9	1.0	56.8	1.0	146.4	-0.5	260.2	-5.4	585.5	-3.1	814.0	-15.8
	5820	7.0	37.3	0.5	79.1	2.0	198.6	12.8	338.1	22.1	689.9	25.9	931.6	10.3
	5825	-3.4	23.3	-0.8	57.6	0.0	150.6	-2.8	252.9	-22.0	555.6	-55.9	766.3	-98.1
Cherry Grove Beach	5830	8.8	25.4	-0.8	59.9	-0.7	148.1	-10.8	264.1	-18.2	597.8	-27.3	845.0	-40.6
	5835	1.1	14.3	-2.4	40.1	-3.3	113.9	-13.1	196.1	-43.0	523.4	-41.3	767.5	-56.7
	5840	-13.9	16.3	-1.6	41.5	-4.1	119.1	-10.6	222.3	-20.8	545.6	-31.6	809.0	-48.4
	5845	-42.8	7.8	-3.9	27.0	-11.0	103.7	-17.2	217.4	-15.0	550.4	-24.0	841.2	-41.5
	5850	-28.7	12.6	-2.8	32.1	-7.7	107.0	-12.9	216.6	-16.8	555.8	-26.5	853.6	-46.8
	5855	-21.1	15.0	-3.6	44.0	-5.2	125.9	-17.4	240.1	-27.0	602.0	-37.9	912.4	-61.4
	5860	-13.6	21.1	-1.4	49.2	-3.3	135.8	-9.8	253.1	-11.8	617.4	-20.5	968.3	-43.4
	5865	-3.3	30.4	-1.5	61.9	-2.3	157.5	-5.0	286.4	-3.7	670.2	-5.1	1023.3	-32.1
	5870	-12.3	20.3	-4.0	46.0	-5.9	134.2	-10.2	254.8	-13.7	628.1	-21.2	992.9	-44.1
	5875	1.9	29.9	-2.4	62.9	-1.2	157.1	-8.5	288.9	-6.7	676.7	-22.1	1031.0	-68.2
	5880	7.6	13.9	-1.8	34.7	-3.2	112.6	-9.8	222.5	-17.7	602.5	-33.1	987.2	-47.2
Futch Beach	5885	-8.4	10.4	-2.0	31.7	-6.0	117.7	-10.5	234.8	-18.4	652.6	-35.1	1045.7	-62.5
	5890	-23.5	14.4	-4.3	30.9	-9.6	116.2	-11.4	233.5	-20.0	673.0	-49.8	1097.9	-73.8
Hog Inlet	5895	-30.3	14.5	-8.1	38.3	-11.9	131.4	-29.6	267.7	-42.8	798.1	-73.1	1273.7	-93.1