National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Shoreline Length and Water Area in the Ocean, Coastal, and Great Lakes Parks (Second Edition)

Updated Statistics for Shoreline Miles and Water Acres

Natural Resource Report NPS/NRSS/WRD/NRR—2024/2633



ON THE COVER
Enderts Beach as seen from Crescent Beach Overlook, Redwood National Park.
NPS

Shoreline Length and Water Area in the Ocean, Coastal, and Great Lakes Parks (Second Edition)

Updated Statistics for Shoreline Miles and Water Acres

Natural Resource Report NPS/NRSS/WRD/NRR—2024/2633

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March 2024

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Winchell, A., O. Helinski, T. Curdts, and M. LaFrance Bartley. 2024. Shoreline length and water area in the ocean, coastal, and Great Lakes parks (second edition): Updated statistics for shoreline miles and water acres. Natural Resource Report NPS/NRSS/WRD/NRR—2024/2633. National Park Service, Fort Collins, Colorado. https://doi.org/10.36967/2299484

NPS 909/192877, March 2024

Contents

Page

Figures....iv

Tables....iv

Appendices....iv

Executive Summary....v

Acknowledgments....vi

List of Acronyms....vii

Introduction....1

Methods....3

List of Ocean, Coastal, and Great Lakes Parks....3

Source Data....3

Shoreline Data....3

NPS Boundary Data....5

Mapping Parameters....5

Reference Imagery....5

Map Projection....6

Review and Editing Process....6

Decision-Making Considerations for Shoreline Editing....6

Calculating Statistics....10

Results....11

Discussion....14

New Park Units....15

Updates to Park Boundaries....15

Shoreline Data....15

Tidal Datum....16

Limitations....17

Literature Cited....19

Figures

Page

Figure 1. An example shoreline delineation for a portion of Timucuan Ecological and Historic Preserve (TIMU) illustrating the extent of tidally influenced area within the park due to river-ocean connections. 8

Figure 2. An example of the shoreline delineation at San Juan National Historic Site (SAJU). 9

Figure 3. An example of dynamic shoreline features along the southern portion of Cape Cod National Seashore (CACO). 10

Tables

Page

Table 1. Shoreline data source details. 4

Table 2. Updated shoreline miles and water acres for the 88 NPS ocean, coastal, and Great Lakes parks. 11

Table 3. Differences in shoreline miles and water acres between 2011 and 2023. 14

Appendices

Page

Appendix A. List of Ocean, Coastal, and Great Lake Park Units 21

Appendix B. Shoreline Data Sources by Park Unit 25

Appendix C. Reference Imagery by Park Unit 30

Appendix D. Projection Parameters 33

Appendix E. Shoreline Delineation Process in ArcGIS Pro 34

Appendix F. Water Acres Process in ArcGIS Pro 35

Appendix G. Explanation of Differences in Shoreline Miles Statistics Between 2023 Update and 2011 Original Report 36

Appendix H. Explanation of Differences in Water Acres Statistics Between 2023 Update and 2011 Original Report 42

Executive Summary

This report details the cumulative shoreline miles and water acres within the 88 ocean, coastal, and Great Lakes National Park units. Across the National Park Service (NPS), there is a total of 14,350 shoreline miles and 2,534,595 water acres. This report serves as an update to the NPS Natural Resource Report titled, "Shoreline length and water area in the ocean, coastal and Great Lakes Parks: Updated statistics for shoreline miles and water acres (rev 1b)" (Curdts 2011). The goal of this project is to recalculate the number of shoreline miles and water area within each park unit using the best available data. Note: For park units located in marine settings, "water acres" refers to ocean, estuarine, and tidally influenced waters. For park units in the Great Lakes region, "water acres" refers to freshwater. For all park units, freshwater bodies such as lakes, ponds, and rivers that exist inland of the marine or Great Lake shoreline are excluded from the calculation.

The methodology of the previous 2011 report is repeated here as much as possible to reduce variability between calculations. Existing shoreline products from federal, state, and NPS sources were visually assessed for each park and compared to reference imagery within ESRI ArcGIS Pro to determine the best available data. The resulting shoreline delineation for each park was reviewed by NPS park, regional, national, and/or Inventory and Monitoring Network staff, and manual adjustments were made as needed to accurately reflect the shoreline. Park boundaries were defined according to the NPS Land Resources Division (LRD), with a few exceptions as noted within the report. Shoreline miles and water acres within each park's boundary were then calculated within a Geographical Information System (GIS) framework.

The results of this report represent a snapshot in time, and variation is to be expected given the dynamic nature of coastal environments. The resulting data do not account for inconsistencies across shoreline products, water level or seasonal variations, or future changes in legal shoreline definitions or park boundaries. Future updates to these statistics may be calculated as new data become available. These shoreline miles and water acres statistics and associated geospatial data and maps are intended for general reference only; they are useful for describing the scale of NPS holdings and management responsibilities. The data should not be used for navigational purposes. The data and maps generated from this project are not legally binding and are not intended to be used as such.

Acknowledgments

This report passed through the hands of many individuals, all of whom offered valuable feedback and assistance in the effort to provide updated data for the ocean, coastal, and Great Lakes National Park units. First, we would like to thank Eva DiDonato (Chief of the NPS Ocean and Coastal Resources Program) who identified the need to conduct this update and guided us throughout the process.

We extend our gratitude to the NPS Regional Ocean Coordinators – Catherine Johnson, Irina Irvine, Brenda Lafrancois, Catherine Toline, and Tahzay Jones – for providing insight into the geography of their designated park units and facilitating communication with the park units themselves. Additionally, we thank regional NPS GIS Coordinators, Program Managers, and Data Managers for providing us with recent data and invaluable information to address questions associated with park shorelines. Specifically, we acknowledge Welles Tisdale and Christopher Barrow from the Southeast Regional Office, Alan Kirschbaum from the Great Lakes Inventory and Monitoring Network (GLKN), and Sara Stevens Nerone, Scott Rasmussen, and Dennis Skidds from the Northeast Coastal and Barrier Inventory and Monitoring Network (NCBN).

Thank you to each of the individual park units – Superintendents, Resource Chiefs, Park Managers, Park Rangers, GIS Specialists, Geographers, Biologists, Ecologists, Botanists, Physical Scientists, and more – for making the time to provide detailed feedback, datasets, and insight into the complexities of the park shorelines throughout the review process. Your help and intimate knowledge of your parks improved the project and resulted in more accurate and meaningful outputs.

Thank you also to the reviewers of this report – Mark Finkbeiner (NOAA), Kyle Arndt (NPS), and Jeff Bracewell (NPS), whose thoughtful comments improved the final product. And thank you to NPS colleagues Jamie Kilgo, Nina Loutchko, and Julia Young for their countless hours spent providing GIS assistance and advice throughout the project.

Lastly, we thank the NPS Land Resources Division for providing a continuously updated geospatial dataset of park unit boundaries. We also acknowledge our sister Federal Agencies and recognize the value of their efforts to publish shoreline data, including the National Oceanic and Atmospheric Administration (NOAA), United States Geological Survey (USGS), and United States Environmental Protection Agency (EPA). Together, the park boundary and publicly available shoreline datasets formed the foundation of this project.

List of Acronyms

AEAC:	Albers Equal Area Conic
AGOL:	ArcGIS Online
ANILCA:	Alaska National Interest Lands Conservation Act
CONUS:	Contiguous U.S.
CUSP:	Continually Updated Shoreline Product
GIS:	Geographical Information System
IRMA:	Integrated Resources Management Applications
LRD:	NPS Land Resources Division
MHW:	Mean high water
NHD:	National Hydrography Dataset
NOAA:	National Oceanic and Atmospheric Administration
NPS:	National Park Service
QC:	Quality Control
USGS:	United States Geographical Survey
Water acres:	Marine, estuarine, and Great Lakes water acres

Introduction

This report details the methodology and results of recalculated shoreline miles and water acres within the 88 ocean, coastal, and Great Lakes park units within the National Park Service (NPS). The goal of this project is to provide a systematic update of statistics using best available data that can be referenced within and outside of NPS.

The comprehensive set of shoreline mile and water acres statistics previously calculated by the NPS Ocean and Coastal Resources Program was published in 2011 (Curdts 2011). As more than a decade has passed since the last effort was undertaken, there was a need to update the statistics using current best available data to delineate shorelines in greater detail and to reflect physical changes in shoreline geographic location that have taken place over time. New shoreline products have become available from NPS and other federal sources, as well as state-led efforts. These products have been evaluated and compared to those used in the original calculations. Also, during the time between the 2011 report and this update, four newly created parks have been added to the original list of 84 and several park unit boundaries have changed, all of which are reflected in this report.

Shorelines are naturally dynamic and shaped by winds, waves, and other natural processes. However, the rate and degree of change is being exacerbated due to human activities and climate change impacts, including sea level rise and storms. Knowledge of the number of shoreline miles and water acres, both cumulatively and within each park unit allows the NPS to make better informed decisions regarding agency-wide planning and management, reporting, and resource allocation. Best available shoreline delineation data will allow parks to better assess shoreline status, prepare and manage for change and disturbance, and prioritize optimal response and restoration actions. This information is also valuable for public education and outreach efforts, including to inspire stewardship and communicate NPS responsibilities.

The calculations of shoreline miles and water acres presented in this report are based on 1) the delineation of the shoreline representing the land-water interface, and 2) the jurisdictional boundary of a given park unit. Park unit boundaries were defined according to the NPS Land Resources Division (LRD), with a few exceptions as noted within the report. Note: For park units located in marine settings, “water acres” refers to ocean, estuarine, and tidally influenced waters. For park units in the Great Lakes region, “water acres” refers to freshwater. For all park units, freshwater bodies such as lakes, ponds, and rivers that exist inland of the marine or Great Lake shoreline are excluded from the calculation.

This update follows the methodology established in the 2011 report to the extent possible. The best available shoreline data from federal and NPS sources were used in this project and manually reviewed and edited as needed. Shoreline delineation outputs can vary based on numerous factors during data processing, including map scale at which the shoreline was delineated; data source, accuracy, resolution, age; tidal state; and considerations of when to include/exclude shoreline (e.g., islands, man-made structures, river-estuary interface). This project applied a consistent methodology and rule set to reduce discrepancies in calculations and present results that are comparable across parks.

This report calculated 14,350 shoreline miles and 2,534,595 water acres across all 88 park units. The statistics for each park are presented in the Results section. The Discussion section explores the overall differences between the statistics calculated for this updated report and the 2011 report, while Appendices G and H provide a brief explanation of the differences for each park unit. Appendix A provides the full name, type, and location of each park unit. Appendices B-F each present aspects of the methodology in more detail.

The results of this report represent a snapshot in time, and variation is to be expected given the dynamic nature of coastal environments. The resulting data do not account for inconsistencies across shoreline products, water level or seasonal variations, or future changes in legal shoreline definitions or park boundaries. Future updates to these statistics may be calculated as new data become available. These shoreline miles and water acres statistics and associated geospatial data and maps are intended for general reference only; they are useful for describing the scale of NPS holdings and management responsibilities. The data should not be used for navigational purposes. The data and maps generated from this project are not legally binding and are not intended to be used as such.

Methods

This project followed the methods of the original report (Curdts 2011) to the extent possible to reduce variability between calculations. The methods presented in this report are an abbreviated version of those presented in the original report; see (Curdts 2011) for additional details on how these methods were established and challenges associated with delineating shorelines. Expanded methodology regarding the clipping, editing, and calculation of the shoreline miles and water acres data in ESRI ArcGIS Pro can be found in Appendices E and F, respectively.

List of Ocean, Coastal, and Great Lakes Parks

As stated in (Curdts 2011), to be included on the list of ocean and coastal parks, a park must be an official NPS unit (i.e., affiliated areas are not included) and meet at least one of the following criteria:

1. Unit includes shoreline on one of the Great Lakes (consistent with the Coastal Zone Management Act, 1972 (16 U.S.C. 1451 et seq.);
2. Unit includes shoreline on one of the oceans (e.g., mean high or mean low water); or
3. Unit includes shoreline on one of the tidally influenced estuaries (usually semi-enclosed by land, but with open, partly obstructed or sporadic access to the open ocean (Cowardin, et al. 1979)), where salt and fresh water mix throughout the water column resulting in regular saline concentrations ≥0.5 ppt.

All 84 parks presented in (Curdts 2011) remain on the current list of ocean, coastal, and Great Lakes national park units; this update did not re-evaluate the original list of park units regarding their eligibility with the original report's criteria. Since the publication of the original report, four park units have been added to the list for a total of 88. A complete list of qualified park units is included in Appendix A. The four park units added are:

- Charles Pinckney National Historic Site (CHPI)
- Fort Monroe National Monument (FOMR)
- Harriet Tubman Underground Railroad National Monument (HATU)
- Minidoka National Historic Site (MIIN)

Source Data

Geospatial datasets delineating the shorelines and NPS park unit boundaries served as the data inputs for calculating shoreline length and water acres in a GIS framework.

Shoreline Data

This update intended to use NOAA's Continually Updated Shoreline Product (CUSP) (NOAA 2022), which was not available when data was analyzed for the 2011 report, to provide a consistent shoreline dataset. CUSP is a respected and widely used shoreline product with coverage for many NPS ocean, coastal, and Great Lakes park units. However, it became clear that in some cases, shoreline data from other federal and NPS sources provided a better representation of current

conditions than the CUSP data. For these cases, these other data sources supplemented or replaced the CUSP data.

Publicly available shoreline data from federal and state sources were visually assessed for each park and compared to recent reference imagery in ESRI ArcGIS Pro to determine the best available data. As with the original 2011 project, a park-by-park "best available data" approach was adopted after it was determined that no one shoreline product was appropriate for all parks. Where needed, manual adjustments were made to more accurately reflect the shoreline. While the "best available data" approach does allow for the most appropriate dataset to be used for each park, it also introduces variability due to differing definitions of shorelines. Refer to the Discussion section of this report and (Curdts 2011) for additional details. The shoreline data sources used for this update are listed in Table 1.

Table 1. Shoreline data source details.

Shoreline Data Source	Information
NOAA Continually Updated Shoreline Product (CUSP)	https://shoreline.noaa.gov/data/datasheets/cusp.html
NOAA Composite Shoreline	https://shoreline.noaa.gov/data/datasheets/composite.html
NOAA National Shoreline	https://coast.noaa.gov/digitalcoast/data/shoreline.html
U.S. Geological Survey (USGS) National Hydrography Dataset (NHD)	https://www.usgs.gov/national-hydrography/national-hydrography-dataset
U.S. Environmental Protection Agency (EPA) and USGS National Hydrology Dataset Plus (NHDPlus)	https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus
NPS-generated shoreline data posted on the Integrated Resources Management Applications (IRMA) Portal (e.g., collected by NPS Inventory and Monitoring Networks)	https://irma.nps.gov/DataStore/
NPS park boundary extent as defined by the NPS Land Resources Division (LRD)	https://irma.nps.gov/DataStore/Reference/Profile/2224545?lnv=True
NPS park staff	Shorelines provided directly from the following park units: DRTO, CAHA, ASIS, GATE, SAHI, FIIS
Report authors	Shorelines segments created manually based on CUSP/park feedback/internal decision-making criteria

Appendix B provides a list of the shoreline data sources used for each ocean, coastal, and Great Lakes park unit. The shoreline data source for each line segment is included as an attribute in the final NPS shoreline geospatial dataset, which may be especially helpful for parks that used multiple sources. The geospatial dataset that accompanies this report is available in the Integrated Resource Management Applications (IRMA) Portal.

NPS Boundary Data

The NPS LRD (LandsNet 2023) is the official steward of NPS boundary data. LRD reviews the enabling legislation, deeds, legal descriptions, surveys/plats, government datasets, imagery, and other available GIS data to spatially define park unit boundaries. The LRD-defined boundaries are available on IRMA for download (Land Resources Division 2022) and are updated quarterly.

During the original 2011 project effort, LRD was involved in a multi-year effort to review, update, and approve boundaries based on a multitude of data sources. In the meantime, this caused some challenges for calculating park unit shoreline mile and water acres statistics (Curdts 2011). As of March 2023, 74 of the 88 ocean, coastal, and Great Lakes park units have LRD-approved boundaries, with the remaining 14 units using data categorized as "unofficial."

Park unit boundaries used for this update were defined according to the NPS LRD, which are established by legislation and best available data at the time. This project uses the quarterly update published in January 2023. However, four park units requested that their day-to-day operations boundary file be used in place of the boundary provided by LRD, or requested slight modifications be made to the LRD boundary. These parks are:

- Acadia National Park (ACAD)
- Assateague Island National Seashore (ASIS)
- Hawai‘i Volcanoes National Park (HAVO)
- Lewis and Clark National Historical Park (LEWI)

For the purpose of this project, the differences between fee/non-fee/conservation easements within park units were not distinguished due to legislative complexity.

Mapping Parameters

ESRI ArcGIS Pro 2.9.5 was used to visualize geospatial data and perform calculations. An ESRI ArcGIS Online (AGOL) map was created during the review phase of the project to easily share data and allow reviewers to add comments. A final AGOL map was created to accompany this report and the downloadable geospatial data.

Reference Imagery

Reference imagery was obtained from the ESRI Image Server within ESRI's ArcGIS Pro 2.9.5 application and was used as a basemap for context. Note: the shoreline delineation used for calculations was not expected to match shoreline shown in the reference imagery; rather the imagery was used to guide data inspection and editing, and for visual assessment of changes between the original and updated geospatial data and statistics. A summary of reference image sources is given below; see Appendix C for the reference image source(s) for each park unit.

Reference Basemap Imagery Sources:

- Maxar
- TerraColor
- State of Florida

- North Carolina Center for Geographic Information and Analysis
- St. Johns County
- New York State
- Planet[1]

Map Projection

This update uses the same map projection as the original 2011 report, which is the Albers Equal Area Conic (AEAC) (USGS version) projection. This projection was chosen because of its ability to accurately represent the contiguous U.S. (CONUS) where the majority of coastal parks are located. An analysis completed by (Curdts 2011) found the error incurred from using the AEAC projection on non-CONUS parks to be negligible for the purpose of this project (Curdts 2011). The AEAC projection parameters are listed in Appendix D.

Review and Editing Process

The data determined to provide the best shoreline delineation for each park was subjected to an initial quality control (QC) process that consisted of detailed visual inspection and additional comparisons to orthorectified imagery. Manual edits were made to the shoreline dataset in ArcGIS Pro as needed, based on the decision-making considerations discussed below. NPS park, regional, national, and Inventory and Monitoring Network staff were then invited to review the draft results in an AGOL map. Additional manual adjustments were made based on the comments received. In total, NPS staff provided comments for 59 of the 88 park units. Details regarding the creation, calculation, and editing of the shoreline and water acres data in ESRI ArcGIS Pro can be found in Appendices E and F, respectively.

Decision-Making Considerations for Shoreline Editing

This project defaulted to using the CUSP dataset when possible, including for decisions such as determining which islands and marshes to include and determining the inland extent of the shoreline. CUSP defines shorelines as follows:

> *"Where applicable, CUSP [references] a mean-high water shoreline based on vertical modeling or image interpretation using both water level stations and/or shoreline indicators"* (NOAA, 2022).

Occasionally, another shoreline product (Table 1) that predated the CUSP data for a park was a better fit when compared to the recent basemap imagery or when considering other data variables, such as the resolution/scale of the delineated shoreline. In these cases, the older data source was used, and any data gaps were filled in with CUSP.

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[1] All of the reference basemap imagery sources are products of ESRI and were found on the ArcGIS Pro basemap, except for imagery from Planet. Planet imagery was referenced for Fire Island National Seashore (FIIS) to help define the shoreline along a recently closed inlet.

Though CUSP was the default shoreline product, NPS-generated data were prioritized where available. Some parks have shoreline monitoring data collected by NPS staff (e.g., Inventory & Monitoring Networks) prioritized. If multiple NPS surveys were conducted, the most recent shoreline data was used. Also, as in the 2011 report, if (portions of) the park unit boundary coincided with the shoreline in the reference imagery, the park unit boundary was considered to be a valid source of shoreline data for this project. In addition, six park units provided shoreline data that they felt better represented the shoreline than the data they reviewed in the AGOL map. These provided files did not cover the full extent of each of the park unit shorelines and therefore, they were supplemented with the other best-fit data.

When multiple shoreline datasets were used for a park unit, any resulting gaps in shoreline delineation were manually digitized referencing the basemap imagery in ESRI ArcGIS Pro.

To make this project as accurate and comparable across space and time as possible, a set of considerations were created and followed to allow for consistent editing to be made across all of the park units. For the purpose of this project, shoreline is defined to *include* the following:

- Features determined to be tidally influenced (Figure 1), such as estuaries, lagoons, marshland, rivers, and ponds. This was determined through park feedback, independent research, and/or the categorization found in the CUSP dataset attribute table.
- Islands, rock outcrops, and sand bars if they were captured by the data sources and/or added in due to park feedback.
- Hardened shorelines such as memorials, seawalls, forts, and marinas.

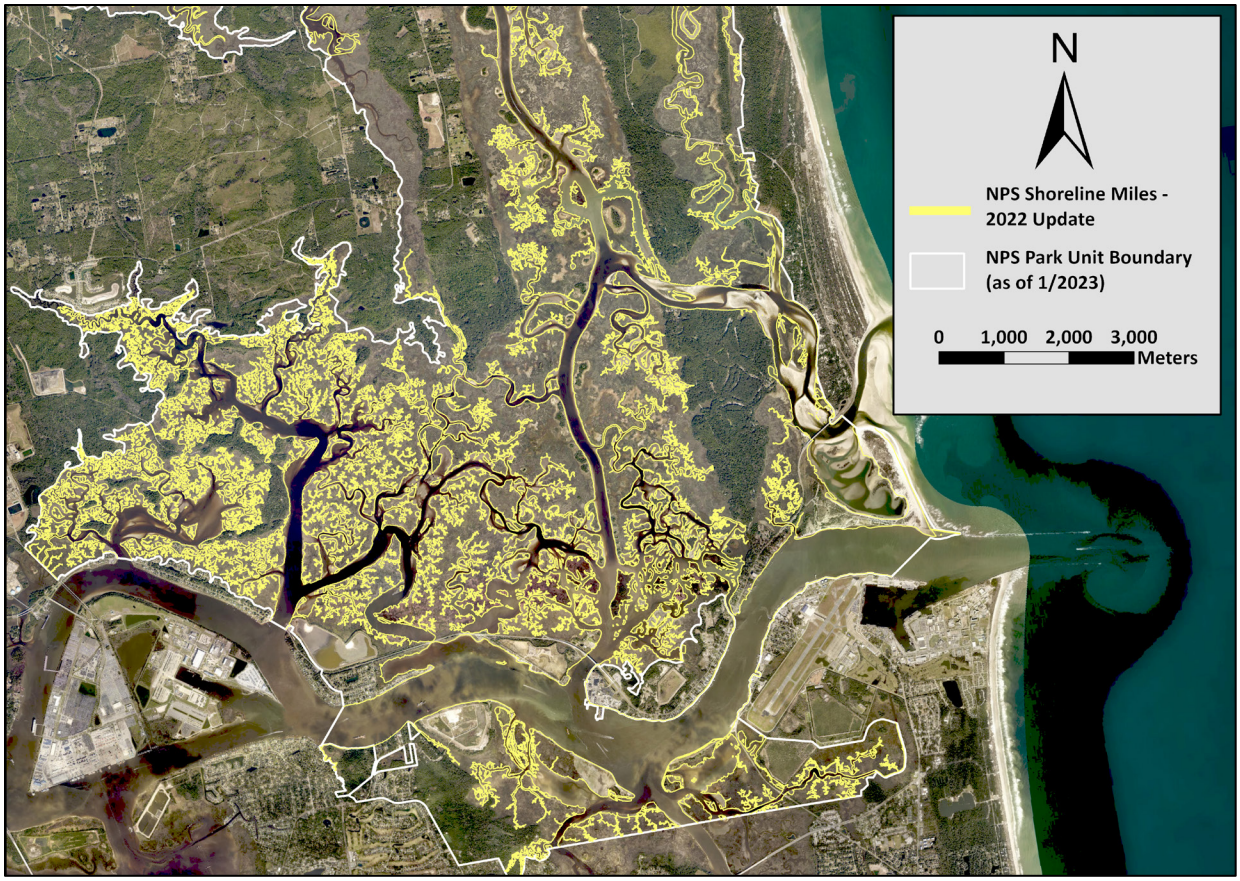


Figure 1. An example shoreline delineation for a portion of Timucuan Ecological and Historic Preserve (TIMU) illustrating the extent of tidally influenced area within the park due to river-ocean connections.

The following features were *not* considered to be representative of shoreline:

- Docks, piers, jetties, and other structures which extend into the water. In these cases, the shoreline delineation was made straight across the landward edge of the structure (as if the structure were not present) or the structure was excluded altogether (Figure 2).

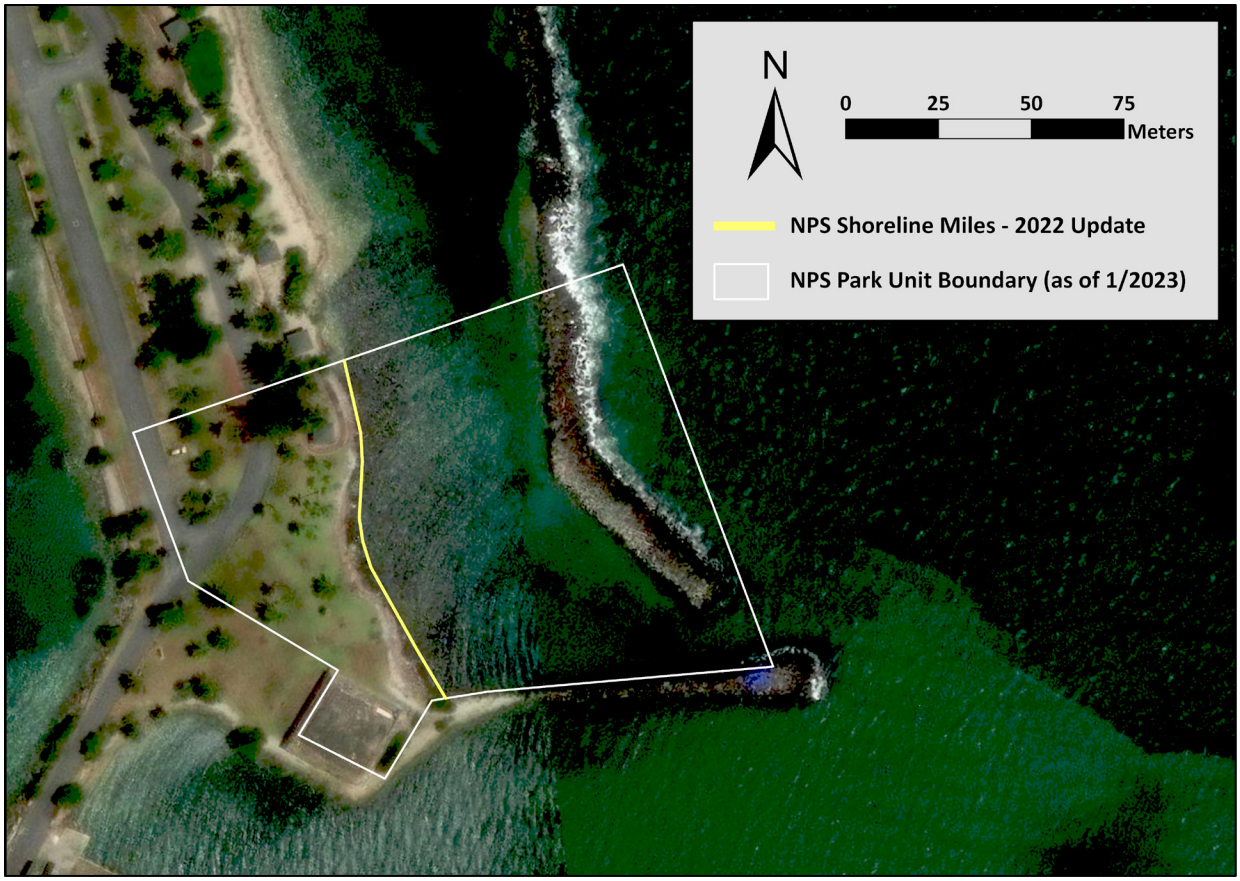


Figure 2. An example of the shoreline delineation at San Juan National Historic Site (SAJU). As seen here, two jetties are present in the park but are not considered to be shoreline.

Additional considerations include:

- Recognition that highly dynamic areas, such as barrier islands and sand bars, are frequently changing in shape and size and that any shoreline delineation for these areas is a snapshot in time. The shoreline delineation used in this update was not always edited to match the most-current shape of these shorelines since the best available data tended to be prior to 2022 (Figure 3). However, manual delineation to match 2022 basemap imagery was conducted for some parks at their request.
- In some cases, the shoreline aligns with, but is located outside of the park boundary, indicating that the boundary is likely intended to follow the shoreline. In these situations, the shoreline was retained and included in the calculation of shoreline miles. Conversely, shoreline veering away from the boundary, suggesting that it is not intended to define (part of) the park boundary, was excluded unless a park specifically requested its inclusion.



Figure 3. An example of dynamic shoreline features along the southern portion of Cape Cod National Seashore (CACO). The sand bars are frequently shifting, and therefore the shoreline was not manually adjusted to reflect the basemap.

Calculating Statistics

Once the shoreline delineation and park boundary datasets were finalized, shoreline miles and water acres statistics were calculated in ArcGIS Pro. Details regarding these calculations can be found in Appendices E and F. In summary, shoreline mile segments with the same data source and date within each park unit were merged to create an organized attribute table. The shoreline mile segments associated with each data source were calculated using the built in ArcGIS Pro calculator; the attribute table was then transferred to Excel where these shoreline mile segments were totaled for each park unit to provide the final statistics. To calculate the water acres statistics, polygons were first created in ArcGIS Pro that were representative of water area for each park. The polygons were then manually reviewed and edited to ensure they captured the water extent from the shoreline to the park's offshore boundary. The individual polygons for each park unit were merged to create one shapefile and the ArcGIS Pro calculator was used to calculate the water acres within each park unit. Further calculations were made in Excel to both the shoreline miles and water acres data to provide additional information referenced throughout this report, including percent difference between the statistics presented in the 2011 report and this report for each park unit.

Results

The number of shoreline miles and water acres for each of the 88 NPS ocean, coastal, and Great Lakes parks is presented in Table 2. Based on these analyses, there are a total of 14,350 miles of shoreline and 2,534,595 acres of water. The four new park units added 94 miles of shoreline and 3,970 acres of water to the total.

Note: For park units located in marine settings, “water acres” refers to ocean, estuarine, and tidally influenced waters. For park units in the Great Lakes region, “water acres” refers to freshwater. For all park units, freshwater bodies such as lakes, ponds, and rivers that exist inland of the marine or Great Lake shoreline are excluded from the calculation.

The shoreline delineations, statistics of shoreline miles and water acres, and associated geospatial data and maps are intended for general reference only. The data should not be used for navigational purposes. The data and maps generated from this project are not legally binding and are not intended to be used as such.

Table 2. Updated shoreline miles and water acres for the 88 NPS ocean, coastal, and Great Lakes parks. See Appendix A for unit codes.

Unit CODE	Shoreline Miles	Water Acres
ACAD	236.6	84.3
ANIA	112.0	1,924.4
APIS	163.8	31,437.3
ASIS	353.3	30,253.4
BELA	811.4	90,495.8
BICY	54.9	340.5
BISC	135.9	166,336.7
BITH	7.7	11.4
BOHA	48.1	0.0
BOST	0.4	7.1
BUIS	2.7	18,819.9
CABR	1.5	5.1
CACO	145.3	17,846.9
CAHA	321.7	8,690.5
CAKR	392.5	27,712.2
CALO	318.5	13,742.9
CANA	306.1	38,008.3
CASA	0.3	0.0
CHIS	250.1	120,588.9
CHPI [1]	0.1	0.1

[1] Park added since 2011.

Table 2 (continued). Updated shoreline miles and water acres for the 88 NPS ocean, coastal, and Great Lakes parks. See Appendix A for unit codes.

Unit CODE	Shoreline Miles	Water Acres
CHRI	0.2	0.1
COLO	74.7	244.5
CUIS	177.6	12,336.9
DESO	0.7	1.7
DRTO	3.9	65,499.0
EBLA	31.6	4,348.7
EVER	4348.6	560,367.6
FIIS	103.5	14,570.6
FOCA	1.5	3.4
FOFR	2.5	0.8
FOMA	6.0	15.8
FOMC	0.7	0.4
FOMR [1]	8.4	35.2
FOPO	0.4	0.0
FOPU	119.4	1,270.2
FORA	2.4	0.0
FOSU	1.3	148.8
GATE	137.6	18,227.0
GEWA	18.5	40.9
GLBA	1178.7	598,611.0
GOGA	112.0	9,908.3
GOIS	0.1	0.0
GRPO	0.7	0.2
GUIS	233.9	111,311.2
HALE	4.6	13.8
HATU [1]	85.2	3,934.5
HAVO	38.5	0.0
INDU	18.5	519.6
ISRO	388.9	408,660.1
JELA	89.2	1,550.7
KAHO	5.5	571.1
KALA	21.9	1,938.8
KATM	534.0	2,083.4
KEFJ	629.4	1,025.4
KLGO	3.0	91.2

[1] Park added since 2011.

Table 2 (continued). Updated shoreline miles and water acres for the 88 NPS ocean, coastal, and Great Lakes parks. See Appendix A for unit codes.

Unit CODE	Shoreline Miles	Water Acres
LACL	206.3	1,424.5
LEWI	12.5	251.6
MIIN [1]	0.1	0.0
NEBE	0.0	0.0
NPSA	24.7	3,046.6
OLYM	127.7	2,995.8
PAIS	413.0	71,428.3
PERL	0.8	0.0
PEVI	0.6	2.0
PIRO	40.5	6,107.1
POCH	0.1	0.9
PORE	120.1	12,355.3
PUHE	0.3	5.3
PUHO	2.6	0.0
REDW	57.3	5,408.5
RORI	3.8	9.9
SACR	0.4	0.4
SAFR	0.4	84.7
SAHI	0.7	1.5
SAIR	0.7	3.3
SAJH	7.8	4.6
SAJU	1.6	2.3
SAMA	0.2	0.0
SAMO	49.6	335.4
SARI	7.2	624.4
SITK	1.2	54.3
SLBE	65.5	10,756.6
STLI	1.8	27.3
TIMU	921.5	13,636.4
VICR	5.8	13,908.8
VIIS	45.8	5,830.1
WAPA	6.1	997.7
WRST	176.9	1,654.4
Total	**14,350**	**2,534,595**

[1] Park added since 2011.

Discussion

This report aims to provide a systematic update to the shoreline miles and water acres statistics for the 84 NPS ocean, coastal, and Great Lakes park units that were previously calculated (Curdts 2011), and include four park units that were added since 2011. The previous methods (Curdts 2011) were followed to the extent possible, but as could be expected, there remained differences between the original statistics and the current statistics present in this report for a variety of factors. These factors include (but are not limited to) updated park boundary geospatial data, the production of more current and higher resolution shoreline delineation data, and the evolving shorelines within the park units themselves (due to natural, human, and/or climate change-related factors) that have occurred in the last decade. It is difficult to discern the contribution of each factor in the resulting statistics for each park, though park specific knowledge can provide insights and allow for a better understanding of the changes that are reflected in the updated shoreline delineation.

Overall, between the 2011 report and this report, there was a 24.5% increase in shoreline miles and a 1.7% increase in water acres (Table 3). Due to the variety of factors that influence the statistics and the time that has passed between the original and current reports, comparison of the two sets of statistics should be undertaken with caution. A lack of change in shoreline miles at a given park unit does not necessarily indicate that no geomorphological change has occurred; rather, the shoreline could be the same number of miles, but its position has moved geographically (e.g., inland due to erosion) or a change in one area of the park could have been offset by another change elsewhere in the park. Similarly, an increase or decrease in shoreline miles does not necessarily signify that accretion or erosion have occurred; rather, it could mean that the shoreline product used in the update is higher resolution and is able to resolve the shoreline in more detail, or that the LRD-defined official park boundary has changed. To comprehensively understand the statistics listed in this report, all of the factors that influence the results must be taken into consideration alongside park specific knowledge. While it can be insightful to compare the original (Curdts 2011) and current statistics, the purpose of this report is to provide an estimation of shoreline miles and water acres for general use. Additional tools, such as modeling and shoreline change rate data, should be used to investigate topics such as shoreline erosion.

Table 3. Differences in shoreline miles and water acres between 2011 and 2023.

Totals	2023	2011	% Difference
Shoreline Miles	14,349.6	11,217.7	24.5%
Water Acres	2,534,594.6	2,490,869.7	1.7%

The main factors responsible for the difference between the 2011 (Curdts 2011) and current shoreline miles and water acres statistics are discussed below. Also, a brief explanation for differences (based on a visual assessment) for each park between the 2011 and 2023 statistics is provided in Appendices G (shoreline miles) and H (water acres) for park units with a difference of 5% or greater; differences

of less than 5% were considered negligible. While these explanations provide a starting point, they do not investigate the full evolution of a park's shoreline over the last decade.

New Park Units

Four new park units were added to the original list of 84 since 2011; two are designated as National Historic Sites (CHPI and MIIN) and two are National Monuments (FOMR and HATU). These units contributed 3,970 acres of water and 94 miles of shoreline, with HATU accounting for 90% of the added shoreline miles and 99% of the water acres.

Updates to Park Boundaries

During the original 2011 project, NPS LRD was involved in a multi-year effort to review, update, and approve park unit boundaries based on a multitude of data sources. The process caused some challenges for calculating park unit shoreline mile and water acres statistics (as discussed in Curdts 2011) that have largely been resolved for this report. As of March 2023, 74 of the 88 ocean, coastal, and Great Lakes park units have LRD-approved boundaries, with the remaining 14 units using data categorized as "unofficial." This LRD effort to provide parks with their official boundaries explains some of the difference between the calculations presented in the 2011 and current report. Note: For the purpose of this project, the differences between fee/non-fee/conservation easements within park units were not distinguished due to legislative complexity.

Shoreline Data

In addition to updates in boundaries and legislation, the current statistics for many parks utilize new shoreline data that became available after 2011. The majority of the current shoreline dataset is NOAA CUSP, which was not available during the calculation of the original statistics. Overall, CUSP provided a high resolution and detailed dataset, extending up tributaries, winding through marshland, and identifying features such as islands and rock outcrops. For example, the shorelines miles for Timucuan Ecological and Historic Preserve (TIMU) increased by 37% between 2011 and the current update primarily attributed to CUSP providing a much more detailed shoreline output than was used in the original report. In addition, the shoreline has physically changed over time. It is difficult to distinguish how much of the shoreline mileage increase can be attributed to each of these factors.

In the current update, the best-available data was used as the default data source, even if the reference imagery coincided with the LRD park boundary. Water acres were counted when the shoreline delineation was within the park boundary and appeared to be within a tidally influenced area based on the reference imagery. In a few cases, water acres between the shoreline delineation and park boundary were not counted based on park feedback and/or internal decision-making criteria; the details of the water acres layer for each park unit are listed in Appendix H. Occasionally, portions of shoreline were updated to reflect the LRD park boundary based on comments received during review and the water acres remained as zero.

Tidal Datum

Tidal datum also influences the calculations; park units may report more or less shoreline miles and water acres depending on the tidal datum the shoreline is referenced to. For example, while the NOAA Composite Shoreline references the shoreline according to Mean High Water (MHW) when possible, the shoreline data provided by Cape Hatteras National Seashore (CAHA) follows the high tide line. Other datasets may not reference a tidal datum, such as the USGS National Hydrography Dataset (NHD). Further investigation into the referenced tidal datum is needed for complete understanding of how it impacts the calculation of shoreline miles and water acres.

Limitations

Although the previous methodology (Curdts 2011) was followed to the extent possible, there remain project differences, challenges, and limitations, primarily associated with the source data, which prevent direct comparison of results between the two projects. Rather, these reports are intended to provide reference data for park shoreline miles and water acres and should be used for general purposes only.

As discussed in Curdts (2011), it remains true that no single shoreline product currently exists with consistent coverage for all park units. Therefore, the merging of multiple data sources was necessary to achieve complete shoreline coverage. Within and between data sources, data were inconsistent regarding scale, seasonality, age, and accuracy. For example, the NOAA CUSP dataset, which provided the majority of the best available data used in this project, does not adhere to a season for data collection. CUSP also does not follow a size criterion for including/excluding islands in the shoreline delineation, with several instances of islands missing that were larger than some that were included. Furthermore, while CUSP aims to use mean-high water (MHW) as the reference tidal state, this is not always the case, and deviation from MHW is not indicated in the shoreline product metadata.

To provide the most accurate shoreline delineation possible, a set of internal criteria was established for decision making and an extensive review process was undertaken to obtain feedback for the 88 park units. Hundreds of manual edits were made in ArcGIS Pro based on comments provided for 59 parks, which resulted in more accurate representations of these shorelines. Still, in some cases, assumptions had to be made when calculating shoreline miles and water acres if feedback was not provided and questions were not confidently resolved from imagery and online research (e.g., determining the extent of tidally influenced waters).

In addition, it is important to acknowledge that this report documenting shoreline position, shoreline miles, and water acres represents a snapshot of a constantly changing environment. This is especially true in highly dynamic coastal environments, such as sandy barrier islands. Without high resolution spatial and temporal datasets, coupled with park-specific knowledge, it is challenging to understand shoreline variation and change over cyclical time scales (e.g., seasonal, annual, decadal) or due to disruptive events (e.g., storms) or shoreline management and other human activities. It is also acknowledged that documenting shoreline position can be a complex and resource intensive process. While many of the best available shoreline delineations used in this project are not as current as would be ideal, they still provide a valuable compilation of geospatial information.

Despite challenges and limitations, this report provides updated calculations of the shoreline miles and water acres that have been referenced by the NPS for over a decade. This report uses the latest and most comprehensive best available data and incorporates feedback received directly from NPS staff. These updated statistics demonstrate the substantial number and geospatial extent of shoreline miles and water acres that NPS is responsible for managing within the 88 ocean, coastal, and Great Lakes park units. This information can facilitate stewardship and management decisions to uphold

the NPS mission to preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations.

Literature Cited

Adams, M. 2021. Cape Cod National Seashore (CACO) GPS Shorelines. Northeast Coastal and Barrier Network, National Park Service.

Curdts, T. 2011. Shoreline length and water area in the ocean, coastal and Great Lakes parks: Updated statistics for shoreline miles and water acres (rev1b). Natural Resource Report NPS/WASO/NRR—2011/464. National Park Service, Fort Collins, Colorado.

National Park Service (NPS). 2023. IRMA Portal (Integrated Resource Management Applications) website. Available at: https://irma.nps.gov (accessed 01 January 2022).

Kramer, L. 2022. ASIS GPS Shorelines. Northeast Coastal and Barrier Network, National Park Service.

Land Resources Division (LRD), National Park Service (NPS). 2023. LandsNet website. Available at: https://landsnet.nps.gov (accessed 02 June 2023).

Land Resources Division, (LRD), National Park Service (NPS). 2022. Administrative Boundaries of National Park System Units 12/31/2022 – National Geospatial Data Asset (NGDA) NPS National Parks Dataset. National Park Service.

United Stated Environmental Protection Agency (EPA). 2023. National Hydrography Dataset Plus (NHD Plus) website. Available at: https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus (accessed 01 July 2021).

National Oceanic and Atmospheric Administration (NOAA), National Geodetic Survey (NGS). 2023. National Shoreline website. Available at: https://coast.noaa.gov/digitalcoast/data/shoreline.html (accessed 08 July 2021).

National Oceanic and Atmospheric Administration (NOAA), National Geodetic Survey (NGS). 2022. Continually Updated Shoreline Product (CUSP) website. Available at: https://shoreline.noaa.gov/data/datasheets/cusp.html (accessed 08 July 2021).

National Oceanic and Atmospheric Administration (NOAA), Office for Coastal Management. 1979. Composite Shoreline website. Available at: https://shoreline.noaa.gov/data/datasheets/composite.html (accessed 02 July 2021).

Northeast Coastal and Barrier Network. 2021. Fire Island National Seashore (FIIS) GPS Shorelines. National Park Service.

Northeast Coastal and Barrier Network. 2021. GATE, Breezy Point Unit GPS Shorelines through Fall 2020. National Park Service.

Northeast Coastal and Barrier Network. 2021. GATE, Plumb Beach GPS Shorelines through Fall 2020. National Park Service.

Northeast Coastal and Barrier Network. 2021. GATE, Sandy Hook Unit GPS Shorelines through Fall 2020. National Park Service.

Northeast Coastal and Barrier Network. 2021. GATE, Staten Island Unit GPS Shorelines through Fall 2020. National Park Service.

Northeast Coastal and Barrier Network. 2019. George Washington Birthplace National Monument (GEWA) GPS Shorelines. National Park Service.

NPGallery Digital Asset Management System. 2023. Ederts Beach as seen from Crescent Beach Overlook. Available at: https://npgallery.nps.gov/AssetDetail/5FE39C25-1DD8-B71B-0BE144FD956FAF7B (accessed 08 February 2023). National Park Service.

U.S. Geological Survey (USGS). 2015. National Hydrography Dataset website. Available at: https://www.usgs.gov/national-hydrography/access-national-hydrography-products (accessed 01 October 2021).

Appendix A. List of Ocean, Coastal, and Great Lake Park Units

Eighty-eight park units met the criteria required to be designated as an official ocean, coastal, or Great Lakes park and therefore, were included in this project (Table A1). The boundary files used in this report are from LRD, with exceptions and distinctions between official/unofficial boundaries denoted by the subscripts. Four new park units were added since the publication of the original statistics (Curdts 2011).

Table A1. List of ocean, coastal, and Great Lake park units.

Count	Unit Code	Unit Name	Unit Type	Unit Location
1	ACAD [1,2]	Acadia	National Park	Maine
2	ANIA	Aniakchak	National Preserve	Alaska
3	APIS	Apostle Islands	National Lakeshore	Wisconsin
4	ASIS [1,2]	Assateague Island	National Seashore	Maryland
5	BELA	Bering Land Bridge	National Preserve	Alaska
6	BICY	Big Cypress	National Preserve	Florida
7	BISC	Biscayne	National Park	Florida
8	BITH	Big Thicket	National Preserve	Texas
9	BOHA	Boston Harbor Islands	National Recreation Area	Massachusetts
10	BOST	Boston	National Historical Park	Massachusetts
11	BUIS	Buck Island Reef	National Monument	U.S. Virgin Islands
12	CABR	Cabrillo	National Monument	California
13	CACO	Cape Cod	National Seashore	Massachusetts
14	CAHA [1]	Cape Hatteras	National Seashore	North Carolina
15	CAKR	Cape Krusenstern	National Monument	Alaska
16	CALO [1]	Cape Lookout	National Seashore	North Carolina
17	CANA	Canaveral	National Seashore	Florida
18	CASA	Castillo de San Marcos	National Monument	Florida
19	CHIS	Channel Islands	National Park	California
20	CHPI [3]	Charles Pinckney	National Historic Site	South Carolina
21	CHRI	Christiansted	National Historic Site	U.S. Virgin Islands
22	COLO	Colonial	National Historical Park	Virginia
23	CUIS	Cumberland Island	National Seashore	Florida

[1] Parks units whose boundaries are listed as “unofficial,” as designated by the Land Resources Divisions as of 03/01/2023.

[2] Park units that provided their own boundary dataset or requested that edits be made to the existing boundary dataset.

[3] Park units that were added since the original report was published (Curdts 2011).

Table A1 (continued). List of ocean, coastal, and Great Lake park units.

Count	Unit Code	Unit Name	Unit Type	Unit Location
24	DESO	De Soto	National Memorial	Florida
25	DRTO	Dry Tortugas	National Park	Florida
26	EBLA [1]	Ebey's Landing	National Historical Reserve	Washington
27	EVER	Everglades	National Park	Florida
28	FIIS [1]	Fire Island	National Seashore	New York
29	FOCA	Fort Caroline	National Memorial	Florida
30	FOFR	Fort Frederica	National Monument	Georgia
31	FOMA	Fort Matanzas	National Monument	Florida
32	FOMC	Fort McHenry	National Monument and Historic Shrine	Maryland
33	FOMR [3]	Fort Monroe	National Monument	Virginia
34	FOPO	Fort Point	National Historic Site	California
35	FOPU	Fort Pulaski	National Monument	Georgia
36	FORA	Fort Raleigh	National Historic Site	North Carolina
37	FOSU	Fort Sumter	National Monument	South Carolina
38	GATE	Gateway	National Recreation Area	New York, New Jersey
39	GEWA	George Washington Birthplace	National Monument	Virginia
40	GLBA	Glacier Bay	National Park and Preserve	Alaska
41	GOGA	Golden Gate	National Recreation Area	California
42	GOIS	Governors Island	National Monument	New York
43	GRPO	Grand Portage	National Monument	Minnesota
44	GUIS	Gulf Islands	National Seashore	Florida, Mississippi
45	HALE	Haleakala	National Park	Hawaii
46	HATU [1,3]	Harriet Tubman Underground Railroad	National Monument	Maryland
47	HAVO [2]	Hawai'i Volcanoes	National Park	Hawaii
48	INDU	Indiana Dunes	National Lakeshore	Indiana
49	ISRO [1]	Isle Royale	National Park	Michigan
50	JELA	Jean Lafitte	National Historical Park and Preserve	Louisiana
51	KAHO	Kaloko-Honokohau	National Historical Park	Hawaii
52	KALA	Kalaupapa	National Historical Park	Hawaii
53	KATM	Katmai	National Park and Preserve	Hawaii

[1] Parks units whose boundaries are listed as "unofficial," as designated by the Land Resources Divisions as of 03/01/2023.

[2] Park units that provided their own boundary dataset or requested that edits be made to the existing boundary dataset.

[3] Park units that were added since the original report was published (Curdts 2011).

Table A1 (continued). List of ocean, coastal, and Great Lake park units.

Count	Unit Code	Unit Name	Unit Type	Unit Location
54	KEFJ	Kenai Fjords	National Park	Alaska
55	KLGO	Klondike Gold Rush	National Historical Park	Alaska
56	LACL	Lake Clark	National Park & Preserve	Alaska
57	LEWI [1,2]	Lewis and Clark	National Historical Park	Oregon
58	MIIN [3]	Minidoka	National Historic Site	Washington
59	NEBE	New Bedford Whaling	National Historical Park	Massachusetts
60	NPSA	National Park of American Samoa	National Park	American Samoa
61	OLYM [1]	Olympic	National Park	Washington
62	PAIS	Padre Island	National Seashore	Texas
63	PERL	Pearl Harbor	National Memorial	Hawaii
64	PEVI	Perry's Victory and International Peace	Memorial	Ohio
65	PIRO	Pictured Rocks	National Lakeshore	Michigan
66	POCH	Port Chicago Naval Magazine	National Memorial	California
67	PORE	Point Reyes	National Seashore	California
68	PUHE	Pu'ukohola Heiau	National Historic Site	Hawaii
69	PUHO	Pu'uhonua o Honaunau	National Historical Park	Hawaii
70	REDW [1]	Redwood	National Park	California
71	RORI	Rosie the Riveter/World War II Home Front	National Historical Park	California
72	SACR	Saint Croix Island	International Historic Site	Maine
73	SAFR	San Francisco Maritime	National Historical Park	California
74	SAHI	Sagamore Hill	National Historic Site	New York
75	SAIR	Saugus Iron Works	National Historic Site	Massachusetts
76	SAJH [1]	San Juan Island	National Historical Park	Washington
77	SAJU [1]	San Juan	National Historic Site	Puerto Rico
78	SAMA	Salem Maritime	National Historic Site	Massachusetts
79	SAMO	Santa Monica Mountains	National Recreation Area	California
80	SARI	Salt River Bay	National Historical Park and Ecological Preserve	U.S. Virgin Islands
81	SITK	Sitka	National Historical Park	Alaska
82	SLBE	Sleeping Bear Dunes	National Lakeshore	Michigan

[1] Parks units whose boundaries are listed as "unofficial," as designated by the Land Resources Divisions as of 03/01/2023.

[2] Park units that provided their own boundary dataset or requested that edits be made to the existing boundary dataset.

[3] Park units that were added since the original report was published (Curdts 2011).

Table A1 (continued). List of ocean, coastal, and Great Lake park units.

Count	Unit Code	Unit Name	Unit Type	Unit Location
82	SLBE	Sleeping Bear Dunes	National Lakeshore	Michigan
83	STLI	Statue of Liberty	National Monument	New York
84	TIMU [1]	Timucuan	Ecological and Historic Preserve	Florida
85	VICR	Virgin Islands Coral Reef	National Monument	U.S. Virgin Islands
86	VIIS	Virgin Islands	National Park	U.S. Virgin Islands
87	WAPA	War in the Pacific	National Historical Park	Guam
88	WRST	Wrangell-St. Elias	National Park and Preserve	Alaska

[1] Parks units whose boundaries are listed as “unofficial,” as designated by the Land Resources Divisions as of 03/01/2023.

[2] Park units that provided their own boundary dataset or requested that edits be made to the existing boundary dataset.

[3] Park units that were added since the original report was published (Curdts 2011).

Appendix B. Shoreline Data Sources by Park Unit

The data sources used in the shoreline delineation for each of the 88 ocean, coastal, and Great Lakes park units are listed below (Table B1). The specific date and/or range of years that the shoreline data source references are also listed; some data sources did not provide the dates referenced. The shoreline data source for each line segment is included as an attribute in the final NPA shoreline geospatial dataset, which is available in the Integrated Resource Management Applications (IRMA) portal.

Table B1. Shoreline data sources by park unit.

Unit CODE	Unit Name	Shoreline Source/Date
ACAD	Acadia National Park	CUSP: 2006–2011; Manually created based on park input
ANIA	Aniakchak National Preserve	NOAA National Shoreline
APIS	Apostle Islands National Lakeshore	CUSP: 09-12-2008 and 09-17-2008
ASIS	Assateague Island National Seashore	CUSP: 2013–2018; Manually created based on CUSP and park input; Provided by park: 11-04-2019 and 01-06-2020; NHD Flowline: 2003–2011
BELA	Bering Land Bridge National Preserve	CUSP: 2003–2019; Manually created based on park input
BICY	Big Cypress National Preserve	CUSP
BISC	Biscayne National Park	CUSP: 2005–2019; NOAA Composite Shoreline: 1972–2015
BITH	Big Thicket National Preserve	CUSP: 1998–2019
BOHA	Boston Harbor Islands National Recreation Area	Manually created based on park input
BOST	Boston National Historical Park	CUSP: 06-23-2005, 07-07-2010, 05-13-2015
BUIS	Buck Island Reef National Monument	CUSP: 2014
CABR	Cabrillo National Monument	CUSP: 10-15-2009 and 11-11-2009
CACO	Cape Cod National Seashore	CUSP: 2011–2020; IRMA – Cape Cod: 2021 and 10-01-2019
CAHA	Cape Hatteras National Seashore	CUSP: 2008–2020; Provided by park: 10-17-2022, 10-18-2022, 10-19-2022; Manually edited based on park input
CAKR	Cape Krusenstern National Monument	CUSP: 2003–2016; Manually created based on park input
CALO	Cape Lookout National Seashore	CUSP: 2009–2020
CANA	Canaveral National Seashore	CUSP: 2006–2016; NOAA Composite Shoreline: 1967–1969

Table B1 (continued). Shoreline data sources by park unit.

Unit CODE	Unit Name	Shoreline Source/Date
CASA	Castillo de San Marcos National Monument	NOAA Composite Shoreline: 02-01-1979
CHIS	Channel Islands National Park	CUSP: 2010–2014; Manually created
CHPI	Charles Pinckney National Historic Site	National Hydrology Dataset (Plus): 04-17-2015
CHRI	Christiansted National Historic Site	CUSP: 2014
COLO	Colonial National Historical Park	CUSP: 2005–2009
CUIS	Cumberland Island National Seashore	CUSP: 2002–2019; Manually created
DESO	De Soto National Memorial	CUSP: 03-13-2006
DRTO	Dry Tortugas National Park	CUSP: 03-23-2015; Provided by park: 10-27-2022, 10-23-2022, 10-12-2022; Manually created
EBLA	Ebey's Landing National Historical Reserve	CUSP: 2013–2017; Manually created based on park input
EVER	Everglades National Park	CUSP: 2013–2019; NOAA Composite Shoreline: 02-01-1972
FIIS	Fire Island National Seashore	CUSP: 2011–2017; NOAA Composite Shoreline: 08-14-1947; NPS Boundary: 2013; IRMA – Fire Island: 1979–2019; Provided by park and breach closed referencing Planet data imagery: 05-25-2022; Manually created based on park input
FOCA	Fort Caroline National Memorial	CUSP: 2001
FOFR	Fort Frederica National Monument	CUSP: 2003
FOMA	Fort Matanzas National Monument	CUSP: 2014–2015; Manually created based on park input
FOMC	Fort McHenry National Monument and Historic Shrine	CUSP: 06-23-2005, 02-09-2007, 05-24-2007
FOMR	Fort Monroe National Monument	CUSP: 2003–2013
FOPO	Fort Point National Historic Site	CUSP: 2010 and 11-01-2010
FOPU	Fort Pulaski National Monument	CUSP: 2017–2019
FORA	Fort Raleigh National Historic Site	CUSP: 09-24-1990
FOSU	Fort Sumter National Monument	CUSP: 2010–2017; Manually created
GATE	Gateway National Recreation Area	CUSP: 1999–2016; IRMA – GATE: 2020; Provided by park: 03-11-2022, 03-23-2022, 03-08-2022; Manually created
GEWA	George Washington Birthplace National Monument	CUSP: 09-03-2008; IRMA – GEWA: 10-04-2019; Manually created based on park input

Table B1 (continued). Shoreline data sources by park unit.

Unit CODE	Unit Name	Shoreline Source/Date
GLBA	Glacier Bay National Park and Preserve	NPS Boundary: 2011
GOGA	Golden Gate National Recreation Area	CUSP: 2002–2018
GOIS	Governors Island National Monument	CUSP: 1999
GRPO	Grand Portage National Monument	NPS Dataset: 2011
GUIS	Gulf Islands National Seashore	CUSP: 1978–2015, NOAA Composite Shoreline: 1978–2015; Manually created based on park input
HALE	Haleakala National Park	NOAA Composite Shoreline: 1960
HATU	Harriet Tubman Underground Railroad National Monument	CUSP: 2006–2009; Manually created
HAVO	Hawai‘i Volcanoes National Park	NPS Boundary: 2021; NOAA Composite Shoreline: 03-01-1977; Manually created based on park input
INDU	Indiana Dunes National Lakeshore	IRMA – Indiana Dunes: 2018
ISRO	Isle Royale National Park	CUSP: 06-14-2009, 07-11-2009, 07-12-2009, 08-06-2009, 06-15-2009, Manually created based on park input
JELA	Jean Lafitte National Historical Park and Preserve	CUSP: 03-14-2010, 02-20-2000; Digitized at 1:5,000 from ESRI image server imagery (USGS 20071015 0.3-meter): 2007; Manually created
KAHO	Kaloko-Honokohau National Historical Park	NOAA Composite Shoreline: 09-01-1963 and 1963–1969
KALA	Kalaupapa National Historical Park	CUSP: 01-2007 and 02-24-2011
KATM	Katmai National Park & Wilderness	CUSP: 2011–2020; NHD: No date provided; Manually created based on park input
KEFJ	Kenai Fjords National Park	CUSP: 1998–2020; Manually created based on park input
KLGO	Klondike Gold Rush National Historical Park	NPS Tract 102-42: No date provided; Manually created based on park input
LACL	Lake Clark National Park & Preserve	NOAA National Shoreline – PH6301B: 1967–1970
LEWI	Lewis and Clark National Historical Park	CUSP: 1955–2015; NOAA Composite Shoreline: 1955–2015; National Hydrography Dataset: 1955–2015; Manually created
MIIN	Minidoka National Historic Site	CUSP: 08-10-2014
NEBE	New Bedford Whaling National Historical Park	Manually created.

Table B1 (continued). Shoreline data sources by park unit.

Unit CODE	Unit Name	Shoreline Source/Date
NPSA	National Park of American Samoa National Park	NOAA National Ocean Service: No date provided; Manually created based on park input
OLYM	Olympic National Park	CUSP: 2006–2011
PAIS	Padre Island National Seashore	CUSP: 2014–2018; NOAA Composite Shoreline and NOAA Merged Vector Shoreline (EVS): 1987 – no date provided
PERL	Pearl Harbor National Memorial	CUSP: 08-09-2013, 09-08-2015, 05-02-2012; Manually created based on park input
PEVI	Perry's Victory and International Peace Memorial	CUSP: 08-18-2008
PIRO	Pictured Rocks National Lakeshore	IRMA – Pictured Rocks: 2015
POCH	Port Chicago Naval Magazine National Memorial	CUSP: 2013
PORE	Point Reyes National Seashore	CUSP: 06-05-2010, 11-01-2010, 05-20-2012, 05-23-2012
PUHE	Pu'ukohola Heiau National Historic Site	USGS 1:24K Hawaii State and County Boundary: No date provided
PUHO	Pu'uhonua o Honaunau National Historical Park	NOAA Composite Shoreline: 03-01-1969
REDW	Redwood National Park	CUSP: 2010–2017; Manually created based on park input
RORI	Rosie the Riveter/World War II Home Front National Historical Park	CUSP: 2010, 04-07-2012, 05-20-2012; Manually created
SACR	Saint Croix Island International Historic Site	CUSP: 07-22-2013
SAFR	San Francisco Maritime National Historical Park	CUSP: 2016–2021
SAHI	Sagamore Hill National Historic Site	CUSP: 10-28-2004; Provided by park: 04-21-2022; Manually created
SAIR	Saugus Iron Works National Historic Site	Manually created based on park input
SAJH	San Juan Island National Historical Park	CUSP: 07-26-1993
SAJU	San Juan National Historic Site	CUSP: 03-31-2016; Manually created based on park input
SAMA	Salem Maritime National Historic Site	CUSP: 06-23-2005; Manually created
SAMO	Santa Monica Mountains National Recreation Area	CUSP: 2005–2017
SARI	Salt River Bay National Historical Park and Ecological Preserve	CUSP: 2014–2018
SITK	Sitka National Historical Park	NOAA National Shoreline – AK9703B: No date provided; Manually created based on park input

Table B1 (continued). Shoreline data sources by park unit.

Unit CODE	Unit Name	Shoreline Source/Date
SLBE	Sleeping Bear Dunes National Lakeshore	IRMA – Sleeping Bear Dunes: 2015
STLI	Statue of Liberty National Monument	CUSP: 1999–2013
TIMU	Timucuan Ecological and Historic Preserve	CUSP: 2001–2017; NOAA Medium Resolution Shoreline: No date provided
VICR	Virgin Islands Coral Reef National Monument	CUSP: 02-15-2007 and 11-2007
VIIS	Virgin Islands National Park	CUSP: 02-15-2007, 11-2007, 04-02-2011; Manually created based on park input
WAPA	War in the Pacific National Historical Park	CUSP: 2007–2013; Manually created based on park input
WRST	Wrangell-St. Elias National Park and Preserve	CUSP: 1998–2017; NPS Boundary: No date provided; Manually created based on park input

Appendix C. Reference Imagery by Park Unit

The imagery used to guide shoreline delineation inspection, editing, and visual assessments for each of the 88 ocean, coastal, and Great Lakes park units is listed below (Table C1). With the exception of the Planet data used for FIIS, the reference imagery was obtained from the ESRI Image Server within ESRI's ArcGIS Pro application and used as a basemap for context. It is expected that this imagery will change as new satellite imagery is made available.

Table C1. Reference imagery by park unit.

Unit Code	ESRI Basemap Imagery Age and Source
ACAD	Maxar; 2016–2018
ANIA	Maxar; 2018
APIS	Maxar; 2010–2020
ASIS	Maxar; 2018–2021
BELA	Maxar, TerraColor; 2018–2020
BICY	Maxar, State of Florida; 2018
BISC	Maxar, State of Florida; 2019–2021
BITH	Maxar; 2020
BOHA	Maxar; 2020
BOST	Maxar; 2020
BUIS	Maxar; 2020
CABR	Maxar; 2021
CACO	Maxar; 2021
CAHA	Maxar; 2019–2020
CAKR	Maxar, TerraColor; 2018–2020
CALO	Maxar, North Carolina Center for Geographic Information and Analysis; 2019–2021
CANA	Maxar, State of Florida; 2018–2020
CASA	St. Johns County 2021
CHIS	Maxar; 2018–2020
CHPI	Maxar; 5-4-2020
CHRI	Maxar; 2019
COLO	Maxar; 2016–2021
CUIS	Maxar; 2016–2021
DESO	State of Florida; 2020
DRTO	Maxar; 2020
EBLA	Maxar; 2018
EVER	Maxar, State of Florida, Monroe County BOCC; 2017–2021
FIIS	New York State; 2020; Planet 12-28-22
FOCA	State of Florida; 2020

Table C1 (continued). Reference imagery by park unit.

Park Code	ESRI Basemap Imagery Age and Source
FOFR	Maxar; 2020
FOMA	St. Johns County; 2021
FOMC	Maxar; 2020
FOMR	Maxar; 10-03-2019
FOPO	Maxar; 2019
FOPU	Maxar; 2019–2021
FORA	Maxar; 2021
FOSU	Maxar; 2020–2021
GATE	New York State, Maxar; 2020–2021
GEWA	Maxar; 2020
GLBA	Maxar, TerraColor; 2014–2020
GOGA	Maxar; 2019–2021
GOIS	New York State; 2020
GRPO	Maxar, 2018
GUIS	Maxar; 2018–2020
HALE	Maxar; 2018–2020
HATU	Maxar; 2018–2020
HAVO	Maxar; 2019–2020
INDU	Maxar; 2020
ISRO	Maxar; 2017–2019
JELA	Maxar; 2020
KAHO	Maxar; 2020
KALA	Maxar; 2020
KATM	Maxar; 2018–2020
KEFJ	Maxar; 2013–2020
KLGO	Maxar; 2014
LACL	Maxar; 2018–2019
LEWI	Maxar; 2014–2019
MIIN	Maxar; 7-19-2020
NEBE	Maxar; 2021
NPSA	Maxar; 2018–2020
OLYM	Maxar; 2015–2021
PAIS	Maxar; 2017–2021
PEVI	Maxar; 2018
PIRO	Maxar; 2016–2021
POCH	Maxar; 2019
PORE	Maxar; 2021

Table C1 (continued). Reference imagery by park unit.

Park Code	ESRI Basemap Imagery Age and Source
PUHE	Maxar; 2020
PUHO	Maxar; 2019–2020
REDW	Maxar; 2021
RORI	Maxar; 2019
SACR	Maxar; 2017
SAFR	Maxar; 2019
SAHI	New York State; 2020
SAIR	Maxar; 2020
SAJH	Maxar; 2020–2021
SAJU	Maxar; 2021
SAMA	Maxar; 2020
SAMO	Maxar; 2018–2021
SARI	Maxar; 2020
SITK	Maxar; 2019
SLBE	Maxar; 2021
STLI	New York State; 2020
TIMU	Maxar, State of Florida; 2020–2021
VALR	Maxar; 2020
VICR	Maxar; 2017–2020
VIIS	Maxar; 2017–2020
WAPA	Maxar; 2020
WRST	Maxar; 2017–2019

Appendix D. Projection Parameters

Listed below are the defined parameters that were used to specify the origin and customize the map projection (Albers Equal Area Conic Projection, USGS Version).

Parameters for Albers Equal Area Conic Projection (USGS Version)

USA_Contiguous_Albers_Equal_Area_Conic_USGS_version

Projection: Albers

False_Easting: 0.000000

False_Northing: 0.000000

Central_Meridian: −96.000000

Standard_Parallel_1: 29.500000

Standard_Parallel_2: 45.500000

Latitude_Of_Origin: 23.000000

Linear Unit: Meter

GCS_North_American_1983

Datum: D_North_American_1983

Appendix E. Shoreline Delineation Process in ESRI ArcGIS Pro

The following text provides details regarding the steps taken to create the shoreline delineation layer in ArcGIS Pro. After the data was uploaded, it was edited according to the park unit boundaries and the feedback received through the review process. Calculations were then made in both ArcGIS Pro and Excel.

Shoreline shapefiles for individual park units were created by selecting the area of the shoreline product that exists around the park unit of interest using the "Select" tool on the Edit ribbon. Then, the features were exported by right clicking the shoreline product on the Contents page and selecting "Data," then "Export Features." The exported data was saved in the project geodatabase as [Park Code]_[ShorelineProduct].

Shoreline vectors entirely outside of the park boundary were deleted by highlighting the segments with the "Select" tool on the Edit ribbon and then pressing the "Delete" key. For shoreline vectors partially inside the boundaries, the Interactive tab of the "Split" tool on the Edit ribbon was used to split the vector before deleting the segments outside of the park boundary. Some parks required the use of the "Explode" tool on the Edit ribbon (before the "Split" tool) to separate the vectors and allow for deletion of only the vectors of interest. Gaps in a park's shoreline were closed with the "Edit Vertices" tool on the Edit ribbon and the separated vectors were connected.

Manual edits made to the park shoreline, such as adding/removing/extending/shortening/reshaping features were made using the "Create" and "Modify" tools in the "Feature" tab of the "Edit" Ribbon. In particular, the "Split," "Delete," and "Edit Vertices" tools were used to delete segments of shoreline. The "Reshape" and "Create" tools were used to edit the existing shorelines or create new segments of shorelines. Manual edits made in each park unit were merged using the "Merge Features" tool and labeled in the attribute table accordingly. Shoreline files provided directly from the files were edited in the "Fields" view of the attribute table to contain only the relevant information. The Data Management Tool "Append" was then used to attach the shoreline files to the final shoreline layer, named "NPS_Shoreline_Miles_2023."

After the final shoreline edits were made, an attribute field for shoreline miles was created with the "Calculate Geometry Attributes" tool found on the Analysis ribbon under Tools. Length (geodesic) was selected as the property, Miles (United States) as the length unit, and USA_Contiguous_Albers_Equal_Area_Conic_USGS_version as the coordinate system. The table was then exported to Excel using the "Table to Excel" Conversion Tool, where the final shoreline miles statistics (per park unit and total) were calculated using the raw data.

Appendix F. Water Acres Process in ESRI ArcGIS Pro

The following text provides details regarding the steps taken to create the water acres layer in ArcGIS Pro. After the water acres polygons were created, they were edited according to the shoreline delineation, park unit boundaries, and the feedback received through the review process. Calculations were then made in both ArcGIS Pro and Excel.

Water acres shapefiles for individual park units were created by selecting the park unit boundary of interest from the NPS_boundary.shp using the "Select" tool on the Edit ribbon. Then, the features were exported by right clicking the shoreline product on the Contents pane, and selecting "Data," then "Export Features." The exported data was saved in the project geodatabase as [Park Code]_[WaterAcres].

With the By Feature tab of the "Split" tool on the Edit ribbon, the individual park ocean acres polygons were split into polygons for land and polygons for water, with the shoreline product as the input feature and the water acres polygon as the target feature. Resulting polygons were deleted when they were visually determined to be representative of land. Features that were excluded in the decision-making criteria for the shoreline, such as docks and jetties, were considered as water features and therefore, were included in the water acres statistics. Since our decision-making criteria excluded features such as docks and jetties from contributing to the shoreline miles, these features, by default, were included in the water acres calculation. We recognize that while docks, which sit on or above the water surface, are appropriate to consider as water, jetties and other stabilization structures do not follow the same reasoning because they extend from above the surface water to the seafloor. However, because the influence of jetties on the total statistics is minimal, these features were counted as water acres to create a consistent and streamlined approach.

Water acres were manually edited to match any edits made to the shoreline layer. In particular, the "Split," "Delete," and "Edit Vertices" tools were used to delete portions of the water acres layer. The "Reshape" and "Create" (specifically created using the "Trace" feature) were used to edit the existing water acres or create water acres polygons. All water acre polygons in each park unit were merged using the "Merge Features" tool and labeled in the attribute table accordingly. The final water acres layer was named, "NPS_Water_Acres_2023."

After the final water acre edits were made, an attribute field for water acres was created with the Calculate Geometry "Attributes" tool found on the Analysis ribbon under Tools. "Area (geodesic)" was selected as the property, "Acres" as the area unit, and "USA_Contiguous_Albers_Equal_Area_Conic_USGS_version" as the coordinate system. The table was then exported to Excel using the "Table to Excel" Conversion Tool, where the total water acres statistics were calculated using the raw data.

Appendix G. Explanation of Differences in Shoreline Miles Statistics Between Reports (2011 and 2024)

Sixty-two park units are listed as having a greater than 5% difference in total shoreline miles between the original statistics (Curdts 2011) and the current statistics (Table G1). The brief, cursory explanations for these differences are based on visual assessment only. Park units with less than 5% of a difference in shoreline miles between the two sets of statistics were considered negligible and were not included in this table.

Table G1. Explanation of differences in shoreline miles statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Shoreline Miles	2011 Total Shoreline Miles	% Difference	Explanation
ACAD	236.56	201.73	15.89	The 2023 update uses a park-provided boundary which includes conservation easements, full fee ownership areas, and future fee acquisition areas. The 2011 report used a NPS LRD boundary which did not include all three of the boundary areas listed above.
ANIA	111.98	135.08	−18.70	The shoreline miles reported in 2011 extended further inland along two rivers than the 2023 update and included islands within the rivers. The length of the shoreline along the rivers was reduced in the 2023 update after receiving feedback from the park regarding salinity change.
BELA	811.41	570.61	34.85	The data used in the 2023 update is more detailed than the data used in 2011; the shoreline delineation includes stream channels that were not previously captured.
BICY	54.90	24.38	76.98	The data used in the 2023 update is more detailed than the data used in 2011; the shoreline delineation includes stream channels that were previously captured.
BITH	7.66	4.66	48.76	The data used in the 2023 update is more detailed than the data used in 2011; the shoreline delineation includes small stream channels that were not previously captured.
BOHA	48.11	40.88	16.24	The data used in the 2023 update is more detailed than the data used in 2011; the shoreline delineation includes tidally influenced features within the islands that were not previously captured.
BOST	0.40	0.50	−22.71	The data used in the 2023 update does not include a dock feature which was previously captured in 2011 but does not meet the criteria set forth in this report.

Table G1 (continued). Explanation of differences in shoreline miles statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Shoreline Miles	2011 Total Shoreline Miles	% Difference	Explanation
CACO	145.26	123.81	15.94	The data used in the 2023 update is more detailed than the data used in 2011; the shoreline delineation includes stream channels and tributaries that were not previously captured. In addition, the 2023 shoreline delineation includes several islands in the southern portion of the park, while the 2011 delineation was one continuous shoreline.
CAHA	321.75	276.02	15.30	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 shoreline delineation extends further inland than the 2011 delineation and includes tidally influenced areas that were not previously captured.
CALO	318.53	343.02	−7.41	The data used in the 2023 update is less detailed than the data used in 2011. The 2023 shoreline delineation reflects a breached area of the shoreline that was closed in the 2011 shoreline delineation. The 2023 shoreline delineation captures an island that appears to be shorter in length than in the 2011 delineation.
CHIS	250.10	186.53	29.12	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 shoreline delineation includes many islands that were not previously captured.
CHPI	0.09	NA	NA	CHPI was added to the official list of ocean, coastal, and Great Lakes National park units after the original report was published in 2011.
CHRI	0.21	0.20	7.47	The 2023 shoreline delineation is slightly offset from the 2011 shoreline delineation.
COLO	74.69	59.55	22.56	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 shoreline delineation includes several tributaries and stream channels that were not previously captured.
DESO	0.67	0.71	−6.30	The 2011 shoreline delineation followed the NPS boundary; the 2023 shoreline delineation is further inland around the peninsula.
DRTO	3.87	5.37	−32.52	The majority of the 2023 shoreline data was provided directly by the park. This data was taken post-Hurricane Ian. The islands are extremely dynamic and frequently change in shape and size.
EBLA	31.57	22.36	34.15	The 2023 shoreline delineation includes several tidally influenced areas that were not captured by the 2011 shoreline delineation; these areas include Crockett Lake, Perego’s Lagoon, and Kennedy’s Lagoon.
EVER	4348.61	2451.53	55.80	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 shoreline delineation extends further inland than the 2011 shoreline delineation and includes tidally influenced areas that were not previously captured.

Table G1 (continued). Explanation of differences in shoreline miles statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Shoreline Miles	2011 Total Shoreline Miles	% Difference	Explanation
FIIS	103.47	93.93	9.66	The 2023 shoreline delineation follows the entire extent of the island, including the southwest end of the island which is outside of the park unit boundary. The park manages the shoreline for the entire island and shoreline data for the oceanside of the island was provided directly by the park. Therefore, at the park's request, the entire island was reflected in the 2023 update, whereas the 2011 shoreline delineation was contained within the park unit boundary.
FOCA	1.54	~1.28	NA	The 2023 shoreline delineation includes a tidally influenced area to the western-most portion of the park unit boundary that was not previously captured. Note: The shoreline miles for FOCA were included in the statistics for TIMU in the 2011 report; the ~1.28 miles reported here was calculated from the 2011 dataset.
FOMA	6.00	5.01	18.05	The 2023 shoreline delineation includes two tidally influenced saltwater ponds and a stream which were not previously captured.
FOMC	0.67	0.63	6.22	The 2023 shoreline delineation follows the entire length of the park unit boundary; the 2011 shoreline delineation did not capture a portion of shoreline along a northern section of the boundary.
FOMR	8.43	NA	NA	FOMR was added to the official list of ocean, coastal, and Great Lakes National park units after the original report was published in 2011.
FOPO	0.40	~0.50	NA	The 2011 shoreline delineation is further inland than the 2023 shoreline delineation, lending itself to a slight increase in shoreline miles. Note: The shoreline miles for FOPO were included in the statistics for GOGA in the 2011 report; the ~0.50 miles reported here was calculated from the 2011 dataset.
FOPU	119.45	99.34	18.38	The data used in the 2023 update is more detailed than the data used in 2011 and includes tidally influenced areas that were not previously captured.
FORA	2.35	1.03	78.24	The 2023 shoreline delineation follows the entire length of the park unit boundary along the water; the 2011 shoreline delineation only followed a portion of the boundary along the water.
FOSU	1.29	1.21	6.28	The 2023 shoreline delineation is slightly different from the 2011 shoreline delineation; the 2023 shoreline delineation follows the hardened shoreline in the northwest unit of the park more closely than the 2011 shoreline delineation. In addition, the shoreline delineation of Fort Sumter Island is different in shape between the 2023 and 2011 delineations.

Table G1 (continued). Explanation of differences in shoreline miles statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Shoreline Miles	2011 Total Shoreline Miles	% Difference	Explanation
GATE	137.61	109.40	22.85	In the northwest park unit, the 2023 shoreline delineation reflects several islands which differ in size and shape in comparison to the 2011 shoreline delineation. In addition, the 2023 shoreline delineation in this area is more detailed than the 2011 delineation and includes tidally influenced areas that were not previously captured.
GEWA	18.51	1.71	166.16	The 2011 shoreline delineation followed two sections of the park unit boundary along the water; the 2023 shoreline delineation follows the entire length of the boundary along the water and includes features such as islands and a peninsula.
GOGA	111.97	91.00	20.67	The data used in the 2023 update is more detailed than the data used in 2011. In particular, the 2023 shoreline delineation includes shoreline around Mavericks Beach, a long stretch of shoreline extending northwards from Gray Whale Cove State Beach, and islands which were not previously captured.
GOIS	0.07	0.06	14.94	The 2023 shoreline delineation includes shoreline in the northern unit of the park that was not included in 2011.
GRPO	0.67	0.62	7.91	The 2023 shoreline delineation includes shoreline around one small tidally influenced area which was not previously captured.
HALE	4.56	2.53	57.21	The 2023 shoreline delineation follows the entire length of the park unit boundary along the water; the 2011 shoreline delineation only followed portions of the boundary along the water.
HATU	85.19	NA	NA	HATU was added to the official list of ocean, coastal, and Great Lakes National park units after the original report was published in 2011.
HAVO	38.53	32.84	15.96	The 2023 shoreline delineation accounts for the latest land acquisition and uses an updated boundary, which increased the amount of shoreline miles included in the park unit.
INDU	18.48	15.98	14.51	The data used in the 2023 update is more detailed than the data used in 2011 and includes two tidally influenced features that were not previously captured.
ISRO	388.85	338.75	13.77	The data used in the 2023 update is more detailed than the data used in 2011.
KALA	21.93	17.46	22.70	The data used in the 2023 update is more detailed than the data used in 2011.
KATM	534.00	458.33	15.25	The data used in the 2023 update is more detailed than the data used in 2011. The update includes stream channels and a large rock outcrop area in the northeast region of the park that was added after receiving park feedback; these features were not previously included.

Table G1 (continued). Explanation of differences in shoreline miles statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Shoreline Miles	2011 Total Shoreline Miles	% Difference	Explanation
KEFJ	629.39	544.66	14.43	The data used in the 2023 update is more detailed than the data used in 2011; streams and tidally influenced water bodies are included that were not previously captured.
KLGO	3.04	0.52	141.45	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 shoreline delineation includes two streams which were not previously captured.
LACL	206.28	219.54	−6.23	The shoreline delineation in 2011 extended further inland in the Tuxendi Bay area than in the 2023 shoreline delineation; this accounts for the decrease in shoreline miles from 2011 to 2023.
MIIN	0.09	NA	NA	MIIN was added to the official list of ocean, coastal, and Great Lakes National park units after the original report was published in 2011.
NEBE	0.00	0.01	−200.00	The 2011 shoreline delineation included one stretch of shoreline which was outside of the 2023 park unit boundary and therefore, was not included in the 2023 update.
OLYM	127.74	93.50	30.96	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 delineation includes tidally influenced areas and islands that were not previously captured.
PERL	0.75	0.39	63.44	The data used in the 2023 update is more detailed than the data used in 2011.
POCH	0.08	0.06	28.47	The shoreline delineation changed shape from 2011 to 2023.
PORE	120.09	100.00	18.26	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 delineation includes tidally influenced areas and islands that were not previously captured.
REDW	57.26	47.73	18.15	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 delineation includes islands and rock features that were not previously captured.
RORI	3.77	3.53	6.84	The 2011 shoreline delineation followed the NPS boundary; the 2023 shoreline delineation follows the shoreline and includes the marina.
SACR	0.44	1.36	−102.52	The 2011 data included a long stretch of shoreline that was not within the 2023 park unit boundary used in the update. The boundary used in the update does not include the federal land fee areas and only includes Saint Croix Island.
SAFR	0.43	~2.60	NA	The 2011 data included shoreline around three features (a jetty, a dock, and a hardened structure) that do not meet the criteria set forth in this report and, therefore, were excluded in the 2023 shoreline delineation. Note: The shoreline miles for SAFR were included in the statistics for GOGA in the 2011 report; the ~2.60 miles reported here was calculated from the 2011 dataset.
SAHI	0.71	0.20	111.01	The 2023 includes a tidally influenced stream that was not previously captured.

Table G1 (continued). Explanation of differences in shoreline miles statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Shoreline Miles	2011 Total Shoreline Miles	% Difference	Explanation
SAIR	0.66	0.60	10.43	The 2023 data captures the entire outline of the tidally influenced water body within the park unit boundary. The water body appears to have been smaller during the period of the 2011 data and therefore, there was less shoreline delineated.
SAJH	7.81	7.30	6.79	The 2023 shoreline delineation includes a section of shoreline in the Westcott Bay that was not delineated by the 2011 data. In addition, the 2023 shoreline delineation follows the park unit boundary, which is more detailed than the smooth lines used in the 2011 shoreline delineation.
SAJU	1.62	2.68	−49.50	The 2011 data included several stretches of shoreline that were outside of the park unit boundary used in the 2023 update and, therefore, were not included. The 2011 data also included shoreline around a jetty which does not meet the criteria set forth in this report and, therefore, the feature was not included in the 2023 shoreline delineation.
SAMA	0.23	1.07	−127.91	The 2011 shoreline delineation included shoreline around docks, which were excluded in the 2023 update because they do not meet the criteria set forth in this report.
SAMO	49.62	40.36	20.58	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 delineation includes shoreline around a tidally influenced river in the western-most section of the park that was not included in the 2011 data in addition to other small features.
SARI	7.17	5.40	28.18	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 delineation includes a tidally influenced water body that was not previously captured.
TIMU	921.52	632.16	37.25	The data used in the 2023 update is more detailed than the data used in 2011; the 2023 delineation includes tidally influences water bodies, tributaries, and islands that were not previously captured.
VICR	5.75	~6.00	NA	The shoreline miles for VICR were originally (2011) included in the statistics for VIIS. However, the 2011 shoreline miles were determined to be ~6.00 miles. The 2011 shoreline delineation includes islands which were not captured in the 2023 update. Note: The shoreline miles for VICR were included in the statistics for VIIS in the 2011 report; the ~6.00 miles reported here was calculated from the 2011 dataset.
WRST	176.88	155.00	13.19	The data used in the 2023 update is more detailed than the data used in 2011.

Appendix H. Explanation of Differences in Water Acres Statistics Between Reports (2011 and 2024)

Fifty-three park units are listed as having a greater than 5% difference in total water acres between the original statistics (Curdts 2011) and the current statistics. The explanations for these differences are based on visual assessment only. Park units with less than 5% of a difference in shoreline miles between the two sets of statistics were considered negligible and were not included in this table.

Table H1. Explanation of differences in water acres statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Water Acres	2011 Total Water Acres	% Difference	Explanation
ACAD	84.32	NA	NA	Three tidally influenced water bodies are included in the 2023 update. In 2011, ACAD was reported to have an undetermined amount of intertidal area and water acres.
ANIA	1924.40	0.00	NA	All tidally influenced water bodies and areas between the shoreline delineation and park unit boundary are included in the 2023 update. Zero water acres were reported in 2011.
APIS	31437.26	27156.67	14.61	The water acres surrounding each of the islands extends slightly further into the water in the 2023 update than in the 2011 update, potentially due to an updated boundary.
ASIS	30253.37	32,408.54	−6.88	A park-provided park unit boundary file was used in the 2023 update. This boundary was located further inland on the coastal side of the island than the 2011 park unit boundary, resulting in fewer water acres.
BICY	340.49	372.91	−9.09	The data used in 2011 included shoreline and water acres outside of the park unit boundary used in the 2023 update; these water acres were excluded in the 2023 update.
BITH	11.40	0.00	NA	Several small tidally influenced areas are included in the 2023 update. Water acres are recorded for sections along the river where there is a distinct gap between the shoreline delineation and the park unit boundary. Zero water acres were reported in 2011.
BOST	7.07	0.00	NA	The 2023 update includes all water acres between the shoreline delineation and park unit boundary. Zero water acres were reported in 2011.
CACO	17846.93	13,721.00	26.14	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. In addition, the 2023 update includes water acres within the southern end of the park which were not previously captured, potentially due to an updated boundary.
CAHA	8690.49	7689.97	12.22	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011.

Table H1 (continued). Explanation of differences in water acres statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Water Acres	2011 Total Water Acres	% Difference	Explanation
CALO	13742.90	12062.71	13.02	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011.
CHPI	0.06	NA	NA	CHPI was added to the official list of ocean, coastal, and Great Lakes National park units after the original report was published in 2011.
CHRI	0.13	0.00	NA	The 2023 update includes the water acres between the shoreline delineation and park unit boundary. Zero water acres were reported in 2011.
COLO	244.52	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. Zero water acres were reported in 2011.
CUIS	12336.86	10612.68	15.03	The 2023 water acres extend further into the water than the water acres from 2011, potentially due to an updated boundary.
DESO	1.68	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. Zero water acres were reported in 2011. The 2011 shoreline delineation followed the NPS boundary while the 2023 shoreline delineation is further inland around the peninsula.
EBLA	4348.66	3896.699444	10.96	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011.
FOCA	3.44	Included in TIMU statistics	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. Note: The water acres for FOCA were included in the statistics for TIMU in the 2011 report. However, visual inspection of the 2011 data for FOCA shows that there were zero water acres.
FOFR	0.76	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. The 2011 shoreline delineation followed the park unit boundary; therefore, zero water acres were reported.
FOMA	15.84	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. The 2011 shoreline delineation followed the park unit boundary; therefore, zero water acres were reported.
FOMC	0.36	0.00	NA	The 2023 update includes water acres between the shoreline delineation and park unit boundary. Zero water acres were reported in 2011.
FOMR	35.22	NA	NA	FOMR was added to the official list of ocean, coastal, and Great Lakes National park units after the original report was published in 2011.

Table H1 (continued). Explanation of differences in water acres statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Water Acres	2011 Total Water Acres	% Difference	Explanation
FOPO	0.00	Included in GOGA statistics	NA	Zero water acres were reported in the 2023 update. Note: The water acres for FOPO were included in the statistics for GOGA in the 2011 report. However, visual inspection of the water acres shows that the water acres for FOPO reflected the shoreline delineation from 2011.
FOPU	1270.24	860.69	38.44	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011.
GATE	18227.01	16,658.81	8.99	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011; the 2023 water acres includes two large water bodies that were not previously captured. In addition, the extent of the water acres offshore differs between 2023 and 2011, potentially due to an updated boundary.
GEWA	40.90	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. The 2011 shoreline delineation followed the NPS boundary; therefore, zero water acres were reported.
GOIS	0.05	0.00	NA	Zero water acres were reported in 2011; the 2023 water acres accounts for the water feature in the eastern unit of the park according to the criteria set forth in this report for delineating shoreline.
GRPO	0.22	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. The 2011 shoreline delineation followed the NPS boundary; therefore, zero water acres were reported. All water acres between the shoreline delineation and park unit boundary are accounted for in the 2023 update.
HALE	13.79	0.00	200.00	Zero water acres were reported in 2011.The 2023 update accounts for all water acres between the shoreline delineation and park unit boundary.
HATU	3934.55	NA	NA	HATU was added to the official list of ocean, coastal, and Great Lakes National park units after the original report was published in 2011.
INDU	519.61	563.31	−8.07	In 2011, water acres were delineated outside of the park unit boundary used in the 2023 update; a potential update in the park unit boundary may account for the decrease in water acres.
KAHO	571.14	612.84	−7.04	In 2011, water acres were delineated outside of the park unit boundary used in the 2023 update; a potential update in the park unit boundary may account for the decrease in water acres.
KATM	2083.36	0.00	NA	Zero water acres were reported in 2011; the 2011 shoreline delineation followed the NPS boundary. All water acres between the 2023 shoreline delineation and park unit boundary were included in the 2023 update.

Table H1 (continued). Explanation of differences in water acres statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Water Acres	2011 Total Water Acres	% Difference	Explanation
KEFJ	1025.38	0.00	NA	Zero water acres were reported in 2011. The 2023 update accounts for all water acres between the shoreline delineation and park unit boundary and includes tidally influenced water bodies.
KLGO	91.20	32.54	94.81	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. On king tides and during certain weather events, the areas adjacent to the delineated shoreline and water acres flood with salt or brackish water; these water acres are accounted for, as requested by the park.
LACL	1424.53	0.00	NA	Zero water acres were reported in 2011. The 2023 water acres includes the water present in all tidally influenced features between the shoreline delineation and park unit boundary.
LEWI	251.60	151.67	49.56	Water acres are not present in the northern-most unit of the park in 2011; these water acres are accounted for in the 2023 update. In addition, the water acre coverage in the lower two units of the park differ between 2023 and 2011, potentially due to an updated boundary.
OLYM	2995.75	4431.94	−38.67	In 2011, water acres were delineated outside of the park unit boundary used in the 2023 update; a potential update in the park unit boundary may account for the decrease in water acres.
PEVI	2.03	0.00	NA	Zero water acres were reported in 2011. The 2023 update accounts for all water acres between the shoreline delineation and park unit boundary.
PIRO	6107.06	7024.89	−13.98	In 2011, water acres were delineated outside of the park unit boundary used in the 2023 update; a potential update in the park unit boundary may account for the decrease in water acres.
REDW	5408.54	5792.59	−6.86	The 2011 shoreline delineation was slightly further inland than the 2023 shoreline delineation, leading to the decrease in water acres.
RORI	9.94	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. The 2011 shoreline delineation followed the NPS boundary; therefore, zero water acres were reported. Water acres between the offset shoreline delineation and park unit boundary are accounted for in the 2023 update.
SACR	0.42	28.49	−194.21	The change in the park unit boundary reflects the change in water acres. The 2023 boundary for SACR does not include the federal land fee areas, whereas the 2011 boundary did.
SAFR	84.71	Included in GOGA statistics	NA	The 2011 water acres did not extend to the edge of the park unit boundary, and they did not include two jetties which were included in the 2023 water acres. Note: water acre for SAFR were included in the statistics for GOGA in the 2011 report. However, upon visual inspection of the two datasets shows there were less water acres in 2011 than in 2023.

Table H1 (continued). Explanation of differences in water acres statistics between 2023 update and 2011 original report.

Unit CODE	2023 Total Water Acres	2011 Total Water Acres	% Difference	Explanation
SAHI	1.49	0.00	NA	Zero water acres were reported in 2011. The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011.
SAIR	3.35	2.00	50.38	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011.
SAJH	4.55	NA	NA	In 2011, water acres could not be calculated due to a lack of accurate shoreline data and jurisdictional uncertainties. The water acreage increase reflects the 2023 shoreline delineation.
SAJU	2.25	0.00	200.00	Zero water acres were reported in 2011. The 2023 shoreline delineation includes the water acres between the shoreline delineation and park unit boundary on the Isla de Cabras.
SAMO	335.38	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. The 2011 shoreline delineation followed the NPS boundary; therefore, zero water acres were reported. All water acres between the shoreline delineation and park unit boundary are accounted for in the 2023 update.
SLBE	10756.64	11357.60	−5.44	The 2011 shoreline delineation was slightly further inland in one portion of the park than the 2023 shoreline delineation, leading to a decrease in water acres.
STLI	27.30	0.00	NA	Zero water acres were reported in 2011. The 2023 update includes all water acres between the shoreline delineation and park unit boundary.
TIMU	13636.40	11958.37	13.11	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011.
VICR	13908.78	12725.07	8.89	Two areas within the 2011 water acres layer were not present within the park unit boundary used in the 2023 update, potentially due to an updated boundary. These water acres were accounted for in the 2023 update.
WRST	1654.39	0.00	NA	The water acreage increase reflects the change in the shoreline delineation between 2023 and 2011. The 2011 shoreline delineation followed nearly the entire extent of the NPS boundary; therefore, zero water acres were reported. The 2023 update includes all water acres between the shoreline delineation and park unit boundary.

The Department of the Interior protects and manages the nation’s natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 909/192877, March 2024

National Park Service
U.S. Department of the Interior

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