



Monitoring Shoreline Position at Gulf Coast Network Parks

Data Quality Standards

Natural Resource Report NPS/GULN/NRR—2017/1502





ON THIS PAGE

Photograph of shoreline surveyor at Horn Island, Gulf Islands National Seashore

ON THE COVER

Photograph of visitor use area at Padre Island National Seashore.
Photograph courtesy of Joe Meiman, National Park Service.

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Jeff Bracewell

National Park Service
Gulf Coast Inventory and Monitoring Network
646 Cajundome Blvd, Ste 175
Lafayette, LA 70506

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Abstract

The purpose of this report is to document the standards used by the Gulf Coast Network for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the Gulf Coast Network and supplement the National Inventory & Monitoring Division Quality Management Plan (In preparation). The plan also serves as a guide for all GULN personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

Coastal geomorphology was ranked as one of the top vital signs for monitoring following the Vital Sign prioritization process, which is documented in the *Gulf Coast Network Vital Signs Monitoring Plan* (Segura et al. 2007). The background and justifications for the network to monitor coastal geomorphology align with those documented in Part 1, Ocean Shoreline Position, of the Northeast Coastal and Barrier Network's (NCBN) Coastal Geomorphology protocol, which states:

Changes in shoreline position are recognized as interacting with many other elements of the ocean beach-dune ecosystem and are thus both driving and responding to the variety of natural and cultural factors active at the coast at a variety of temporal and spatial scales. The direction and magnitude of shoreline change can be monitored through the application of a protocol that tracks the spatial position of the neap-tide, high tide swash line under conditions of temporal sampling. Spring and fall surveys conducted in accordance with standard operating procedures will generate consistent and comparable shoreline position data sets that can be incorporated within a data matrix and subsequently analyzed for temporal and spatial variations (Psuty et al. 2010, p. ix).

The Gulf Coast Network will follow Northeast Coastal and Barrier Network methods for monitoring coastal geomorphology as documented in Psuty et al. (2010), to monitor shoreline position at Gulf Islands and Padre Island National Seashores. Handheld and utility task vehicle (UTV)-mounted Global Positioning Systems (GPS) or Global Navigation Satellite Systems (GNSS) will be used to record shoreline position by walking or driving the neap tide, high tide swash line.

Monitoring Objective: The Gulf Coast Network monitoring objective is to identify the biennial and long-term trends and variability of shoreline position in network parks. This contrasts with the Northeast Coastal and Barrier Network's objective, which includes seasonal variability and annual sampling (Psuty et al. 2010, p. 9). By reducing the sampling frequency, the Gulf Coast Network can maintain an achievable long-term workload while still providing meaningful information about geomorphological change on its seashore parks.

Protocol Activities and Modules

Data are collected or derived as a part of the *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017) in 14 different activities or modules (Table 1).

Table 1. Protocol activity matrix for *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Activity Category	Activity no.	Activity detail	Description
Site Recon, Establishment, and Maintenance	1	Site Recon	GULN has visited the shorelines that will be monitored as part of this protocol. The sites are known to be accessible by boat or UTV.
	2	Site Establishment	A foundational network of physical markers exists at both parks being monitored that will serve as a means to periodically assess and cross-validate the spatial accuracy of the shoreline position. This network consists of variety of permanent markers or structures including: deep-rod survey monuments, park infrastructure (i.e. parking areas, buildings, etc), jetties, and pier and piles.
	3	Site Maintenance	The number and condition of physical markers will be assessed with each monitoring visit. If it is deemed necessary to replace a marker, GULN will note the location of the missing or damaged marker, and take the necessary steps to establish a new marker prior to, or on, the next sampling visit.
Field Observations	4	Field Conditions	Any interruption or anomaly in the shoreline position that would cause confusion in the interpretation of the high tide swash line will be recorded on the field data sheet by the observer and photographed. Examples of these scenarios include an interruption caused by a new tidal inlet or the presence of an ambiguous swash line.
	5	Photopoint data	Photos taken at four cardinal directions from surveyed benchmark. Photos taken at beginning and end of each survey to document the shoreline position being surveyed. Photos will also be taken throughout the survey whenever the surveyor is in doubt of the shoreline position. All photos will have a GPS point taken at the photographer position that will be cross-referenced to the photo, or set of photos.
Sensor Data	6	GPS/GNSS	Sub-meter GPS or GNSS devices will be used to record the shoreline position. The raw files will be differentially corrected using the closest CORS station/s. Logging interval will be set to 3 meters for linear features and 10 points at a one second interval for point features
External Data	7	Weather (NOAA NWS)	Weather and Tide data will be used in planning survey events and in reports
	8	Tide (NOAA COOPS)	Weather and Tide data will be used in planning survey events and in reports

Table 1 (continued). Protocol activity matrix for Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan (Bracewell 2017).

Activity Category	Activity no.	Activity detail	Description
Derived Data	9	Baseline	A shapefile or Geodatabase feature class that represents the normalized shoreline. The baseline is offset from the actual shoreline position and this feature is the benchmark that all shoreline position measurements will be measured from. The feature should be continuous and topologically correct – free from gaps and overlap except where necessary.
	10	Continuous shoreline feature	Shapefile or Geodatabase feature class derived from the post-processed shoreline data (.cor). The Continuous shoreline feature should be topologically correct – free from gaps and overlap except where necessary.
	11	Shoreline Distance Matrix	The shoreline distance matrix will report the measured distances between the baseline and the shoreline position. The matrix will be appended after each monitoring visit and will be used to derive calculations such as change distance and rate.
Quality Control Data	12	GPS/GNSS observations of benchmarks (real-time)	GPS data loggers will be loaded with the locations of established benchmarks. A set of these benchmarks should be visited before and during the shoreline position survey to ensure that the real-time location of the device is proximal to the recorded location. This allows the user to tie the data logger's virtual space to a physical marker.
	13	GPS/GNSS observations of benchmarks (post-processed)	The benchmarks recorded during the survey can be used in the desktop environment, after post-processing has occurred to measure the distance between the established point and the new point.
	14	Post-Processed horizontal accuracy report	Post Processing report generated after differential corrections have been performed. This report gives frequency count for spatial accuracies associated with a survey.

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Activity-level sample design matrix for *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017). Numbers (left column) match those in the Protocol Activity Matrix (Table 1).

Activity Category	Activity no.	Activity detail	Sampling Design	Revisit Design
Field Observations	4	Field Conditions	Targeted - Includes areas where the survey is interrupted or when the swash line becomes ambiguous	Biennial
	5	Photopoint data (Survey beginning and end)	Targeted - Photos will be taken at the beginning and end of each survey to document the swash line that is being surveyed	Biennial. Location and frequency of photos is dependent on number of survey starts and stops that will vary between surveyors and based on field conditions.
	5	Photopoint data (Field Conditions)	Targeted – Photos taken at areas where the survey is interrupted or when the swash line becomes ambiguous	Biennial. Location and frequency is dependent on number of interruptions and ambiguities
Sensor Data	6	GPS/GNSS (Shoreline)	Census - Continuous survey of entire survey area (points collected every 3 meters). Survey areas chosen in consultation with park staff. All of PAIS Gulf shoreline. GUIS - All of Horn and Petit Bois Islands, Gulf sides of Perdido Key and Fort Pickens Units (including Pensacola Pass).	Biennial
Derived Data	11	Shoreline distance matrix	Systematic - distance measurements collected every 10 m along shoreline feature.	Established in project design. The matrix will be updated biennially
Quality Control Data	13	GPS/GNSS	GPS/GNSS observations of benchmarks (post-processed). Benchmark locations are selected using expert judgment and include the use of NGS published benchmarks where available.	Biennial

Data Quality Objectives

Data quality values and standards for implementation are provided in Table 3 through Table 5.

Table 3. Data Quality Values (DQVs) for *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Data Quality	Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	Total Accuracy of the shoreline position is an estimated 5 meters. This total positional uncertainty is related to the following potential sources of error: GPS/GNSS accuracy, differential tide position, meteorological effects (waves), and Interpretation of the line (Psuty et al 2010).
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	<u>PAIS:</u> Shoreline feature is representative of springtime neap high tide swash line within the entire park. <u>GUIS Horn and Petit Bois Islands:</u> Representative springtime neap high tide swash line on both Gulf and Sound sides of these entire islands. <u>GUIS Perdido Key and Fort Pickens:</u> Representative of springtime neap high tide swash line within these two park units.
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	Shoreline is sampled biennially in the same season. Efforts are made to ensure swash lines are recorded in neap tide periods and do not follow weather-related tidal surges. Whereas this protocol will implement the sampling protocol established in Psuty et al (2010), with minor modifications, GULN results will be park-specific and comparisons will not be made among GULN parks or with NCBN coastal parks.
	Timeliness / Currency	How recent the data need to be to be considered valid for their intended use. Data represents conditions and/or is available and in a format for use at the appropriate time in the decision-making process.	Data processing occurs in a timely fashion based on certification requirements and intended use of data. Where certified data cannot be provided for resource management decisions in a timely manner, requirements for provisional use of data are defined and documented prior to data dissemination and use.

Table 3 (continued). Data Quality Values (DQVs) for *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Data Quality	Value	Definition	Protocol Considerations
Contextual Data Quality (continued)	Completeness	All data and measures required to evaluate accuracy and representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	It is always the goal of the shoreline surveyor to collect the entire shoreline within the survey unit, and under ideal conditions, for each and every survey. When this is not possible: (1) Gaps in the shoreline feature will be self-evident and explained by complementary datasets (field notes, location info, and photos). (2) Where the shoreline is collected outside of ideal conditions established by the protocol, those features will be clearly flagged in the shoreline database.
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	Data quality is defined as “fit for analysis” or “not fit for analysis.” Data collection should occur during similar seasonal, tidal and weather conditions as defined by the GULN shoreline protocol implementation plan to capture a similar shoreline feature across time. Data collected outside of these conditions will be clearly flagged in the shoreline database as unfit for analysis.
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	All Accepted (QA/QCed) data and products generated from this monitoring effort will be available to the public via IRMA. Raw and Provisional Data will also be published on IRMA, but their distribution will be limited to network staff and will be made available upon request.

Table 4. Measurement Quality Objectives for *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Measure	Indicator	Quality objective
Survey Benchmark (Initial Measurement).	Location Accuracy (survey grade)	Positional instrument accuracy ≥ 0.03 meters horizontal circular positional error using repeated independent measurements from at least three observations separated by at least 24 hours.
	Location Description Detail	Description and photo provided with enough detail to relocate the physical benchmark without use of GPS equipment
Survey Benchmark (During shoreline survey)	Location Accuracy (real-time field check)	Distance between rover position and pre-loaded benchmark position should not exceed 1.03 meters horizontal (provided real-time estimated accuracy meets or exceeds 1m).
	Location Accuracy (post-processed)	Distance between post-processed benchmark position and extant survey grade position should not exceed 1.03m horizontal.
Positional Accuracy During Survey	Location Accuracy (estimated post-processed)	Accuracy ≥ 1 m horizontal (estimated). This positional instrument accuracy estimate references the estimated post-processed accuracy and is reported in real-time on the GPS/GNSS unit.
	Location Accuracy (post-processed)	Accuracy ≥ 1 m horizontal (validated). This positional instrument accuracy estimate is generated upon post-processing GPS/GNSS rover files. In a Trimble Pathfinder Office workflow, the estimates are reported at the feature level (individual points) and at the entire survey level (all features collected during the survey).
Photopoints	Image resolution	Set to highest available
	Image format	.jpg w/ embedded EXIF metadata

Table 5. Data Protection standards for *Monitoring Shoreline Position at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017). With the exceptions noted, all data collected are to be made publicly available in a timely fashion.

Type of Data	Level of Protection	Rules for Dissemination
<u>Location Data and Information</u>		
Raw and Provisional Data	Operationally protected	Data provided upon request only. Includes: Raw and corrected GPS/GNSS files, Exported shapefile, Edited shapefile
<u>Personally Identifiable Information</u>		
Non-NPS Staff Information	Legally Protected	All but first name and last initial redacted from public release

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Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

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