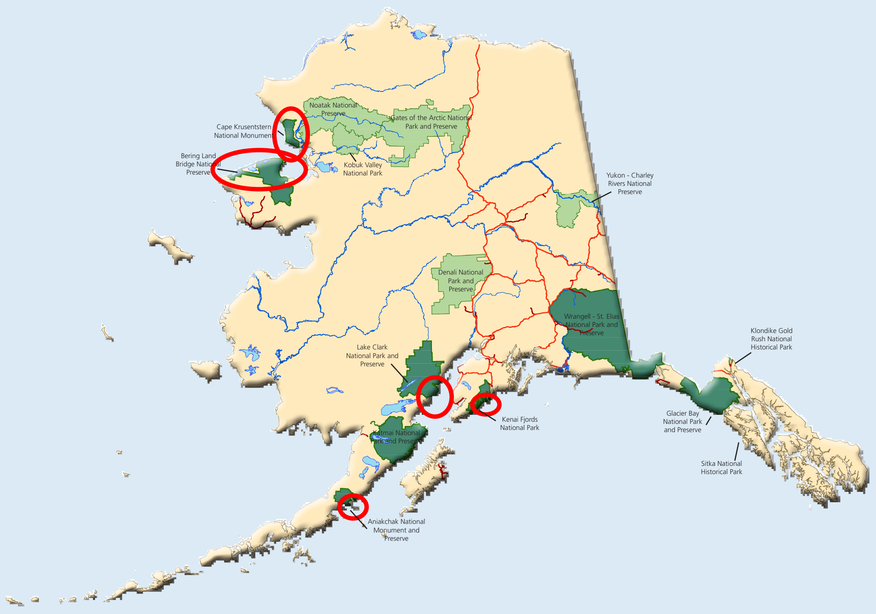
Compilation of an Accurate and Contemporary Digital Shoreline for Five Alaska Coastal Parks

Alaska Regional Office
National Park Service
U.S. Department of the Interior



Background

Alaska Regional GIS Team is working with St. Mary's University of Minnesota (SMUMN) through a CESU agreement to update five Alaska coastal park shorelines using the best available digital shorelines from the National Oceanic and Administration (NOAA) National Ocean Service (NOS) services. These parks include: Aniakchak National Monument, Lake Clark National Park and Preserve, Kenai Fjords National Park, Cape Krusenstern National Monument and Bering Land Bridge National Preserve. These data will be integrated into the National Hydrographic Dataset (NHD) and will replace, in many cases, the 1950's era shoreline. The resulting GIS data will be made available for park staff, collaborators, and the public through the National Map. Providing high quality fundamental base data of the interface between land and water is essential to future research understanding and management of coastal resources. This high resolution shoreline makes modern GPS-based project studies possible.

The Importance of Mean High Water(MHW) in GIS

Imprecise or ambiguous shorelines like High Water or Vegetation lines common in USGS topo products are generally of less use than the line of Mean High Water (MHW), which is a tidal datum representing the boundary separating state owned tidelands from uplands in most locations in Alaska. Digital shorelines in this project are derived from NOAA's Office of Coast Survey – the agency responsible for developing tidally derived shorelines like MHW.

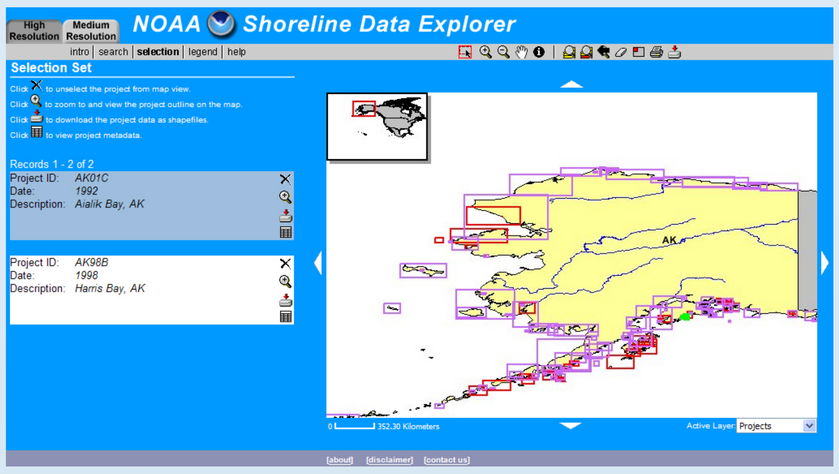
Replacing Shorelines

The process of replacing shorelines can be broken down in 3 major steps. This includes: data mining, protocol development and construction of NHD-ready shorelines.

1 Data mining: *Acquire and compile the digital shoreline products from NOAA for five Alaska Coastal Parks*

This process included reviewing over 2000 kilometers of shoreline data from NOAA's Electronic Nautical Charts (ENC), Electronic Vectorized Shoreline (EVS), and NOAA Electronic Survey Data. This project focused entirely on the narrow coastal band of data representing the Mean High Water Line, or as much as possible a continuous coastline that represents the border between upland and marine/estuarine areas.

Shoreline data available from these websites are of various scales, qualities, and sources (including historic paper charts to modern aerial surveys). With the exception of the northwest parks, most of the shoreline data were vectorized from original T sheets which were translated into a schema with attributes such as Natural Mean High Water, Natural River, or Stream. These attributes could then be queried out in GIS to provide a continuous shoreline.



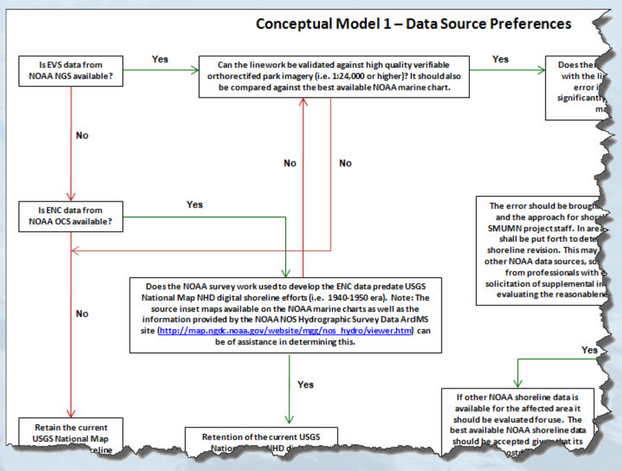
NOAA's Shoreline Data Explorer Website, which contained the highest quality data in this project.

Park	ENC Cell Name	Marine Chart Number/Name	Charting Survey Dates	Scale
ANIA	US2AK5FM	16011/Alaska Peninsula and Aleutian Islands to Seguam Pass	1950-1970	1:1,023,188
	US4AK5HE	16566/Chignik and Kujulik Bays, Alaska Pen		1:77,477
	US4AK5IE	16568/Wide Bay to Cape Kumlik, Alaska Pen.		1:106,600
BELA	US1BS03M	514/Bering Sea Northern Part	1950-2003	1:3,500,000
	US3AK80M	16200/Norton Sound; Golovnin Bay		1:400,000
CAKR	US1BS03M	514/Bering Sea Northern Part	1950-2003	1:3,500,000
	US2AK92M	16005/Cape Prince of Wales to Point Barrow		1:700,000
KEFJ	US4AK2DM	16680/Point Elrington to East Chugach Island	1927-2001	1:200,000
	US4AK2EM	16681/Seal rocks to Gore Point		1:83,074
	US4AK2FM	16682/Cape Resurrection to Two Arm Bay; Seward		1:81,847
LACL	US4AK13M	16661/Cook Inlet, Anchor Point to Kalgin Island	1935-1975	1:100,000

Here is an example of the range of source dates and scales for the five parks in this project. The electronic forms of these products are called ENC data and represent a digital replica of the marine chart in ArcGIS.

2 Protocol development

The next step was to develop detailed protocols for incorporating shoreline data into the NHD framework. This document will ensure that a consistent approach is taken that complies with both NHD stewardship and considers the NGS mapping methods employed. This Shoreline Selection Protocol outlines the rationale or decision process to be used for best available shoreline selection and documentation. This protocol is a working document based largely on scenarios encountered during the compilation of a revised digital shoreline for Kenai Fjords National Park.

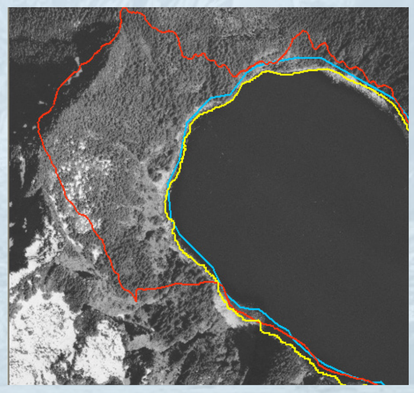


The main steps outlined in selecting the highest quality shoreline include:

a) **Validation using best available orthoimagery**: Over 100 hours were spent in the validation process of comparing various shorelines in ArcMap with best available imagery. In some cases gross charting errors were exposed most likely due to steep terrain, while other areas exposed glacial changes. NOAA survey documents were used in many cases to discern between errors and guide the shoreline selection process.

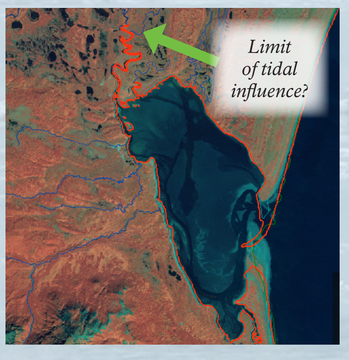
Some EVS datasets were updated by hand (NPS) to match with best available imagery along glacial extents. This depicts Aialik glacier that has receded from the marine charted 1998 location.

b) **Picking the best of the worst**: Due to forces beyond this project's control we were unable to justify replacement of all existing NHD coastline features for all the parks in this project. This is due to datedness of NOAA data and the surveying technologies employed of the day. For example, over half of the NHD coastline feature for Kenai Fjords National Park (KEFJ) will not be replaced at this time. This is due to 1920's NOAA survey data in the western half of KEFJ. NHD data from revised hydro and USGS data files has been determined to be of higher quality.



*Pony Cove: This shows EVS dataset registration errors (**red**). At this location EVS deviates from 1993 coastal orthos by more than 350 meters. NHD (**blue**) was also significantly different compared to ENC data (**yellow**). In this location, ENC data was chosen.*

3 Construction of NHD-ready data and edit checks



Once the highest quality data has been selected for inclusion into NHD the data was provided to SMUMN for compiling into NHD ready edit form. This includes running queries on NOAA data to extract a continuous shoreline. This has been a difficult process due to inconsistencies in data attribution or coding schemes in some areas.

In some locations it was necessary to join small segments of different NOAA datasets together (User Added Arcs) or connect between existing NHD shorelines and NOAA data. In other locations the GIS team worked closely with USFWS and other land agencies to ensure offshore islands (Maritime refuge lands along LACL and KEFJ) were included in this process. It became apparent that it would serve the GIS community best if we took a more global approach to replacing NHD in areas adjacent to NPS lands.

Tidally influenced creeks like this area in Aniakchak (shown to the left) required local park personnel to identify limits of tidal influence. Local stewardship of NHD is crucial to provide the best available data through this process. Background is a 2004 IKONOS satellite image.

4 Conflation into NHD data

This step is in progress. USGS is in the process of updating the NHD editing tools and these should be available early in 2012. SMUMN will then convert the NOAA shoreline data into coastline reach features allowing for a consistent shoreline across these parks and upload into the National Hydrographic Data Model.

Questions? Contact Joel Cusick by email at Joel_Cusick@nps.gov or by telephone (907) 644-3549