MARYLAND DEPARTMENT OF NATURAL RESOURCES
RESOURCE ASSESSMENT SERVICE
MARYLAND GEOLOGICAL SURVEY

Metadata
for
Water Level Data

Hydrodynamic Modeling in the Southern Coastal Bays: Water level monitoring, September 7-October 12, 2004

(MSCB2004WaterLevelData_metadata.pdf)
December, 2004

1 Identification Information

1.1 Citation
8 Citation Information
8.1Originator: Maryland Geological Survey (MGS)
8.2 Publication Date: 2004
8.4 Title: Hydrodynamic Modeling in the Southern Coastal Bays: Water level monitoring, September 7-October 12, 2004
8.6 Geospatial Data Presentation Form: Text
8.8 Publication Information: Maryland Geological Survey
8.8.1 Publication Place: Baltimore land, USA
8.8.2 Publisher: Maryland Geological Survey
8.10 Online Linkage: http://www.mgs.md.gov

1.2 Description
1.2.1 Abstract: This data set consists of four ASCII, comma-delimited files containing water level data collected at four locations within Sinepuxent and Chincoteague Bays. The water level monitoring was conducted between September 7 and October 12, 2004.:

File Name	Location	Time Period
SnugHbr.txt	Snug Harbor, Sinepuxent Bay, Md.	9/8/04-10/12/04
SouthPt.txt	South Pt. Boat Ramp, Sinepuxent Bay, Md.	9/7/04-9/30/04
PublicLg.txt	Public Landing, Chincoteague Bay, Md.	9/7/04-10/12/04
HbrOfRef.txt	Harbor of Refuge, Chincoteague Island. Chincoteague Bay, Va	9/9/04-10/12/04

Each file has three columns: Date (MM/DD/YY), Time (HH:MM:SS, UTC) and [water] Level (6-minute average, NAVD88, ft.). The first two rows contain header information. The first row is location name; the second row contains column headings.

Supplemental Information: Description of methods for collecting the water level data

reduction are included in final report submitted to Tidewater Ecosystem Assessment, Resource Assessment Service, Md. Dept. of Natural Resources:

Wells, D.V., VanRyswick, S., Ortt, R., Jr., Conkwright, R.D., and Offerman, K.A., 2004, Hydrodynamic Modeling in the Southern Coastal Bays: Water level monitoring, September 7-October 12, 2004, Coastal and Estuarine Geology File Report No. 04-6, Maryland Geological Survey, Baltimore, Md.

1.2.2 Purpose: This data were collected to refine the grid size and validate a circulation model being developed by the Army Corps of Engineers, Engineer Research & Development Center, Coastal & Hydraulics Laboratory (CHL). This numeric model has been fine-tuned in the Ocean City Inlet area by increasing the computational mesh resolution in the vicinity of the Inlet and collecting current and tide data for model calibration. Additional tide and current data were needed to refine the grid size and validate the model in Chincoteague, Newport and Sinepuxent Bays. This data set is a result of one of two study components conducted over a one-month period: 1) The University of Maryland, Center for Environmental Science (UMCES) monitored currents velocities at Chincoteague and Ocean City Inlets utilizing both fixed Acoustic Doppler Current Profilers (ADCP) and towed ADCPs; 2) Concurrent with the UMCES ADCP monitoring, the Maryland Geological survey recorded water levels at four locations in the southern bays.

1.3 Time Period of Content
9 Time Period Information
9.2 Multiple Dates/Times: Date and time of day were recorded with water level observations at four locations.
9.3 Range of Dates/Times
9.3.1 Beginning Date: September 7, 2004
9.3.3 Ending Date: October 12, 2004
1.3.1 Currentness Reference: The water level values are in feet, adjusted to NAV88 datum.

1.4 Status
1.4.1 Progress: Complete
1.4.2 Maintenance and Update Frequency: None planned

1.5 Spatial Domain
1.5.1 Bounding Coordinates
1.5.1.1 West Bounding Coordinate: -075.50
1.5.1.2 East Bounding Coordinate: -075.08
1.5.1.3 North Bounding Coordinate: 38.32
1.5.1.4 South Bounding Coordinate: 37.85

1.6 Keywords
1.6.1 Theme
1.6.1.1 Theme Keyword Thesaurus: Global Change Master Directory (BCMD) Science Keywords, (CATEGORY > TOPIC > Term > Variable)
http://gcmd.nasa.gov/Resources/valids/keyword_list.html

1.6.1.2 Theme Keyword: EARTH SCIENCE > OCEANS > Coastal Processes > Tidal Height
1.6.2 Place
1.6.2.1 Place Keyword Thesaurus: U.S. Geological Survey, Index to Topographic and Other Map Coverage: Maryland, Delaware, and District of Columbia (38076-H4-MI-99X), 22 p.
1.6.2.2 Place Keyword: USA
1.6.2.2 Place Keyword: Maryland (MD)
1.6.2.2 Place Keyword: Worcester County (WO)
1.6.2.2 Place Keyword: Boxiron Quadrangle
1.6.2.2 Place Keyword: Girdletree Quadrangle
1.6.2.2 Place Keyword: Public Landing Quadrangle
1.6.2.2 Place Keyword: Tingles Island Quadrangle
1.6.2.2 Place Keyword: Whittington Point Quadrangle
1.6.2.2 Place Keyword: Newport Bay
1.6.2.2 Place Keyword: Sinepuxent Bay
1.6.2.2 Place Keyword: Chincoteague Bay

1.8 Use Constraints: Acknowledgment of the Maryland Geological Survey, and Tidewater Ecosystem Assessment, both part of the Resource Assessment Service, Maryland Department of Natural Resources, shall be made in products derived from these data.

1.9 Point of Contact
10 Contact Information
10.1 Contact Person Primary
10.1.1 Contact Person: Darlene Wells
10.1.2 Contact Organization: Maryland Geological Survey
10.4 Contact Address
10.4.1 Address Type: mailing and physical address
10.4.2 Address: 2300 St. Paul Street
10.4.3 City: Baltimore
10.4.4 State or Province: Maryland
10.4.5 Postal Code: 21218-5210
10.4.6 Country: USA
10.5 Contact Voice Telephone: (410) 554-5518
10.7 Contact Facsimile Telephone: (410) 554-5502
10.8 Contact Electronic Mail Address: dwells@mgs.md.gov
10.9 Hours of Service: 9:00 a.m. - 5:00 p.m. EST

1.11 Data Set Credit: Funding for the project - Hydrodynamic Modeling in the Southern Coastal Bays: Water level monitoring, September 7-October 12, 2004 - was provided by the Maryland Coastal Bays Program (MCBP).

2 Data Quality Information

2.2 Logical Consistency Report
Position (Horizontal) Data: The horizontal position of each water level recorder was determined

using a hand-held GPS unit (no differential correction) and recorded as UTM coordinates (NAD83, meters).

Water Levels: Global Water Instrumentation, Inc originally calibrated the water level recorders prior to shipping. The calibration was done over a depth range of 0 to 15 feet, and in 'fresh' water (0 ‰ salinity). Prior to deployment for this study, calibration of each unit was verified and compared with the other units. Calibration check was done after the level sensors were mounted in the stilling well. The still wells were set at the same depth, affixed to a dock located in an interior canal in the Ocean Pines Community (located in Isle of Wight Bay, Maryland) and allowed to record one-minute observations for several days. Calibration check prior to deployment indicated that the recorders were accurately measuring water levels and time, and that the units were within 0.03 ft of each other. Any differences between recorder readings and actual depths were attributed to the fact that the original calibrations were done in water with 0 ppt salinity. The salinity in the canal was not measured at the time of the pre deployment calibration check. The salinity in an Ocean Pines canal can range from 15 ppt to over 30 ppt, depending in time of year and amount of rainfall. A change from 0 ppt salinity to 30 ppt salinity in 3 feet of water will yield an offset of 0.07 feet (assuming constant water temperature of 10 degrees C). Given the tide ranges, salinities, and water depths encountered during this study, the actual offsets would be smaller. For this study, water level readings were not corrected for salinity or temperature.

At Snug Harbor, South Pt. and Public Landing, a metal 5-ft tide staff was mounted next to the stilling wells. The tide staffs, marked in 0.1-ft intervals, were mounted so that the 4.0 ft. mark lined up with 4- ft mark on the stilling wells. The tide staffs were used to verify the readings from the data recorders when downloading in the field. At Harbor of Refuge, an existing tide staff, located at the boat ramp, was used as a field check.

At the end of the study, calibration of each recorder was checked in laboratory. Level sensors were removed from the stilling wells and cleaned. Calibration check was done in a plexiglas tube (1.77 meters high, 0.15 meters inside diameter) filled with de-ionized water. Post deployment calibrations for the sensor used at Harbor of Refuge indicated the sensor was still in calibration. The results of the post deployment calibrations for sensors used at Snug Harbor and Public Landing were inconsistent. Comparisons of sensor readings to staff readings at those locations suggest the accuracy of readings may have deteriorated toward the end of deployment (after September 30). However, any deterioration is not discernable in plots of the data. Post-deployment calibration check of the sensor used at South Point revealed that the sensor was off by more than a foot. The sensor had malfunction after 9/30/04 at 21:26.

2.3 Completeness Report: The water level monitoring was conducted between September 7 and October 12, 2004. Continuous 6-minute observations of water levels were collected at four locations. Time gaps in observations (> 6 minutes) were due to interruption in data recording during the downloading process. Data gaps generally did not exceed 30 minutes. Data record at South Point is less than 28 days due to fouling of sensor.

2.4 Positional Accuracy

2.4.1 Horizontal Positional Accuracy Report: The accuracy of the horizontal position of each

water level recorder is ± 3.0 meters.

2.4.2 Vertical Positional Accuracy

2.4.2.1 Vertical Positional Accuracy Report: The accuracy of the water level data is estimated to be ± 0.1 ft (0.03 meters). This estimate takes in account of the error introduced with the water level adjustments and elevation accuracy of the water level recorders.

2.5.2 Process Step

2.5.2.1 Process Description: Water level recorders were installed and operated at four locations: Snug Harbor and South Point, both of which are in Sinepuxent Bay; Public Landing, Chincoteague Bay, Maryland; and Harbor of Refuge, in Chincoteague Bay, Virginia. Water level data were collected using instruments manufactured by Global Water Instrumentation, Incorporated. Two models were used: GL400 logger with WL300 or WL400 sensor; and WL15 combined unit. Both systems consist of a data logger interfaced with a sensor for remote monitoring and recording of water level data. The level sensor is a submersible pressure transducer consisting of a solid-state pressure sensor encapsulated in a stainless steel submersible 3/4"' diameter housing. The sensor is connected to the data logger by a 25-ft., molded-on waterproof cable that is vented to the atmosphere. The vent to the atmosphere minimized offsets caused by barometric changes. The reported accuracy of the sensor is +/- 0.2% full scale (range 0-15 ft, 35° F to 70° F). Time accuracy of the data loggers is reported to be 0.0015%. To minimize noise from wave activity, each water level sensor was mounted in a "stilling well" which consisted of a 5-foot length of 3-inch PVC pipe. The sensor was affixed to the inside wall of the pipe. The level above the sensor was marked in 1-foot intervals on the outside of the pipe. The top and bottom of the PVC pipe were capped. To allow slow passage of water between the inside and outside of the pipe, four 1/8" holes were drilled through the PVC wall near the bottom of the pipe and two 1/8" holes at the top of the pipe. The PVC pipe was securely mounted on a piling, with the bottom of the pipe positioned on or just above the sediment surface. The GL400 data logger was housed in a 254mm x 191mm x 114mm water resistant "pelican" box. The WL15's data logger, contained in a 7/8" diameter x 12" length weather-resistant cylindrical enclosure, was inserted in a 2" PVC pipe for mounting on site. The data loggers were mounted above the respective stilling wells where possible. After installation, the horizontal position of each water level recorder was determined, using a hand-held GPS. Each water level recorder site was surveyed to determine elevation of the water level sensor relative to NAVD88. One or more benchmarks (BM) were used at each recorder site and relative elevations between the BMs and 4 ft reference marks on the stilling well of the recorders were determined by differential leveling.

Location	UTM Coordinates (NAD83,m)	Elevation of sensor (NAVD88, ft)
Snug Harbor	N4238320, E488644	-1.105 ± 0.02
South Pt. Boat Ramp	N4229842, E483269	-1.98 ± 0.05
Public Landing	N4222330, E474972	-2.78 ± 0.0
Harbor of Refuge	N4195066, E464173	-2.63 ± 0.01

The data loggers were programmed to take a reading every minute or every two minutes, depending on the data logger model. Because of limited memory of the data loggers, data was downloaded weekly. A handheld PDA running Palm OS was used to download data from the

units in the field (Global Water Instrumentation, Inc., 2002a). Time of day was synchronized with GPS time when water level data were downloaded to the palm pilot and data loggers were reset. Data output from the loggers included date (MM/DD/YYYY), time of day (UTC-hh:mm:ss), and water level (0.001 ft) in comma-delimited ASCII format. In the office, the water level data were transferred to PC and imported in MS Excel for verification and processing. Water level data were reduced to six-minute observation.

3 Spatial Data Organization Information

3.1 Indirect Spatial Reference: This data set contains a listing of 6-minute water levels collected at four locations designated by Universal Transverse Mercator (UTM) Northing and Easting coordinates referenced to North America Datum of 1983 (NAD83)

4 Spatial Reference Information

4.1 Horizontal Coordinate System Definition
4.1.2 Planar
4.1.2.2 Grid Coordinate System
4.1.2.2.1 Grid Coordinate System Name: Universal Transverse Mercator
4.1.2.2.2 Universal Transverse Mercator
4.1.2.2.2.1 UTM Zone Identifier: 18
4.1.2.1.2 Transverse Mercator
4.1.2.1.2.2 Longitude of central meridian: -75.0
4.1.2.1.2.3 Latitude of projected origin: 0.0
4.1.2.1.2.4 False Easting: 500000
4.1.2.1.2.5 False Northing: 0.0
4.1.2.1.2.17 Scale factor at central meridian: 0.999
4.1.2.4 Planar Coordinate Information
4.1.2.4.1 Planar Coordinate Encoding Method: coordinate pair
4.1.2.4.4 Planar Distance Units: meters
4.1.4 Geodetic Model
4.1.4.1 Horizontal Datum Name: North American Datum of 1983
4.1.4.2 Ellipsoid Name: Geodetic Reference System 80
4.1.4.3 Semi-major Axis: 6,378,137 meters
4.1.4.4 Denominator of Flattening Ratio: 298.257

5 Entity and Attribute Information

5.1 Detailed Description
5.1.1 Entity type
5.1.1.1 Entity Type Label: Water level
5.1.1.2 Entity Type Definition: A measured water height, referenced to a specific plane of reference (vertical datum).

5.1.1.3 Entity Type Definition Source: None.
5.1.2 Attribute
5.1.2.1 Attribute Label: Date (Corresponds to first column or attribute)
5.1.2.2 Attribute Definition: Date in Month/Day/Year (M/D/YYYY) format, referenced to Coordinated Universal Time (UTC), representing the date at which the water level was measured.
5.1.2.3 Attribute Definition Source: None
5.1.2.4 Attribute Domain Values
5.1.2.4.2 Range Domain
5.1.2.4.2.1 Range Domain Minimum : 9/7/2004
5.1.2.4.2.2 Range Domain Maximum: 10/12/2004
5.1.2.5 Attribute Units of Measurement: M/D/YYYY
5.1.2 Attribute
5.1.2.1 Attribute Label: Time
5.1.2.2 Attribute Definition: Time of day in Hour:Minute:Seconds (H:MM:SS), based on 24 hour time, referenced to Coordinated Universal Time (UTC), at which water level measurement was taken and recorded. In this particular data set, the time corresponds to the time of the last water level observation used in 6-minute average.
5.1.2.3 Attribute Definition Source: None
5.1.2.4 Attribute Domain Values
5.1.2.4.2 Range Domain
5.1.2.4.2.1 Range Domain Minimum : 15:43:03
5.1.2.4.2.2 Range Domain Maximum: 18:03:03
5.1.2.5 Attribute Units of Measurement: H:MM:SS, based on 24 hour time
5.1.2 Attribute
5.1.2.1 Attribute Label: Level
5.1.2.2 Attribute Definition: Elevation, in hundredths of feet (0.001), of the water surface referenced to North America Vertical Datum of 1988 plane (NAV88). Values represent an average of consecutive water levels recorded over a 6-minute interval
5.1.2.3 Attribute Definition Source: None
5.1.2.4 Attribute Domain Values
5.1.2.4.2 Range Domain
5.1.2.4.2.1 Range Domain Minimum: -1.409
5.1.2.4.2.2 Range Domain Maximum: 2.628
5.1.2.5 Attribute Units of Measurement: feet

6 Distribution Information

6.1 Distributor
10 Contact Information
10.2 Contact Organization Primary
10.2.1 Contact Organization: Maryland Geological Survey
Publications Office
10.1.2 Contact Person: Darlene Wells
10.4 Contact Address
10.4.1 Address Type: mailing and physical address

10.4.2 Address: 2300 St. Paul Street
10.4.3 City: Baltimore
10.4.4 State or Province: Maryland
10.4.5 Postal Code: 21218-5210
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7 Metadata Reference Information

7.1 Metadata Date: 20041207
7.4 Metadata Contact
10 Contact Information
10.1 Contact Person Primary
10.1.1 Contact Person: Darlene Wells
10.1.2 Contact Organization: Maryland Geological Survey
10.4 Contact Address
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10.8 Contact Electronic Mail Address: dwells@dnr.state.md.us
10.9 Hours of Service: 9:00 a.m. - 5:00 p.m. EST

7.5 Metadata Standard Name: FGDC Content Standards for Digital Geospatial Metadata
7.6 Metadata Standard Version: Version dated 19940608