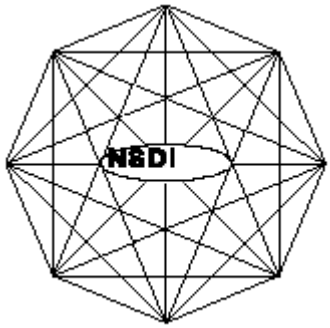
FGDC Document Number



National Spatial Data Infrastructure

Shoreline Metadata Profile (Public Review Draft)

Bathymetric Subcommittee
Federal Geographic Data Committee
January 18, 2000

Federal Geographic Data Committee
Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy
Department of Housing and Urban Development, Department of the Interior, Department of State
Department of Transportation, Environmental Protection Agency
Federal Emergency Management Agency, Library of Congress
National Aeronautics and Space Administration, National Archives and Records Administration
Tennessee Valley Authority

Federal Geographic Data Committee

The Federal Geographic Data Committee (FGDC) was established by Office of Management and Budget Circular A-16 to promote the coordinated development, use, sharing, and dissemination of geographic data.

The FGDC is composed of representatives from the Departments of Agriculture, Commerce, Energy, Housing and Urban Development, the Interior, State, and Transportation; the Environmental Protection Agency; the Federal Emergency Management Agency; the Library of Congress; the National Aeronautics and Space Administration; the National Archives and Records Administration; and the Tennessee Valley Authority. Additional Federal agencies participate on subcommittees and working groups. The Department of the Interior chairs the Subcommittee on Cadastral Data.

Federal Geographic Data Committee subcommittees work on issues related to data categories coordinated under the circular. Subcommittees establish and implement standards for data content, quality, and transfer; encourage the exchange of information and the transfer of data; and organize the collection of geographic data to reduce duplication of effort. Working groups are established for issues that transcend data categories.

For more information about the committee, or to be added to the committee's newsletter mailing list, please contact:

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The following is the recommended bibliographic citation for this publication:

Shoreline Metadata and Glossary in Support of a National Shoreline Data Content Standard, FGDC, January 1999, Reston, Virginia.

CONTENTS

Introduction

In recent times, accurate delineation of the shoreline and the development of a shoreline standard have become important due to international and legal issues. With emerging technologies such as digital cartography, geographic information systems (GIS), Computer Aided Design and Drafting (CADD), digital data products, electronic charts, and the World Wide Web, temporal and spatial accuracy is very important when producing maps. The purpose of the “Shoreline Metadata Profile” is to address the complexities of shoreline data while serving the community of users involved with geospatial data "activities" that intersect the U.S. Shoreline.

1. Objective

This Shoreline Metadata Profile is the first in a series of standards that will define a Shoreline Data Content Standard. The metadata profile is to be used as an extension or profile to the existing Content Standards for Digital Geospatial Metadata (CSDGM). The glossary and bibliography are informative annexes that will provide a basis for understanding the shoreline and related issues. Because the CSDGM only allows for the documentation of generic geospatial data, the Bathymetric Subcommittee felt it was neccessary to develop a metadata profile that addressed shoreline data and data that intesects with the shoreline. The objective of the metadata profile is to capture the critical processes and conditions that revolve around creating and collecting shoreline data. The metadata produced using this standard will be important for clearinghouse activities to locate potential data sets and to indicate the fitness for use and accuracy of a given data set. This Standard is intended to serve the community of users who are involved with geospatial data "activities" that intersect the U.S. Shoreline. The purpose is to clarify (standardize) some of the complexities of shoreline data by developing a metadata profile, bibliography and glossary, which will be an extension or profile of the FGDC CSDGM.

2. Scope

The Shoreline Metadata Profile provides the format and content for describing data sets related to shoreline and other coastal data sets. The metadata complies with the FGDC Content Standards for Digital Geospatial Standard. It provides additional terms and data elements required to support metadata for shoreline and coastal data sets.

The profile is primarily oriented toward providing the elements necessary for documenting shoreline data and reaching a common understanding of the shoreline for national mapping purposes and other geospatial and Geographic Information Systems (GIS) applications. Shoreline data are important for coastal zone management, environmental monitoring, resource developments, legal land jurisdictional issues, ocean and meteorological modeling, engineering, construction, planning, and many other uses. A published standard by a responsible agency will provide the affected community with a basis from which to assess the quality and utility of their shoreline data. Shoreline is an integral component of the geospatial data framework.

The shoreline glossary provides the working vocabulary for shoreline topics and thesaurus for the metadata standard. Every reference in the glossary has at least one reference to the bibliography. Additional explanatory material about the use of the term, common or known mis-uses of the term, and confounding or clarifying descriptions are included in the glossary. The glossary is structured so that users understand relationships among terms.

3. Applicability

This standard is to be used for reporting the availability of shoreline and coastal data sets in the National Spatial Data Infrastructure (NSDI) clearinghouse. It is also directly applicable to all data sets that intersect

with the shoreline. It will be used to support reporting the collection, transformation, accuracy, and fitness for use of various shoreline data sets.

4. Related Standards

A cross-cutting standards review and data model developed by FGDC in 1995 indicated that most of the FGDC thematic subcommittees and working groups have an entity relationship to shoreline data. FGDC endorsed standards that include reference to the shoreline are the Cadastral Data Content Standard (FGDC-STD-003) and Classification of Wetlands and Deep Water Habitats (FGDC-STD-004). The Tri Service Spatial Data Standard and feature reference model contain a relationship to shoreline. The National Imagery and Mapping Agency has also recently published a geospatial systems data model for shoreline data.

5. Standard Development Procedures

The location and attributes of the shoreline are valuable to the diverse user community. Mapping of the shoreline has produced a high volume of important information.

The determination of the shoreline is the responsibility of the Federal Government. Agencies such as the National Oceanic and Atmospheric Administration (NOAA) survey internal U.S. shorelines, while the Department of Defense (DoD) and National Imagery and Mapping Agency (NIMA) address external Shoreline surveying.

The primary organizations involved in the development of this standard are members of the shoreline engineering, coastal zone management, flood insurance, and resource management community. Federal agencies involved include NOAA, U.S. Geological Survey, Minerals Management Service, Bureau of Land Management, Federal Emergency Management Agency, U.S. Environmental Protection Agency, Department of State, Department of Justice, U.S. Bureau of the Census, U.S. Coast Guard, U.S. Army Corps of Engineers, and NIMA. There has also been participation from private surveying contractors, the real estate industry, the insurance industry, various state and local government agencies, and private landowners.

In summer 1997, a notice of a workshop on shoreline data and a standards proposal were published in the *Federal Register.* The notice was then posted on several GIS, mapping, and coastal zone management related list servers and web sites. Based on the comments received and the level of interest, the workshop was expanded to include more participants than originally expected. The participants came together for the workshop in Charleston, South Carolina on November 3-5, 1997. An Internet site was established, and action items were initiated. This standard is the result of the work of participants.

The metadata requirements were expanded at a Shoreline Bathymetric Subcommittee meeting in Silver Spring, Maryland on February 5-6, 1998. This meeting focused on: what metadata is, how it could be used by shoreline managers and technical staff, and how to identify the unique characteristics of shoreline data.

In the winter of 1998, the Shoreline Metadata Profile proposal was approved by the FGDC Standards Working Group. The draft was developed by the Bathymetric Subcommittee Metadata Working Group over the next year and presented to the SWG in June of 1999.

6. Maintenance of Standard

The U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), NOAA Coastal Services Center will maintain the Shoreline Metadata Profile, Glossary and Bibliography for the Federal Geographic Data Committee. Address questions concerning this standard to:

David Stein, Secretary, FGDC Bathymetric Subcommittee

NOAA Coastal Services Center

2234 South Hobson Avenue, Charleston, SC 29405-2413

email: dstein@csc.noaa.gov

Elements of the Content Standard for Digital Geospatial Metadata

All of the standard elements of the Content Standard for Digital Geospatial Metadata (CSDGM) are available for use in the Shoreline Metadata Profile. All of the mandatory elements from the CSDGM must be provided in a metadata document compliant with the CSDGM Profile for Shoreline Data.

Modifications to the Content Standard for Digital Geospatial Metadata

Conditionality Changes

To accurately document shoreline data and data that intersect with our nation's shorelines, some changes to the conditionality of optional elements were required. Those changes are detailed below using the numbering scheme found in the CSDGM.

Production rules, types, and domains are provided below for the modified elements (this information supersedes the information provided in the CSDGM). It should be noted that the hierarchal structure of the CSDGM was not modified or expanded in this section, only the conditionality of some of the standard elements.

Modified Geospatial Data Metadata =

1.6.4 Temporal: time period(s) characterized by the data set.

Type: compound

Obligation: mandatory

Short Name: temporal

Rationale: Since time is a key component in developing shoreline data, this section is now required by the Shoreline Metadata Profile. All of the "time" elements that could be changed to mandatory were changed for the purposes of this profile.

1.6.4.2 Temporal Keyword: the name of a time period covered by a data set.

Type: text

Obligation: mandatory

Domain: free text

Short Name: tempkey

Rationale: Since time is a key component in developing shoreline data, this section is required by the Shoreline Metadata Profile. Relevant information to document here would be whether the data were captured before or after a major weather event or the time and type of tide.

9.1.2 Time of Day: the hour and minute, and (optionally second) of the day.

Type: time

Obligation: mandatory

Rationale: Since time is a key component in developing shoreline data, this section is now required by the Shoreline Metadata Profile. All of the "time" elements that could be changed to mandatory were changed for the purposes of this profile.

9.3.2 Beginning Time: the first hour and minute, or (optionally second) of the day for the event.

Type: time

Obligation: mandatory

Rationale: Since time is a key component in developing shoreline data, this section is now required by the Shoreline Metadata Profile. All of the "time" elements that could be changed to mandatory were changed for the purposes of this profile.

9.3.4 Ending Time: the last hour and minute, or (optionally second) of the day for the event.

Type: time

Obligation: mandatory

Rationale: Since time is a key component in developing shoreline data, this section is now required by the Shoreline Metadata Profile. All of the "time" elements that could be changed to mandatory were changed for the purposes of this profile.

Domain Changes

To accurately document shoreline data and data that intersect with our nation's shorelines, some additions and restrictions to domains of standard elements were required. Those changes are detailed below, using the numbering scheme found in the CSDGM. Unless otherwise stated in the Shoreline Metadata Profile, the obligation for use assigned to the compound and data elements should follow the CSDGM.

Production rules, types and domains are provided below for the modified elements. Each modified element listed below has an extended or restricted domain field which lists the possible responses to the data element, and a rationale field which explains why the modification to the field was made.

Modified Geospatial Data Metadata =

1.6.1.1 Theme Keyword Thesaurus: reference to a formally registered thesaurus or a similar authoritative source of theme keywords.

Domain: Free text

Extended Domain: "Shoreline Bibliographic References and Glossary in Support of a National Shoreline Data Content Standard"

Rationale: The "Shoreline Bibliographic References and Glossary in Support of a National Shoreline Data Content Standard" has a list of terms and definitions that could serve as a theme keyword thesaurus or a separate thesaurus could be derived from this document.

2.4.1.1 Horizontal Positional Accuracy Report: an assessment of the accuracy of the positions of spatial objects. If possible, this assessment should be made in compliance with the steps outlined in the "National Standard for Spatial Data Accuracy (NSSDA)."

Domain: free text

Extended Domain: use of the accuracy assessment methodology provided by the NSSDA

Rationale: For the Shoreline Metadata Profile, the positional accuracy should comply, if possible, with the "National Standard for Spatial Data Accuracy." In short, the NSSDA provides a method for measuring positional accuracy in geographic data in digital and print formats. There are six steps involved in using the NSSDA. To compute positional accuracy, the following steps should be followed:

1) Select Test Points. A data set's accuracy is tested by comparing the coordinates of several points within the data set to the coordinates of the same points from a controlled data set of greater accuracy. Points used for this comparison must be well defined and easy to measure in the data set being tested and in the controlled data set. For further information, refer to the NSSDA.

2) Select a Control Data Set. The control data set must be acquired separately from the data set being tested. It must be more accurate than the original data set and should be of the highest accuracy available. A good rule of thumb is for the control data set to be three times more accurate than the expected accuracy of the original data set. The accuracy of the controlled data set should always be reported in the metadata.

3) Capture Measurement Values. The next step is to collect the coordinate values for the test points, both the x and the y values from both the test data and the control data set.

4) Calculate the Accuracy Statistic. Once the coordinate values for each test point from the test data set and the control data set have been determined, it is time to compute the positional accuracy statistic. A spreadsheet has been developed and should be referred to for this step.

5) Report Accuracy for Tested Data Sets. Once the positional accuracy of a test data set has been determined, it is important to report that value in a consistent and meaningful way. To do this, one of two reporting statements can be used.

A. Tested_____ (meters, feet) (horizontal, vertical) accuracy at 95% confidence level

B. Compiled to meet_____ (meters, feet) (horizontal, vertical) accuracy at 95% confidence level

6) Include the Accuracy Report in Metadata. The accuracy statements above as well as the process used to test the accuracy should be included in the metadata.

2.4.1.2.1 Horizontal Positional Accuracy Value: an estimate of the accuracy of the horizontal coordinate measurements in the data set expressed in (ground) meters.

Domain: free real

Extended Domain: use of the accuracy assessment methodology provided by the NSSDA

Rationale: If applicable, the NSSDA statistic should be placed in this field.

2.4.2.1 Vertical Positional Accuracy Report: an explanation of the accuracy of the vertical coordinate measurements and a description of the tests used.

Type: text

Domain: free text

Extended Domain: use of the accuracy assessment methodology provided by the NSSDA

Rationale: This field should explain how the accuracy value was determined and should include the steps outlined in the NSSDA

2.4.2.2.1 Vertical Positional Accuracy Value: an estimate of the accuracy of the vertical coordinate measurements in the data set expressed in (ground) meters.

Domain: free real

Extended Domain: use of the accuracy assessment methodology provided by the NSSDA

Rationale: If applicable, the NSSDA statistic should be placed in this field.

2.4.2.2.1 Vertical Positional Accuracy Explanation: an estimate of the accuracy of the vertical coordinate measurements in the data set expressed in (ground) meters.

Domain: free text

Extended Domain: use of the accuracy assessment methodology provided by the NSSDA

Rationale: This field should explain how the accuracy value was determined and should include the steps outlined in the NSSDA

2.5.2.1 Process Description: Rationale of the event and related parameters or tolerances.

Domain: free text; reference to published protocol if available

Extended Domain: reference to published protocol if applicable

Rationale: a detailed description of the methodology used to collect and/or develop the data set. If the methodology is a published protocol, then a reference to that methodology should be included.

7.7 Metadata Time Convention: form used to convey time of day information in the metadata entry. Used if time of day information is included in the metadata entry.

Domain: " local time"

Restricted Domain: the domain for Metadata Time Convention was restricted to "local time" for the purposes of the Shoreline Metadata Profile.

Rationale: Because time is such an important element when collecting shoreline data, the domain was restricted to local time for consistency purposes.

9.1.2 Time of Day: the hour and minute, and (optionally second) of the day.

Domain: free time, local time to the minute, "unknown"

Extended Domain: local time to the minute

Rationale: the shoreline metadata profile requires local time to the minute; therefore, the domain was change to reflect this.

9.3.2 Beginning Time: the first hour and minute, or (optionally second) of the day for the event.

Domain: free time, local time to the minute, "unknown"

Extended Domain: local time to the minute

Rationale: The shoreline metadata profile requires the time to the minute; therefore, the domain was change to reflect this.

9.3.4 Ending Time: the last hour and minute, or (optionally second) of the day for the event.

Domain: free time, Local time to the minute, "unknown"

Extended Domain: local time to the minute

Rationale: The Shoreline Metadata Profile requires local time to the minute; therefore, the domain was change to reflect this.

Extended Elements

The following are the production rules for how the extended elements fit within the hierarchical structure of the Content Standard for Digital Geo-Spatial Metadata. The extended elements and their parent elements were bolded for easy identification. The source for all of the extended elements is the Shoreline Metadata Working Group of the FGDC Bathymetric Subcommittee.

Identification_Information =
Citation +
Description +
Time_Period_of_Content +
Status +
Spatial_Domain +
Keywords +
Access_Constraints +
Use_Constraints +
(Point_of_Contact) +
(1{Browse_Graphic}n) +
(Data_Set_Credit) +
(Security_Information) +
(Native_Data_Set_Environment) +
(1{Cross_Reference}n)

Description =
Abstract +

Purpose +

(Supplemental_Information)+

Intended Use of Data

Spatial_Domain =

Bounding_Coordinates +

(1{Data_Set_G-Polygon}n)+

Description of Geographic Extent

Data_Quality_Information =

0{Attribute_Accuracy}1 +

Logical_Consistency_Report +

Completeness_Report +

0{Positional_Accuracy}1 +

Lineage +

(Cloud_Cover)+

Tidal Information+

Marine Weather Condition+

Environmental Event

Lineage =

Source Information+

Process Step+

Process Citation

Tidal Information =

Type of Tide+

Time of Tide+

Tide Table Reference+

Supplemental Tidal Information

Time of Tide =

Time of Low Tide+

Time of High Tide+

Tidal Datum+

Range of Tide

Marine Weather Condition =

Wind Speed+

Wind Direction+

Wave Height

Metadata_Reference_Information =

Metadata_Date +

(Metadata_Review_Date) +

(Metadata_Future_Review_Date) +

Metadata_Contact +

Metadata_Standard_Name +

Metadata_Standard_Version +

0{Metadata_Time_Convention}1 +

(Metadata_Access_Constraints) +

(Metadata_Use_Constraints) +

(Metadata_Security_Information) +

1{Metadata_Extensions}n

Metadata_Extensions =

0{Online_Linkage}n +

Profile_Name

A continuation of the numbering scheme used in the Content Standards for Digital Geospatial Metadata is applied in this section. Where applicable, a rationale field was added to further explain the element.

1.2.4 Intended Use of Data: a brief narrative describing the suitability and the intended use of the data

Source: Shoreline Metadata Working Group

Type: text

Domain: free text

Short Name: datause

Parent: Description

1.5.3 Description of Geographic Extent: the general location of the data set expressed qualitatively.

Source: Shoreline Metadata Working Group

Type: text

Domain: free text

Short Name: genloc

Rationale: This description is especially important when the extent of the data set is not well defined by "Bounding Rectangle Coordinates." This is usually the case with shoreline data as it is not usually oriented true north and south or east and west. This should be an indirect spatial reference, ie. Southeast Coast of the United States, Southern California Shoreline, or the Lake Erie Shoreline from Cleveland to the Lake and Ashtablula County line.

Parent: Spatial Domain

2.5.2.7 Process Step Citation: Reference to a published protocol.

Source: Shoreline Metadata Working Group

Type: text

Domain: free text

Short Name: procite

Rationale: If a published protocol was used to collect or develop the data set, then the bibliographic citation should be placed in this field.

Parent: Process Step

2.7 Tidal Information: means of encoding tidal information

Source: Shoreline Metadata Working Group

Type: Compound

Short Name: tidinfo

Parent: Data Quality Information

Child: Type of Tide, Time of Tide, Tide Table Reference, Supplemental Tidal Information

2.7.1 Type of Tide: a classification based on characteristic forms of a tide curve

Source: Shoreline Metadata Working Group

Type: text

Domain: “semidiuranal” “mainly semidiurnal” “mainly diurnal” “diurnal”

Shortname: tidtype

Parent: Tidal Information

2.7.2 Time of Tide: time of “low” and time of “high” tides the day(s) the data were collected

Source: Shoreline Metadata Working Group

Type: Compound

Shortname: tidtime

Parent: Tidal Information

Child: Time of High Tide, Time of Low Tide, Tidal Datum, Range of Tide

2.7.2.1 Time of Low Tide: the time of low tide on the day (s) the data were collected

Source: Shoreline Metadata Working Group

Type: time

Domain: "Unknown" “local time” local time with differential factor” “universal time”

Short Name: time

Parent: Time of Tide

Rationale: The shoreline metadata profile requires the time to the minute; therefore, the domain was change to reflect this.

2.7.2.2 Time of High Tide: the time of high tide on the day(s) the data were collected

Source: Shoreline Metadata Working Group

Type: time

Domain: "Unknown" “local time” local time with differential factor” “universal time”

Short Name: time

Parent: Time of Tide

Rationale: the shoreline metadata profile requires the time to the minute; therefore, the domain was change to reflect this.

2.7.2.3 Tidal Datum: the base elevation defined by a certain tidal phase.

Source: Shoreline Metadata Working Group

Type: text

Domain: free text “unknown”

Short Name: tidedat

Parent: Time of Tide

2.7.2.4 Range of Tide: the difference in height between consecutive high and low waters.

Source: Shoreline Metadata Working Group

Type: integer

Domain: free integer “unknown”

Parent: Time of Tide

Short Name: tidrang

Rationale: The range of tide should be given for the day(s) the data were collected.

Parent: Time of Tide

2.7.3 Tide Table Reference: tables which give daily predictions of the times and heights of the tide.

Source: Shoreline Metadata Working Group

Type: text

Domain: free text

Short Name: tideref

Parent: Tidal Information

2.7.4 Supplemental Tidal Information: additional information that is necessary for the completion of this section. If data were collected through tidal cycles, it should be noted here.

Source: Shoreline Metadata Working Group

Type: text

Domain: free text

Short Name: tidesup

Parent: Tidal Information

2.8 Marine Weather Condition: wind and wave conditions existing over an ocean or lake during the time of data collection.

Source: Shoreline Metadata Working Group

Type: compound

Short Name: marweat

Parent: Data Quality Information

Child: Wind Speed, Wind Direction, Wave Height

2.8.1 Wind Speed: the velocity of wind expressed in mph

Source: Shoreline Metadata Working Group

Type: integer

Domain: > 0 “unknown”

Short Name: windsp

Parent: Marine Weather Condition

2.8.2 Wind Direction: the direction of wind expressed in degrees

Source: Shoreline Metadata Working Group

Type: integer

Domain: 0 - 360

Short Name: windir

Parent: Marine Weather Condition

2.8.3 Wave Height: the height of waves or swells expressed in feet

Source: Shoreline Metadata Working Group

Type: integer

Domain: > 0, “unknown”

Short Name: wavhite

Parent: Marine Weather Condition

2.9 Environmental Event: any environmental event occuring shortly before or after the data were collected that would affect the current state of the data.

Source: Shoreline Metadata Working Group

Type: text

Domain: Free Text “none” “unknown”

Short Name: event

Parent: Data Quality Information

Rationale: This element should document events that have altered the environment causing the data or parts of the data to be altered. For example, such events could be hurricanes, nor' easters, earthquakes, or tectonic activity.

7.11.2 Profile Name: the name given to a document that describes the application of the Standard to a specific user community.

Source: Shoreline Metadata Working Group

Type: text

Domain: Shoreline Metadata Profile

Short Name: metprof

Parent**:** Metadata Extensions

INFORMATIVE ANNEXES

GLOSSARY, REFERENCES AND BIBLIOGRAPHY

The glossary and bibliography provide a basis for understanding shoreline and coastal management issues, concerns, and existing standards.

Glossary

accretion: The gradual and imperceptible accumulation of land by natural causes, as out of the sea or a river. This may be the result of a deposit of alluvion upon the shore, or a recession of the water from the shore. Accretion is the act, while alluvion is the deposit itself. (Shalowitz, 1964)

accuracy: Degree of conformity with a standard. Accuracy relates to the quality of a result and is distinguished from precision, which relates to the quality of the operation by which the result is obtained. (Ellis, 1978)

apparent shoreline: Line drawn on a map or chart in lieu of a mean high water line (MHWL) or the mean water level line (MWLL) in areas where either may be obscured by marsh, mangrove, cypress, or other type of marine vegetation. This line represents the intersection of the appropriate datum on the outer limits of vegetation and appears to the navigator as the shoreline. (Ellis, 1978)

avulsion: The loss of lands bordering on the seashore by sudden or violent action of the elements, perceptible while in progress; a sudden and rapid change in the course and channel of a boundary river. Neither of these changes works a change in the riparian boundary. (Shalowitz, 1964)

backshore: That part of the beach that is usually dry, being reached only by the highest tides, and by extension, a narrow strip of relatively flat coast bordering the sea. (Ellis, 1978)

bank: Edge of a cut or fill; the margin of the watercourse; an elevation of the seafloor located on a continental shelf or an island shelf and over which the depth of water is relatively shallow but sufficient for safe surface navigation (reefs or shoals, dangerous to surface navigation may arise above the general depths of a bank). (Ellis, 1978)

coast line: (According to Public Law 31) Line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters. (Shalowitz, 1964)

base line (seaward boundaries) Reference used to position limits of the Territorial Sea and the Contiguous Zone. Source data from which the base line is determined are the mean low water line (MLWL) on the Atlantic and Gulf coasts and the mean lower low water line (MLLWL) on the Pacific coast, Alaska, and Hawaii. The United Nations Conference on the Law of the Sea defined the low water line along the coast, as shown on large-scale charts of the coastal state (country) to be the base line for determining the limit of the territorial limit.(Ellis, 1978)

bathymetry: Science of measuring water depths (usually in the ocean) in order to determine bottom topography. (Ellis, 1978)

beach: (or seabeach) Zone of unconsolidated material that extends landward from the low water line to the place where there is marked changes in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves). A beach includes foreshore and backshore. (Ellis, 1978)

beach berm: Nearly horizontal portion of the beach or backshore formed by the deposit of materials by wave action. Some beaches have no berms, others have one or several. (Ellis 1978)

bench mark: A fixed physical object or mark used as reference for a vertical datum. A tidal bench mark is one

771 near a tide station to which the tide staff and tidal datums are referred. A primary bench mark is the principal (or
772 only) mark of a group of tidal bench marks to which the tide staff and tidal datums are referenced. The standard
773 tidal bench mark of the National Ocean Service (NOS) is a brass, bronze, or aluminum alloy disk 3-2 inches in
774 diameter containing the inscription NATIONAL OCEAN SERVICE together with other individual identifying
775 information. A geodetic bench mark identifies a surveyed point in the National Geodetic Vertical Network. Most
776 geodetic bench mark disks contain the inscription VERTICAL CONTROL MARK NATIONAL GEODETIC
777 SURVEY with other individual identifying information. Benchmark disks of either type may, on occasion, serve
778 simultaneously to reference both tidal and geodetic datums. Numerous bench marks of predecessor organizations to
779 NOS, or parts of other organizations absorbed into NOS, still bear the inscriptions: U.S. COAST GEODETIC
780 SURVEY, NATIONAL OCEAN SURVEY, U.S. LAKE SURVEY, CORPS OF ENGINEERS, and U.S.
781 ENGINEER OFFICE. (Hicks, 1984)
782
783 **bench mark (tidal):** Bench mark set to reference a tide staff at a tidal station, the elevation of which is determined
784 with relation to the local tide station. (Ellis, 1978)
785
786 **berm:** Nearly horizontal portion of a beach or backshore having an abrupt fall and formed by wave deposition of
787 material and marking the limit of ordinary high tides. (Ellis, 1978)
788
789 **berm crest:** Seaward limit of a berm. (Ellis, 1978)
790
791 **bluff:** A cliff or headland with an almost perpendicular face. (Hydrographic Dictionary, 1990)
792
793 **bottom lands:** Land below navigable freshwater bodies.(Coastal States Organization, 1997)
794
795 **boundary survey:** Survey made to establish or to reestablish a boundary line on the ground, or to obtain data for

796 constructing a map or plat showing a boundary line. (Ellis, 1978)

797

798 **cliff**: Land rising abruptly for a considerable distance above the water or surrounding land. (Hydrographic
799 Dictionary, 1990)

800

801 **coast:** General region of indefinite width that extends from the sea inland to the first major change in terrain
802 features. (Ellis, 1978)

803

804 **coastal boundary:** The mean high water line (MHWL) or mean higher high water line (MHHWL) when tidal lines
805 are used as the coastal boundary. Also, lines used as boundaries inland of and measured from (or points thereon)
806 the MHWL or MHHWL. See marine boundary. (Hicks, 1984)

807

808 **coastal zone:** (legal definition for coastal zone management) The term coastal zone means the coastal waters
809 (including the lands therein and thereunder) and the adjacent shore lands (including the waters therein and
810 thereunder), strongly influenced by each and in proximity to the shorelines of the several coastal states, and
811 includes islands, transitional and inter-tidal areas, salt marshes, wetlands, and beaches. The zone extends, in Great
812 Lakes waters, to the international boundary between the Unites States and Canada and in other areas seaward to the
813 outer limit of the United States territorial sea. The zone extends inland from the shorelines only to the extent
814 necessary to control shorelines, the uses of which have a direct and significant impact on the coastal waters.
815 Excluded from the coastal zone are lands the use of which is by law subject solely to the discretion of or which is
816 held in trust by the Federal Government, its officers, or agents. (Hicks, 1984)

817

818 **coastline:** Same as shoreline. See coast line. (Hicks, 1984)

819

820 **contiguous zones:** Zones beyond the marginal sea over which a nation exercises certain types of jurisdiction and

control without affecting the character of the area as high seas. (Shalowitz, 1964)

control station: Point on the ground whose position (horizontal or vertical) is used as a base for a dependent survey. (Ellis, 1978)

coordinated universal time (UTC): The time scale that is available from most broadcast time signals. It differs from International Atomic Time by an integral number of seconds. UTC is maintained within 1 second of UT1 by the introduction of 1second steps (leap seconds) when necessary, normally at the end of December. DUT1, an approximation of the difference UT1 minus UTC, is transmitted in code on broadcast time signals. (Hydrographic Dictionary, 1990)

cotidal line: A line on a chart or map passing through places having the same cotidal hour. (Hicks, 1984)

Datum (chart): The tidal datum used on nautical charts for referencing the soundings (depth units). (Shalowitz 1964)

Datum (tidal): A level of the sea defined by some phase of the tide, from which water depths and heights of tide are reckoned**.** (Hydrographic Dictionary, 1990)

Datum (vertical): For marine applications, a base elevation used as a reference from which to reckon heights or depths. It is called a tidal datum when defined in terms of a certain phase of the tide. Tidal datums are local datums and should not be extended into areas which have differing hydrographic characteristics without substantiating measurements. In order that they may be recovered when needed, such datums are referenced to fixed points known as bench marks. See chart datum. (Hicks, 1984)

differential Global Positioning System: Differential Global Positioning System is implemented by placing a GPS monitor receiver at a precisely known location. Instead of computing a navigational fix, the monitor determines the range error to every GPS satellite it can track. These ranging errors are then transmitted to local users where they are applied as corrections before computing the navigation result. (Hydrographic Dictionary, 1990)

diurnal: Having a period or cycle of approximately one tidal day. Thus, the tide is said to be diurnal when only one high water and one low water occur during a tidal day, and the tidal current is said to be diurnal when there is a single flood and a single ebb period of a reversing current in the tidal day. A rotary current is diurnal if it changes its direction through all points of the compass once each tidal day. A diurnal constituent is one which has a single period in the constituent day. The symbol for such a constituent is the subscript 1. See stationary wave theory and type of tide. (Hicks, 1984)

diurnal range: The difference in height between mean higher high water and mean lower low water. The expression may also be used in its contracted form, diurnal range. (Hicks, 1984)

diurnal tide level: A tidal datum midway between mean higher high water and mean lower low water. (Hicks, 1984)

dry sand beach: Sandy area between the mean high tide line and the vegetation line. (Coastal States Organization, 1997)

epoch: Also known as phase lag. Angular retardation of the maximum of a constituent of the observed tide (or tidal current) behind the corresponding maximum of the same constituent of the theoretical equilibrium tide. It may also be defined as the phase difference between a tidal constituent and its equilibrium argument. As referred to the

local equilibrium argument, its symbol is k. When referred to the corresponding Greenwich equilibrium argument, it is called the Greenwich epoch that has been modified to adjust to a particular time meridian for convenience in the prediction of tides is represented by g or by k'. The relations between these epochs may be expressed by the following formula:

$$G = k + pL$$

$$g = k' = G - aS / 15$$

in which L is the longitude of the place and S is the longitude of the time meridian, these being taken as positive for west longitude and negative for east longitude; p is the number of constituent periods in the constituent day and is equal to 0 for all long-period constituents, 1 for diurnal constituents, 2 for semidiurnal constituents, and so forth; and a is the hourly speed of the constituent, all angular measurements being expressed in degrees. (2) As used in tidal datum determination, it is the 19-year cycle over which tidal height observations are meaned in order to establish the various datums. As there are periodic and apparent secular trends in sea level, a specific 19-year cycle (the National Tidal Datum Epoch) is selected so that all tidal datum determinations throughout the United States, its territories, Commonwealth of Puerto Rico, and Trust Territory of the Pacific Islands, will have a common reference. See National Tidal Datum Epoch. (Hicks, 1984)

erosion: Transportation of weathered (decomposed) rock material or soil by natural forces. (Ellis, 1978)

estuary: An embayment of the coast in which fresh river water entering at its head mixes with the relatively saline ocean water. When tidal action is the dominant mixing agent it is usually termed a tidal estuary. Also, the lower reaches and mouth of a river emptying directly into the sea where tidal mixing takes place. The latter is sometimes called a river estuary. (Hicks, 1984)

extreme high water: The highest elevation reached by the sea as recorded by a tide gauge during a given period.

The National Ocean Service routinely documents monthly and yearly extreme high waters for its control stations. (Hicks, 1984)

extreme low water: The lowest elevation reached by the sea as recorded by a tide gauge during a given period. The National Ocean Service routinely documents monthly and yearly extreme low water for its control stations. (Hicks, 1984)

first reduction: A method of determining high and low water heights, time intervals, and ranges from an arithmetic mean without adjustment to a long-term series through simultaneous observational comparisons. (Hicks, 1984)

foreshore: That part of shore which lies between the high and low water mark at ordinary tide. (Hydrographic Dictionary, 1990)

freshwaters: Waters that do not ebb and flow with the tide. The determinative factor is that the water body does not ebb and flow with the tide, not the salt content of the water. (Coastal States Organization, 1997)

gauge: See tide gauge. (Hicks, 1984)

geodesy: Often used to include both the science which must depend upon determinations of the figure and size of the earth from direct measurements made on its surface (triangulation, leveling, astronomic and gravity determinations), and the art which utilizes the scientific determinations in a practical way and is usually termed geodetic surveying or geodetic engineering. (Ellis, 1978)

Global Positioning System (GPS): A satellite navigation system intended to provide highly accurate position and

velocity information in three dimensions and precise time and time interval on a global basis continuously. (Hydrographic Dictionary, 1990)

Greenwich Mean Time (GMT): Mean solar time at the Greenwich meridian. (Hydrographic Dictionary, 1990)

Gulf Coast Low Water Datum line: The line on a chart or map which represents the intersection of the land with the water surface at the elevation of Gulf Coast Low Water Datum. (Hicks, 1984)

half tide level: A tidal datum midway between mean high water and mean low water. (Shalowitz, 1964)

harmonic analysis: The mathematical process by which the observed tide at a place is analyzed by breaking it down into a number of constituent tides of simple periodic forces, each having a fixed period. In this process, the sun and moon are replaced by a number of hypothetical tide-producing bodies which move in circular orbits around the earth in the plane of the equator. (Shalowitz, 1964)

harmonic prediction: Method of predicting tides and tidal currents by combining the harmonic constituents into a single tide curve. The work is usually performed by electronic digital computer. (Hicks, 1984)

head of tide: The inland or upstream limit of water affected by the tide. For practical application in the tabulation for computation of tidal datums, head of tide is the inland or upstream point where the mean range becomes less than 0.2 foot. Tidal datums (except for mean water level) are not computed beyond head of tide. (Hicks, 1984)

higher high water: The higher of the two high waters of a tidal day where the tide is of the semidiurnal or mixed type. The single high water occurring daily during periods when the tide is diurnal is considered to be higher high water. (Shalowitz, 1964)

higher low water: The higher of the two low waters of a tidal day where the tide is of the semidiurnal or mixed type. (Shalowitz, 1964)

high tide: Same as high water. (Hicks, 1984)

high water: The maximum height reached by a rising tide. This may be due solely to the periodic tidal forces or it may have superimposed upon it the effects of prevailing meteorological conditions. (Shalowitz, 1964)

high water line: A generalized term associated with the tidal plane of high water but not with a specific phase of high water, for example, higher high water, lower high water. (Shalowitz, 1964)

high water mark: A line or mark left upon tide flats, beach, or along shore objects indicating the elevation of the intrusion of high water. The mark may be a line of oil or scum on along shore objects, or a more or less continuous deposit of fine shell or debris on the fore shore or berm. This mark is physical evidence of the general height reached by wave run up at recent high waters. It should not be confused with the mean high water line or mean higher high water line. (Hicks, 1984)

Inland waters: (also called national waters, interior waters, and internal waters) The waters of a country, both tidal and nontidal, that lie landward of the marginal sea, as well as the waters within its land territory, such as rivers and lakes, over which the nation exercises complete sovereignty. Waters landward of the marginal sea are those landward of the low-water mark and those landward of the seaward limits of ports, bays, harbors, and rivers. The seaward limit of a bay is a headland-to-headland line where the bay constitutes inland waters: otherwise it is the low-water mark following the sinuosities of the shore. (Shalowitz, 1964)

inshore: In beach terminology, the zone of variable width between the shore face and the seaward limit of the

breaker zone. (Ellis, 1978)

intertidal zone (technical definition): The zone between the mean higher high water and mean lower low water lines. (Hicks, 1984)

island: A piece of land completely surrounded by water. (Hydrographic Dictionary, 1990)

julian date: Technique for the identification of successive days of the year when monthly notation is not desired. This is especially applicable in computer data processing and acquisition where library indexing is necessary. (Hicks, 1984)

***Jus privatum*:** Private law as distinguished from *jus publicum,* or public law. The law regulating the rights of individuals. The right, title, or dominion of a private owner. In common law, title to lands below the high water mark was in the King as the sovereign, but the dominion was vested in him as the representative of the people and for their benefit. (Shalowitz, 1964)

***Jus publicum*:** Public law as distinguished from *jus privatum* or, private law. The right which a sovereign exercises in a public capacity for the benefit of the people, as distinguished from a right exercised in a proprietary capacity. (Shalowitz, 1964)

latitude: The angular distance between a terrestrial position and the equator measured northward or southward from the equator along a meridian of longitude. (Hicks, 1984)

ledge: A shelf-like projection, on the side of a rock or mountain. A rocky formation continuous with and fringing the shore. (Hydrographic Dictionary, 1990)

levee: Artificial bank confining a stream channel or limiting adjacent areas subject to flooding; an embankment bordering a submarine canyon or channel, usually occurring along the outer edge of a curve. (Ellis, 1978)

littoral: Pertaining to the shore, especially of the sea; a coastal region. Used extensively with "riparian." (Shalowitz, 1964)

local time: Time in which noon is defined by the transit of the sun over the local meridian as distinguished from standard time, which is based upon the transit of the sun over a standard meridian. Local time may be either mean or apparent, according to whether reference is to the mean or actual sun. Local time was in general use in the United States until 1883, when standard time was adopted. The use of local time in other parts of the world has also been practically abandoned in favor of the more convenient standard time. (Hicks, 1984)

Longitude: Angular distance in a great circle of reference reckoned from an accepted origin to the projection of any point on that circle. Longitude on the earth's surface is measured on the Equator east and west of the meridian of Greenwich and may be expressed either in degrees or in hours, the hour being taken as the equivalent of 15 degrees of longitude. Celestial longitude is measured in the ecliptic eastward from the vernal equinox. The mean longitude of a celestial body moving in an orbit is the longitude that would be attained by a point moving uniformly in the circle of reference at the same average angular velocity as that of the body, with the initial position of the point so taken that its longitude would be the same as that of the body at a certain specified position in its orbit. With a common initial point, the mean longitude of a body will be the same in whatever circle it may be reckoned. (Hicks, 1984)

low tide: Same as low water. (Hicks, 1984)

low water: The minimum height reached by a falling tide. This may be due solely to the periodic tidal forces or it

may have superimposed upon it the effects of prevailing meteorological conditions. (Shalowitz, 1964)

low water datum: (1) The geopotential elevation (geopotential difference) for each of the Great Lakes and Lake St. Clair and the corresponding sloping surfaces of the St. Marys, St. Clair, Detroit, Niagara, and St. Lawrence Rivers to which are referred the depths shown on the navigational charts and the authorized depths for navigation improvement projects. Elevations of these planes are referred to International Great Lakes Datum IGLD (1955) and are Lake Superior 600.0 feet, Lakes Michigan and Huron 576.8 feet, Lake St. Clair 571.7 feet, Lake Erie 568.6 feet, and Lake Ontario 242.8 feet. (2) An approximation of mean low water that has been adopted as a standard reference for a limited area and is retained for an indefinite period regardless of the fact that it may differ slightly from a better determination of mean low water from a subsequent series of observations. Used primarily for river and harbor engineering purposes. Boston low-water datum is an example. (Hicks, 1984)

low water interval (LWI): See lunitidal interval. (Hicks, 1984)

low water line: A generalized term associated with the tidal plane of low water but not with a specific phase of low water, for example, lower low water, higher low water. (Shalowitz, 1964)

lower high water: The lower of the two high waters of any tidal day where the tide is of the semidiurnal or mixed type. (Shalowitz, 1964)

lower low water: The lower of the two low waters of any tidal day where the tide is of the semidiurnal or mixed type. The single low water occurring daily during periods when the tide is diurnal is considered to be lower low water. (Shalowitz,1964)

lower low water datum (LLWD): An approximation of mean lower low water that has been adopted as a

standard reference for a limited area and is retained for an indefinite period regardless of the fact that it may differ slightly from a better determination of mean lower low water from a subsequent series of observations. Used primarily for river and harbor engineering purposes. Columbia River lower low water datum is an example. (Hicks 1984)

lunitidal interval: The interval between the moon's transit (upper or lower) over the local or Greenwich meridian and the following high or low water. The average of all high water intervals for all phases of the moon is known as mean high water lunitidal interval and is abbreviated to high water interval (LWI). Similarly, mean low water lunitidal interval is abbreviated to low water interval (LWI). The interval is described as local or Greenwich according to whether the reference is to the transit over the local or Greenwich meridian. When not otherwise specified, the reference is assumed to be local. When there is considerable diurnal inequality in the tide, separate intervals may be obtained for the higher high waters, lower high waters, higher low waters, and lower low waters. These are designated respectively as higher high water interval (HHWI), lower high water interval (LHWI), higher low water interval (HLWI), and lower low water interval (LLWI). In such cases, and also when the tide is diurnal, it is necessary to distinguish between the upper and lower transit of the moon with reference to its declination. (Hicks, 1984)

marine boundary: The mean lower low water line (MLLWL) when used as a boundary. Also, lines used as boundaries seaward of and measured from (or points thereon) the MLLWL. See coastal boundary. (Hicks, 1984)

mean diurnal tide level (MDTL): A tidal datum. The arithmetic mean of mean higher high water and mean lower low water. (Hicks, 1984)

mean high water: The average height of the high waters over a 19-year period. All high waters are included in the average where the type of tide is either semidiurnal or mixed. Where the type of the tide is predominantly diurnal,

only the higher high water heights are included in the average on those days when the tide is semidiurnal. (Shalowitz, 1964)

mean high water line (MHWL): The line on a chart or map which represents the intersection of the land with the water surface at the elevation of mean high water. See shoreline. (Hicks, 1984)

mean higher high water: The average height of the higher high waters over a 19-year period. (Shalowitz, 1964)

mean lower low water: The average height of the lower low waters over a 19-year period. The tidal plane used on the Pacific coast as the datum for soundings on the hydrographic surveys and nautical charts of the Coast and Geodetic Survey. (Shalowitz, 1964)

mean sea level: The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly readings. A determination of mean sea level that has been adopted as a standard for heights is called a sea level datum. The sea level datum now used for the Coast and Geodetic Survey level net is officially known as the Sea Level Datum of 1929, the year referring to the last general adjustment of the net, and is based upon observations taken over a number of years at various tide stations along the coasts of the United States and Canada. (Shalowitz, 1963)

mean tide level: Same as half tide level. (Shalowitz, 1963)

mean low tide: The mean average of all the low tides (high low tides and low low tides) occurring over a certain period of time, usually 18.6 years (one lunar epoch). (Coastal States Organization, 1997)

mean lower low- water line (MLLWL): The line on a chart or map which represents the intersection of the land

with the water surface at the elevation of mean lower low water. (Hicks, 1984)

mean range of tide (Mn): The difference in height between mean high water and mean low water. (Hicks, 1984)

mean water level line (MWLL): The line on a chart or map which represents the intersection of the land with the water surface at the elevation of mean water level. (Hicks, 1984)

National Geodetic Vertical Datum of 1929 (NGVD 1929): A fixed reference adopted as a standard geodetic datum for elevations determined by leveling. The datum was derived for surveys from a general adjustment of the first-order leveling nets of both the United States and Canada. In the adjustment, mean sea level was held fixed as observed at 21 tide stations in the United States and 5 in Canada. The geodetic datum now in use in the United States is the National Geodetic Vertical Datum. The year indicates the time of the general adjustment. A synonym for Sea-level Datum of 1929. The geodetic datum is fixed and does not take into account the changing stands of sea level. Because there are many variables affecting sea level, and because the geodetic datum represents a best fit over a broad area, the relationship between the geodetic datum and local mean sea level is not consistent from one location to another in either time or space. For this reason, the National Geodetic Vertical Datum should not be confused with mean sea level. (Hicks, 1984)

National Tidal Datum Convention of 1980: Effective November 28, 1980, the Convention: (1) establishes one uniform, continuous tidal datum system for all marine waters of the United States, its territories, Commonwealth of Puerto Rico, and Trust Territory of the Pacific Islands, for the first time in its history; (2) provides a tidal datum system independent of computations based on type of tide; (3) lowers the chart datum from mean low water to mean lower low water along the Atlantic coast of the United States; (4) updates the National Tidal Datum Epoch from 1941 through 1959, to 1960 through 1978; (5) changes the name Gulf Coast Low Water Datum to mean lower low water; (6) introduces the tidal datum of mean higher high water in areas of predominantly diurnal tides;

and (7) lowers mean high water in areas of predominantly diurnal tides. See chart datum. (Hicks, 1984)

National Tidal Datum Epoch: The specific l9-year period adopted by the National Ocean Service as the official time segment over which tide observations are taken and reduced to obtain mean values (e.g., mean lower low water) for tidal datums. It is necessary for standardization because of periodic and apparent secular trends in sea level. The present National Tidal Datum Epoch is 1960 through 1978. It is reviewed annually for possible revision and must be actively considered for revision every 25 years. (Hicks, 1984)

National Water Level Observation Network (NWLON): The network of tide and water level stations operated by the National Ocean Service along the marine and Great Lakes coasts and islands of the United States. The NWLON is composed of the primary and secondary control tide stations of the National Ocean Service. Distributed along the coasts of the United States, this network provides the basic tidal datums for coastal and marine boundaries and for chart datums of the United States. Tide observations at a secondary control tide station or tertiary tide station are reduced to equivalent l9-year tidal datums through the comparison of simultaneous observations with a primary control tide station. In addition to hydrography and nautical charting, and to coastal and marine boundaries, the network is used for coastal processes and tectonic studies, tsunami and storm surge warnings, and climate monitoring. The National Water Level Observation Network also includes stations operated throughout the Great Lakes Basin. The primary network is composed of 54 sites with 139 seasonal gauge sites selectively operated four months annually for the maintenance of International Great Lakes Datum (IGLD). The network supports regulation, navigation and charting, river and harbor improvement, power generation, various scientific activities, and the adjustment for vertical movement of the Earth's crust in the Great Lakes Basin. (Hicks, 1984)

nautical chart: A printed reproduction of a compilation of data derived from topographic and hydrographic surveys and miscellaneous information for use in marine navigation. The distinction between a survey and a chart is that the first is an original record of a given date, whereas the second is a compilation of many surveys of

different dates. (Shalowitz, 1964)

navigable inland waters: Under federal law, those inland waters which are available for navigation in their natural condition, or which can be made available for navigation by reasonable improvements. (Shalowitz, 1963)

navigability: The actual navigable capacity of a waterway and not the extent of tidal influence. (Shalowitz, 1963)

neap range: See neap tides. (Hicks, 1984)

normal tide: A nontechnical term synonymous with tide; i.e., the rise and fall of the ocean due to the gravitational interactions of the sun, moon, and earth alone. Use of this term is discouraged. (Hicks, 1984)

North American Vertical Datum of 1988 (NAVD 88): A fixed reference for elevations determined by geodetic leveling. The datum was derived from a general adjustment of the first-order terrestrial leveling nets of the United States, Canada, and Mexico. In the adjustment, only the height of the primary tidal bench mark, referenced to the International Great Lakes Datum of 1985 (IGLD 85) local mean sea level height value, at Father Point, Rimouski, Quebec, Canada was held fixed, thus providing minimum constraint. NAVD 88 and IGLD 85 are identical. However, NAVD 88 bench mark values are given in Helmert orthometric height units while IGLD 85 values are in dynamic heights. See International Great Lakes Datum of 1985, National Geodetic Vertical Datum of 1929, and geopotential difference. (Hicks, 1984)

ordinary high water line: Same as mean high water line. (Shalowitz, 1963)

ordinary low water mark: A term used by the Supreme Court in a submerged lands case to indicate where federal paramount rights begin in the offshore submerged lands, and which the Special Master in the California case was

called upon to interpret with respect to the type of tide found along the California coast. The intersection of the tidal plane of mean low water with the shore. (Shalowitz, 1963)

photogrammetry: The science or art of obtaining reliable measurements from photographs. (Hydrographic Dictionary,1990)

precision: The degree of refinement of a value; not to be confused with accuracy, which is the degree of conformance with the correct value. (Hydrographic Dictionary, 1990)

***Prima facie* public trust lands:** Lands that appear to be subject to the Public Trust Doctrine in that they lay beneath tidal or navigable-in-fact waters below the ordinary high water mark. (Coastal States Organization,1997)

public trust servitude: The bundle of rights held by the public to use and enjoy privately held trust lands for certain public purposes. The burden on the subordinate *jus privatum* owner by the dominant *jus publicum* interest of the public. (Coastal States Organization, 1997)

range of tide: The difference in height between consecutive high and low waters. The mean range is the difference in height between mean high water and mean low water. The great diurnal range or diurnal range is the difference in height between mean higher high water and mean lower low water. For other ranges see spring, neap, perigean, apogean, and tropic tides, and tropic ranges. (Hicks, 1984)

real-time: Pertains to a data collecting system that controls an ongoing process and delivers its outputs (or controls its inputs) not later than the time when these are needed for effective control. (Hicks, 1984)

recession: Continuing landward movement of the shoreline; a net landward movement of the shoreline over a

specified period. (Ellis, 1978)

reduction of tides or tidal currents: A processing of observed tide or tidal current data to obtain mean values for tidal or tidal current constants. (Hicks, 1984)

reference station: A tide or current station for which independent daily predictions are given in the Tide Tables and Tidal Current Tables, and from which corresponding predictions are obtained for subordinate stations by means of differences and ratios. (Hicks, 1984)

riparian: Associated with or appurtenant to shorelines of non-tidal waters. (Coastal States Organization, 1997)

riparian rights: The rights of an owner of land bordering a river or the sea; relates to the water (its use), ownership of the shore, right of ingress and egress, accretions, etc. (Shalowitz, 1963)

river estuary: See estuary. (Hicks, 1984)

sea level (water level): Height of the surface of the sea at any time. (Ellis, 1978)

sea level datum (SLD): An obsolete term. See National Geodetic Vertical Datum of 1929 and mean sea level. (Hicks, 1984)

secondary control tide station: A tide station at which continuous observations have been made over a minimum period of 1 year but fewer than 19 years. The series is reduced by comparison with simultaneous observations from a primary control tide station. This station provides for a 365-day harmonic analysis including the seasonal fluctuation of sea level. See tide station, tertiary tide station, and subordinate tide station (1). (Hicks, 1984)

semidiurnal: Having a period or cycle of approximately one-half of a tidal day. The predominant type of tide throughout the world is semidiurnal, with two high waters and two low waters each tidal day. The tidal current is said to be semidiurnal when there are two flood and two ebb periods each day. A semidiurnal constituent has two maxima and two minima each constituent day, and its symbol is the subscript 2. See type of tide. (Hicks, 1984)

shore profile: Intersection of the shore with a vertical plane that is perpendicular to the shoreline. The profile may extend from the top of the dune line to the seaward limit of sand movement; but for shoreline mapping purposes, extends from the berm crest offshore to the mean low water line or mean lower low water line. (Ellis, 1978)

shorelines: General term including tidelands and navigable freshwater shores below the ordinary high water mark. (Coastal States Organization, 1997)

shoreline: The line of contact between the land and a body of water. On Coast and Geodetic Survey nautical charts and surveys the shoreline approximates the mean high water line. In Coast Survey usage the term is considered synonymous with coastline. (Shalowitz, 1963)

slack water (slack): The state of a tidal current when its speed is near zero, especially the moment when a reversing current changes direction and its speed is zero. The term also is applied to the entire period of low speed near the time of turning of the current when it is too weak to be of any practical importance in navigation. The relation of the time of slack water to the tidal phases varies in different localities. For a perfect standing tidal wave, slack water occurs at the time of high and of low water, while for a perfect progressive tidal wave, slack water occurs midway between high and low water. See slack, ebb begins. (Hicks, 1984)

slack, ebb begins (slack before ebb): The slack water immediately preceding the ebb current. (Hicks, 1984)

small diurnal range: Difference in height between mean lower high water and mean higher low water. (Hicks, 1984)

spring high water: Same as mean high water springs (MHWS). See spring tides. (Hicks, 1984)

spring low water: Same as mean low water springs (MLWS). See spring tides and mean low water springs. (Hicks, 1984)

spring range (Sg): See spring tides. (Hicks, 1984)

spring tides: Tides of increased range occurring semimonthly as the result of the moon being new or full; that is, when the sun, moon and earth are in a line. Tides during these periods rise higher and fall lower than during the rest of the month. (Shalowitz, 1964)

stand of tide: Sometimes called a platform tide. An interval at high or low water when there is no sensible change in the height of the tide. The water level is stationary at high and low water for only an instant, but the change in level near these times is so slow that it is not usually perceptible. In general, the duration of the apparent stand will depend upon the range of tide, being longer for a small range than for a large range, but where there is a tendency for a double tide the stand may last for several hours even with a large range of tide. (Hicks, 1984)

standard time: A kind of time based upon the transit of the sun over a certain specified meridian, called the time meridian, and adopted for use over a considerable area. With a few exceptions, standard time is based upon some meridian which differs by a multiple of 15 degrees from the meridian of Greenwich. The United States first adopted standard time in 1883 on the initiative of the American Railway Association, and at noon on November 18 of that year the telegraphic time signals from the Naval Observatory at Washington were changed to this system.

(Hicks, 1984)

submerged lands: Lands covered by water at any stage of the tide, as distinguished from tidelands which are attached to the mainland or an island and cover and uncover with the tide. Tidelands presuppose a high water line as the upper boundary, submerged lands do not. (Shalowitz, 1963)

subordinate tide station (1)**:** A tide station from which a relatively short series of observations is reduced by comparison with simultaneous observations from a tide station with a relatively long series of observations. See tide station, secondary control tide station, and tertiary tide station. (2) A station listed in the Tide Tables from which predictions are to be obtained by means of differences and ratios applied to the full predictions at a reference station. See reference station. (Hicks, 1984)

temporal variation: Any change in the earth's magnetic field which is a function of time. Also referred to as magnetic temporal variation. (Hydrographic Dictionary, 1990)

tertiary tide station: A tide station at which continuous observations have been made over a minimum period of 30 days but less than 1 year. The series is reduced by comparison with simultaneous observations from a secondary control tide station. This station provides for a 29-day harmonic analysis. See tide station, secondary control tide station, and subordinate tide station (1). (Hicks, 1984)

tidal estuary: See estuary. (Hicks, 1984)

tidal gauge: A device for measuring the height of tide. A graduated staff in a sheltered area where visual observations can be made, or it may consist of an elaborate recording instrument making a continuous graphic

record of tide height against time. Such an instrument is usually actuated by a float in a pipe communicating with the sea through a small hole which filters out shorter waves. (Hydrographic Dictionary, 1990)

tidal zoning: The practice of dividing a hydrographic survey area into discrete zones or sections, each one possessing similar tidal characteristics. One set of tide reducers is assigned to each zone. Tide reducers are used to adjust the soundings in that zone to chart datum (MLLW). Tidal zoning is necessary in order to correct for differing water level heights occurring throughout the survey area at any given time. Each zone of the survey area is geographically delineated such that the differences in time and range do not exceed certain limits, generally 0.2 hour and 0.2 foot respectively; however, these limits are subject to change depending upon type of survey, location, and tidal characteristics. The tide reducers are derived from the water levels recorded at an appropriate tide station, usually nearby. Tide reducers are used to correct the soundings throughout the hydrographic survey area to a common, uniform, uninterrupted chart datum. (Hicks, 1984)

tide mark: High-water mark left by tidal water; the highest point reached by high tide; a mark placed to indicate the highest point reached by a high tide, or occasionally, any specified stage of tide. (Ellis, 1978)

tide staff: A tide gauge consisting of a vertical graduated staff from which the height of the tide can be read directly. It is called a fixed staff when secured in place so that it cannot be easily removed. A portable staff is one that is designed for removal from the water when not in use. For such a staff a fixed support is provided. The support has a metal stop secured to it so that the staff will always have the same elevation when installed for use. (Hicks, 1984)

tide (water level) station: The geographic location at which tidal observations are conducted. Also, the facilities used to make tidal observations. These may include a tide house, tide gauge, tide staff, and tidal bench marks. See secondary control tide station, tertiary tide station, and subordinate tide station (1). (Hicks, 1984)

tide tables: Tables which give daily predictions of the times and heights of the tide at various reference stations, and tidal differences and constants by which additional predictions can be obtained for numerous other places. (Shalowitz, 1963)

tidelands: The land that is covered and uncovered by the daily rise and fall of the tide. More specifically, it is the zone between the mean high waterline and the mean low water line along coast, and is commonly known as the "shore" or "beach." Referred to in legal decisions as between ordinary high water mark and ordinary low water mark. Tidelands presuppose a high water line as the upper boundary. (Shalowitz, 1964)

tidewaters: Waters subject to the rise and fall of the tide. Sometimes used synonymously with tidelands, but would be better to limit tidewaters to areas always covered with water. The amount of tide is immaterial. (Shalowitz, 1964)

type of tide: A classification based on characteristic forms of a tide curve. Qualitatively, when the two high waters and two low waters of each tidal day are approximately equal in height, the tide is said to be semidiurnal; when there is a relatively large diurnal inequality in the high or low waters or both, it is said to be mixed; and when there is only one high water and one low water in each tidal day, it is said to be diurnal. Quantitatively (after Dietrich), where the ratio of K1 + O1 to M2 + S2 is less than 0.25, the tide is classified as semidiurnal; where the ratio is from 0.25 to 1.5, the tide is mixed, mainly semidiurnal; where the ratio is from 1.5 to 3.0, the tide is mixed, mainly diurnal; and where greater than 3.0, diurnal. (Hicks, 1984)

Universal Time (UT): Same as Greenwich Mean Time (GMT). (Hicks, 1984)

upland: Land above mean high water mark and subject to private ownership, as distinguished from tidelands, ownership of which is *prima facie* in the state but also subject to divestment under state statutes. (Shalowitz, 1964)

wash: The visible or audible motion of agitated water, especially that caused by the passage of a vessel. (Hydrographic Dictionary, 1990)

water line: Juncture of land and sea. This line fluctuates, changing with the tide or other fluctuations in the water. (Ellis, 1978)

wet sand beach: Area between the ordinary high tide and the ordinary low tide lines. (Coastal States Organization, 1997)

World Geodetic System: A global geodesic reference system developed by the United States for satellite position fixing and recommended by the IHO for hydrographic and cartographic use. (Hydrographic Dictionary, 1990)

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