





# A Guide to CO-OPS SHEF and CREX Products

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## REVISION HISTORY

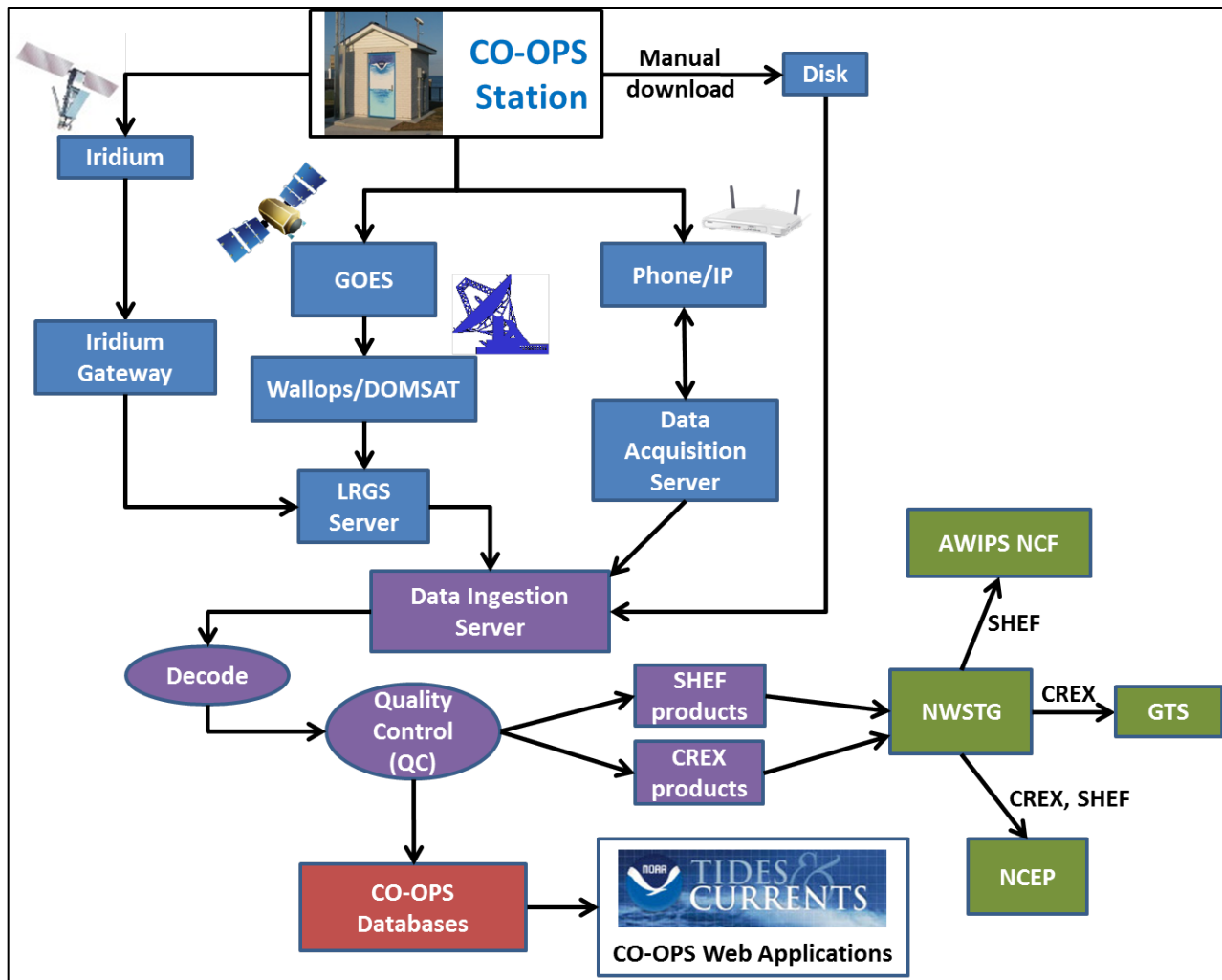
<b>Date</b>	<b>Reason For Changes</b>
2001/09	Initial Draft
2002/03	Minor revisions
2004/10	Minor revisions
2013/11	Major revisions: Title of report changed from “A NWS Guide to the Use of NWLON and PORTS Computer-Based Products.” Includes updates to SHEF and CREX products, and implementation of new SHEF and CREX products.











**Fig.2.** Data flow from CO-OPS stations. Boxes indicate hardware or a system, and ovals indicate an action performed on the data. Blue refers to the data acquisition process, purple to the data ingestion process, red to database insertion, and green to distribution through the NWS Telecommunications Gateway.

the Advanced Weather Interactive Processing System (AWIPS) Network Control Facility (NCF), which allows forecasters to view the data in AWIPS, a system heavily used by forecast centers. The NOAA/NWS National Centers for Environmental Prediction (NCEP) also ingests SHEF and CREX messages into their data tanks. CREX messages go through the Global Telecommunications Gateway (GTS) where they are accessible by the international user community. CO-OPS partner data are also included in the CREX and SHEF data products. A subset of these stations report via hourly GOES, however, therefore observations may not always populate the higher-frequency SHEF and CREX bulletins.

Each SHEF and CREX product is assigned a World Meteorological Organization (WMO) header that users require to identify the messages, and the stations data are grouped by geographic region under these headings. Both headers contain data type and geographical designators that allow users to identify the product at a glance. See Appendix 4 for a listing of the WMO and AWIPS headers.



In the Data section:

- **3237339** and **-06470331** are the latitude and longitude respectively, and are provided to 5 decimal places, as described in CREX/BUFR Table D [REF 3]. In this case, the coordinates are 32.37339 N and 64.70331 W. Note that positive latitude/longitude values correspond to North and East, respectively and negative values correspond to South and West, respectively.
- **BEPB6** is the National Weather Service Location Identifier (NWSLI) for Bermuda. Appendix 1 provides a list of the stations and associated NWSLI and NOS station identifiers.
- **2013 07 31 17 54** is the base time (7/31/2013 17:54 GMT) used to calculate the measurement times for the water level values contained in the bulletin for the given station.
- **3038** is the sea surface temperature in Kelvin to the tenths (303.8 K).
- **00 07** are two checks that indicate the overall quality of the data. The first set of digits is the automated water level check and indicates the quality of the data (see Appendix 5 for a list of all automated checks). **00**, per Appendix 5, indicates the data quality is good. The second set of digits is the manual water level check that is presently not used, therefore will always be set to **07**, as defined in WMO Manual on Codes [REF 2].
- **00 06** are time increments applied to the base time to calculate the measurement timestamp of the first and oldest water level value for the given station. **00** indicates the number of minutes that must be added to the first measurement, which is 0. The following **06** indicates the time increment between measurements, and is also added to the base time to determine the timestamp of the first measurement.

In a six-minute water level bulletin, a data record contains six water level values and six associated residuals (except at Great Lakes stations). All data are reported in GMT, and are in millimeters. To determine the time of each 6-minute measurement start with the base time provided in the station header record, which in this case is **7/31/2013 17:54 GMT**. The station header record indicates **00** minutes need to be added to **17:54** to calculate the measurement time for the first and oldest water level value. Then **06** minutes are added to the first value and then each succeeding measurement time. This means for BEPB6 the data listing is:

Measurement date/time (GMT)	Observed water level (above MLLW)	Residual
7/31/2013 18:00	0.644 m	-0.021
7/31/2013 18:06	0.653 m	-0.023
7/31/2013 18:12	0.669 m	-0.018
7/31/2013 18:18	0.680 m	-0.018
7/31/2013 18:24	0.687m	-0.020
7/31/2013 18:30	0.693 m	-0.023

### 3.1.2 Meteorological

The water level bulletins are supplemented by separate meteorological bulletins every thirty minutes. The meteorological bulletins contain one observation of surface winds, air temperature and barometric pressure (adjusted to mean sea level) for the most recent thirty-

minute transmission. Not all stations have all sensors, so it is possible to have meteorological bulletins that do not contain information for all of the given data types. Wind observations are at the height of the installed anemometer, which is typically 8-10 meters. Meteorological sensor elevations are available on the CO-OPS website, on the station information page for each station [REF 4]. The following is an example of a meteorological message:

```
KSAA30 KWBC 311844 RRA
CREX++
T000119 A001 D01021 D06021++
3237339 -06470331 BEPB6 2013 07 31 18 00 00 07 285 10218 315 0020+
4490460 -06698290 PSBM1 2013 07 31 18 00 00 07 180 10157 157 0048+
2455570 -08180790 KYWF1 2013 07 31 18 00 00 07 329 10176 /// ////++
7777
```

WMO headers for meteorological CREX bulletins are the same as the six-minute water level bulletins. The **RRA** indicates that this bulletin is supplemental to the water level bulletin.

In the Data Description section the only difference from the 6-minute water level message is the sequence **D06021**, which indicates the message contains a station ID, date/time (GMT), data checks, air temperature (°C), barometric pressure adjusted to Mean Sea Level (mb), wind direction (degrees true), and wind speed (m/s) [REF 3].

In the Data section, the data provided are for the time stamp within the message. In this case, for **BEPB6**, the date of the measurements is **7/31/2013 18:00** GMT. The following values are listed in the order of the **D06021** parameters. All data are provided to the nearest tenth, except wind direction. In this example, for BEPB6 at 7/31/2013 18:00 GMT:

Air temperature	<b>285</b>	28.5 °C
Barometric pressure	<b>10218</b>	1021.8 mb
Wind direction	<b>315</b>	315 degrees
Wind speed	<b>0020</b>	2.0 m/s.

Not all stations contain every meteorological sensor, and any missing values will be presented as ///.

### 3.2 Observed One-minute Water Level Bulletins

In addition to the routine six-minute data bulletins, CO-OPS also generates one-minute water level bulletins containing the most recent six samples of one-minute water level data. Tidal residuals are not produced for one-minute observations, therefore are not included. These bulletins are issued every three minutes. One-minute data are not collected at Great Lakes stations or stand-alone meteorological stations. See Appendix A for a list of stations that collect one-minute water levels. These bulletins are similar to the six-minute CREX bulletins but contain different sequences in the data description section, explained below:

```
SZAK35 KWBC 311848
CREX++
T000119 A001 D01021 D06019 R01006 B22038++
```

5533183 -13162619 KECA2 2013 07 31 18 31 2868 00 07 00 01  
02666 02660 02654 02647 02641 02635+  
5624670 -13464700 PLXA2 2013 07 31 18 31 2838 00 07 00 01  
01787 01792 01793 01785 01772 01760++  
7777

In the message header:

- **SZAK35 KWBC** is the WMO header for the Alaska Region CREX message, per Appendix 4.
- **311848**: The bulletin was created on day 31 at 18:48 GMT.

In the Data Description section:

- **D01021**: The message contains latitude and longitude.
- **D06019**: The message contains a station ID, date/time, sea surface temperature, quality control checks, and time increments [REF 3].
- **R01006** is a replicator and is applied to the following **1** element repeated **6** times.
- **B22038** refers to “tidal elevation with respect to local chart datum.” Since only coastal stations measure 1-minute water levels, the chart datum is MLLW. Therefore, 6 tidal elevation values are provided, as specified by the R01006.

In the Data section:

- **55333183** and **-13162619** are the latitude and longitude respectively, and are provided to 5 decimal places. In this case, the coordinates are 55.33183 N and 131.62619 W. Note that positive latitude/longitude values correspond to North and East, respectively and negative values correspond to South and West, respectively.
- **KECA2** is the NWSLI for Ketchikan, AK. Appendix 1 provides a list of the CO-OPS and partner stations and associated NWSLI and NOS stations.
- **2013 07 31 18 31** is the base time (07/31/2013 18:31 GMT) used to calculate the measurement times for the water level values contained in the bulletin for the given station. All data are in GMT.
- **2868** is the sea surface temperature in Kelvin to the tenths (286.8 K).
- **00 07** are two checks that indicate the overall quality of the data. The first set of digits is the automated water level check and indicates the quality of the data (see Appendix 5 for a list of all automated checks). **00**, per Appendix 5, indicates the data quality is good. The second set of digits is the manual water level check that is presently not used, therefore will always be set to **07**, as defined in WMO Manual on Codes [REF 2].
- **00 01** are time increments applied to the base time to calculate the measurement time of the first and oldest water level value for the given station. **00** indicates the number of minutes that must be added to the first measurement, which is 0. The following **01** indicates the time increment between measurements, which is also applied to the first measurement.

In a 1-minute water level bulletin, a data record contains six water level values reported in millimeters. To determine the time of each 1-minute measurement start with the time provided in the station header record, which in this case is **7/31/2013 18:31 GMT**. The station header record indicates **00** minutes need to be added to **18:31** to calculate the measurement time for the first and oldest water level value. Then **01** minutes are applied to

the first value to determine each succeeding measurement time. This means for KECA2 the data listing is:

<b>Measurement date/time (GMT)</b>	<b>Observed water level</b>
<b>7/31/2013 18:32</b>	2.666 m
<b>7/31/2013 18:33</b>	2.660 m
<b>7/31/2013 18:34</b>	2.654 m
<b>7/31/2013 18:35</b>	2.647 m
<b>7/31/2013 18:36</b>	2.641 m
<b>7/31/2013 18:37</b>	2.635 m







Data string:

- **DH2048** indicates that the observation time associated with the initial water level value is 20:48 GMT, and is in the hour/minute format.
- **HMIRG** are the parameter codes, which in this example indicates observed tide data referenced to MLLW and received via GOES.
  - The **HM** designates water level data that have been corrected to MLLW (Mean Lower Low Water). An **HH** in this position indicates the water level data are corrected to Mean Sea Level (MSL) and an **HG** in this position refers to height above river stage.
  - The **I** indicates the data are instantaneous.
  - All observed water level values will have either **RG** to indicate the value is received via GOES, or **RP** to indicate the value is received via phone or IP. Oftentimes, stations are set up with redundant modes of communication, and the SHEF messages will contain two lines of duplicate data values from each data source (e.g. HMIRG and HMIRP).
- The time interval, **DIN06**, indicates a time increment unit of minutes (**N**) and the interval is **6**. Therefore, the data are 6-minute observations.

The remaining values in the .E records associated with the given station are the water level data reported in feet. To determine the date and time of each measurement, start with the observation date and time, which in this case is **8/28/2013 20:48 GMT**. This is the date and time for the first measurement. Since Data Interval designator indicates there is a 6-minute increment between each data measurement, 6 minutes are to be added to this time to determine the next measurement time, and so on. Therefore, the water level values for Eastport in this example are:

Measurement date/time (GMT)	Observed water level (MLLW)
<b>8/28/2013 20:48</b>	17.89 ft
<b>8/28/2013 20:54</b>	17.98 ft

### Meteorological

If meteorological data exists for a station, a meteorological SHEF bulletin is generated at the same time that the SHEF water level bulletin is generated, but under a different WMO header so that the bulletins are not overwritten. Currently, the meteorological parameters that can be included in the bulletin are air temperature, barometric pressure (sea level), wind speed, wind direction, wind gusts, water conductivity, and water temperature (sea surface). Not all stations have all sensors, so it is possible to have meteorological bulletins that do not contain information for all of the given data types. Should a new type of meteorological sensor be installed at a station, the data collected from that sensor for the given station would be added to the bulletin. Each meteorological bulletin includes the six-minute meteorological data value for each data type from the most recent transmission.

SXUS51 KWBC 161839  
 OSONT  
 :SHEF ENCODED 6-MINUTE NOS MET DATA  
 :NATIONAL WATER LEVEL OBSERVATION NETWORK (NWLON)  
 :TA(AIR TEMP DEG F) SLP(SEA LEVEL PRESSURE INCHES)  
 :UD(WIND DIRECTION WHOLE DEGREES) US (WIND SPEED MPH)  
 :TW(WATER TEMP DEG F) UG(WIND GUSTS MPH) WC(CONDUCTIVITY  
 uMHOS/CM)  
 :-9999 (MISSING VALUES)  
 :PROVIDED BY DOC/NOAA/NOS/CO-OPS, (301) 713-2540  
 :corms@noaa.gov  
 .A NWPR1 20130916 Z DH1830/TAIRP -9999/UGIRP 6/PLIRP 30.01/UDIRP 324/USIRP  
 5/TWIRP 65/WCIRP -9999  
 .E CPTR1 20130916 Z DH1824/TAIRG/DIN06/ 61/ 61/-9999  
 .E CPTR1 20130916 Z DH1824/PLIRG/DIN06/30.03/30.02/-9999  
 .E CPTR1 20130916 Z DH1824/USIRG/DIN06/ 7/ 6/-9999  
 .E CPTR1 20130916 Z DH1824/UDIRG/DIN06/ 294/ 297/-9999  
 .E CPTR1 20130916 Z DH1824/UGIRG/DIN06/ 9/ 8/-9999  
 .E CPTR1 20130916 Z DH1824/TWIRG/DIN06/ 70/ 70

Message header:

- **SXUS51 KWBC** is the WMO header for meteorological surface data in the North Atlantic, per Appendix 4.
- **161839**: The bulletin was created on day 16 at 18:39 GMT.
- **OSONT** is the AWIPS header for meteorological data in the North Atlantic Region, per Appendix 4.

Positional Fields:

- Both .A and .E formats are used within the bulletin. On the first data line in the above example, the meteorological data for the given station is reported using the .A format (single station, multiple parameters).
- **NWPR1** is the NWSLI for Newport, Rhode Island. Appendix 1 provides a list of stations and associated NWSLI and NOS station identifiers.
- **20130916** (year/month/day) is the observation date that is to be associated with the meteorological value(s).
- **Z** specifies that the data are being reported in GMT. If the data are from a Great Lakes station, this time is local standard time (**CS** for Central Standard or **ES** for Eastern Standard).

Data string:

- **DH1830** indicates that the observation time is 18:30 GMT.
- There are several parameter codes included in the meteorological bulletins, as seen in the above example, e.g. **TAIRG**, **UGIRG**, etc. These differentiate the sensor reported.
  - Physical elements:
    - **TA** for air temperature (degrees Fahrenheit),
    - **UG** for wind gusts (miles per hour),
    - **PL** for barometric pressure (sea level, inches),
    - **UD** for wind direction (degrees),

- **US** for wind speed (miles per hour),
- **TW** for water temperature (sea surface, degrees Fahrenheit),
- **WC** for water conductivity (uMHOS/CM).
- The **I** indicates the data are instantaneous.
- All observed water level values will have either **RG** to indicate the value is received via GOES, or **RP** to indicate the value is received via phone or IP.

Therefore, the data for Newport, RI in this example are:

Measurement date/time (GMT)	Parameter	Observed data
<b>9/16/2013 18:30</b>	Air temperature	Not reported
	Wind gust	6 mph
	Barometric pressure	30.01 in
	Wind direction	324 deg
	Wind speed	5 mph
	Water temperature	65 F
	Conductivity	Not reported

The meteorological data for the next station are reported using the .E format, meaning only one data type is provided as a time-series. The NWSLI is **CPTR1** for Conimicut Light, RI. The observation date and time associated with the first meteorological value is 9/16/2013 18:24 GMT. The parameter codes are interpreted in the same manner as described previously for the .A-formatted records. TAIRG indicates the data are air temperature observations, transmitted via GOES. Since these are a time-series format, the first air temperature value at 18:24 GMT is 61 F, and the next value increments six minutes (18:30 GMT) and is 61 F.

## 4.2 Astronomical Tide Bulletins

CO-OPS generates SHEF astronomical tide (also referred to as predicted tide) bulletins once per day at twenty minutes after midnight (GMT). Each bulletin contains ninety-six hourly water level predictions for each station within the given region, starting with 00:00 GMT of the day the report is run and ending with 23:00 GMT four days into the future. Since Great Lakes stations do not have tides, predictions are not calculated for these stations.

SOUS61 KWBC 160120

TIDNT

:SHEF ENCODED 1 HOUR NOS WATER LEVEL PREDICTED DATA

:NATIONAL WATER LEVEL OBSERVATION NETWORK (NWLON)

:WATER LEVEL VALUES REFERENCED TO MLLW IN FEET (HMIFA)

:AND MSL IN FEET (HHIFA) PROVIDED BY DOC/NOAA/NOS/CO-OPS

:(301)713-2540, corms@noaa.gov

.E PSBM1 20130916 Z DH0000/DC09160000/HMIFA/DIH1/ 19.52/ 18.07/ 14.88/ 10.79

.E1 6.35/ 2.28/ -0.17/ 0.06/ 2.75/ 6.88/ 11.61/ 15.96/ 18.53/ 18.51

.E2 16.31/ 12.80/ 8.64/ 4.37/ 1.04/ 0.04/ 1.78/ 5.50/ 10.24/ 15.15

.E3 18.85/ 20.05/ 18.61/ 15.33/ 11.00/ 6.20/ 1.78/ -0.80/ -0.51/ 2.35

.E4 6.80/ 11.99/ 16.70/ 19.37/ 19.27/ 16.88/ 13.08/ 8.50/ 3.79/ 0.23  
.E5 -0.77/ 1.15/ 5.15/ 10.31/ 15.60/ 19.45/ 20.56/ 18.94/ 15.42/ 10.79  
.E6 5.65/ 1.04/ -1.45/ -0.87/ 2.37/ 7.25/ 12.84/ 17.71/ 20.24/ 19.82  
.E7 17.08/ 12.89/ 7.90/ 2.90/ -0.67/ -1.39/ 0.90/ 5.29/ 10.83/ 16.33  
.E8 20.05/ 20.84/ 18.87/ 15.04/ 10.11/ 4.78/ 0.24/ -1.88/ -0.78/ 2.93  
.E9 8.22/ 14.04/ 18.79/ 20.88/ 19.96/ 16.77/ 12.21/ 6.94/ 1.88/ -1.40  
.E10 -1.61/ 1.17

Message header:

- **SOUS61 KWBC** is the WMO header for data generated in the North Atlantic, per Appendix 4.
- **160120**: The bulletin was created on day 16 at 01:20 GMT.
- **TIDNT** is the AWIPS header for tide data in the North Atlantic Region, per Appendix 4.

Positional Fields:

- Only the **.E** format is used (single station, single parameter time-series).
- On the first **.E** line in the example, **PSBM1** is the NWSLI for Eastport, ME. Appendix 1 provides a list of stations and associated NWSLI and NOS station identifiers.
- **20130916** (year/month/day) is the date associated with the first astronomical tide value.
- **Z** specifies that the data are being reported in GMT.

Data string:

- **DH0000** indicates that the time of the first astronomical tide value is 00:00 GMT.
- **DC09160000** (month/day/time) is the creation date of 09/16 00:00 GMT. Although this information is already included within the bulletin, and thus may seem redundant, the creation date is included to avoid generating a ‘nonfatal SHEF error’ in decoders. Therefore, CO-OPS has chosen to include this DC field with the same month/day/hour/minute information contained in **20130916** and **DH0000**.
- **HMIFA** is the parameter code for the predicted tide data. (Note: In previous versions, HMIFZ was used but has been changed to FA as of Dec. 2012.).
  - **HM**: Water level data that have been corrected to MLLW. An **HH** in this position would designate water level data that have been corrected to MSL.
  - **I** indicates the data are instantaneous.
  - **FA** indicates adjusted forecast model data, per the NWS SHEF Code Manual [REF 5].
- The final set of characters in the header, **DIH1**, indicates a time increment of 1 hour between each data measurement.

The remaining values are astronomical tides above MLLW, reported in feet. The date and time for the first measurement is 09/16/2013 00:00 GMT, and the Data Interval designator indicates 1 hour is to be added to this time to determine the next value timestamp, and so on. Therefore, the tide predictions for Eastport in this example are:

Date/time (GMT)	Astronomical tide (MLLW)
9/16/2013 00:00	19.52 ft
9/16/2013 01:00	18.07 ft

<b>9/16/2013 02:00</b>	<b>14.88 ft</b>
•	
•	
•	
<b>9/19/2013 21:00</b>	-1.40 ft
<b>9/19/2013 22:00</b>	-1.61 ft
<b>9/19/2013 23:00</b>	1.17 ft

### 4.3 OFS Water Level Guidance Bulletins

In December 2012, CO-OPS released new SHEF bulletins containing Operational Forecast System (OFS) water level model guidance from the OFS models. Ten OFS models (Chesapeake Bay, Delaware Bay, Tampa Bay, Northern Gulf of Mexico, Columbia River Estuary, and the five Great Lakes models) produce 48-hour model guidance of time series data updated every 6 hours, and two models (New York/New Jersey and St. Johns River) provide 24-hour model guidance updated every 6 hours. Modeled water levels are total water levels (astronomical tide plus surge). CO-OPS models are not designed as a storm surge model, although meteorological conditions are taken into account. Model guidance is only provided at the location of active and historical water level station locations (Appendix 1). Historical stations are stations that have been physically removed and are no longer used. Model grid points outside these locations are not included. Thus, the OFS Water Level SHEF bulletins contain the full 48-hour or 24-hour model guidance of 30-minute data, and are issued every 6 hours to remain consistent with the OFS output. More information on the OFS models can be found on the CO-OPS website [REF 4].

SOUS41 KWBC 191630

TIDCB

:SHEF ENCODED 30 MINUTE WATER LEVEL MODEL GUIDANCE

:WATER LEVEL VALUES REFERENCED TO MLLW IN FEET (HMIFU)

:TIME ZONE IS UTC

:WATER LEVEL MODEL GUIDANCE IS FOR TOTAL WATER LEVELS

:PROVIDED BY DOC/NOAA/NOS/CO-OPS

:corms@noaa.gov 301-713-2540

.E SWPV2 20121119 Z DH1200/DC11191200/HMIFU/DIN30/ 1.537 / 1.644 / 1.809 / 2.064 / 2.433

.E1 3.254/ 3.571 / 3.819 / 4.057 / 4.245 / 4.346 / 4.386 / 4.328 / 4.187 / 3.972 / 3.768 / 3.555

.E2 3.257/ 2.910 / 2.537 / 2.212 / 1.941 / 1.781 / 1.716 / 1.716 / 1.759 / 1.872 / 2.058 / 2.321

.E3 2.641/ 2.992 / 3.321 / 3.600 / 3.810 / 3.955 / 4.019 / 4.013 / 3.956 / 3.848 / 3.696 / 3.515

.E4 3.300/ 3.037 / 2.723 / 2.396 / 2.110 / 1.895 / 1.773 / 1.737 / 1.773 / 1.859 / 2.004 / 2.214

.E5 2.489/ 2.813 / 3.154 / 3.484 / 3.763 / 3.975 / 4.102 / 4.140 / 4.115 / 4.027 / 3.890 / 3.709

.E6 3.505/ 3.256 / 2.940 / 2.577 / 2.218 / 1.908 / 1.678 / 1.536 / 1.471 / 1.469 / 1.524 / 1.636

.E7 1.818/ 2.071 / 2.382 / 2.731 / 3.060 / 3.350 / 3.579 / 3.734 / 3.812 / 3.811 / 3.762 / 3.665

.E8 3.523/ 3.342 / 3.119 / 2.853 / 2.548 / 2.246 / 1.987

Message header:

- **SOUS41 KWBC** is the WMO header for surface data in the North Atlantic, per Appendix 4.
- **191630**: The bulletin was created on day 19 at 16:30 GMT.
- **TIDCB** is the AWIPS header, and pertains to the Chesapeake Bay OFS, per Appendix 4.

Positional Fields:

- Only the .E format is used (single station, single parameter time-series).
- On the first .E line in the above example, **SWPV2** is the NWSLI for Sewells Point, VA. Appendix 1 provides a list of active and historical stations that may be used in the OFS bulletins.
- **20121119** (year/month/day) is the date that is to be associated with the first model guidance value.
- **Z** specifies that the data are being reported in GMT.

Data string:

- **DH1200** indicates that the time of the first value is 12:00 GMT.
- **DC11191200** is the creation date of 11/19 at 12:00 GMT, which is the date and time that the model guidance is valid. In this case, the Chesapeake Bay OFS model was run on 11/19 at 12:00 GMT.
- **HMIFU** is the parameter code for the model guidance data.
  - **HM** designates the generation of forecast water level data that has been corrected to MLLW (Mean Lower Low Water). An **HH** in this position would designate water level data that have been corrected to MSL (Mean Sea Level) and an **HG** in this position refers to height above river stage.
  - The **I** indicates the data are instantaneous.
  - **FU** indicates unadjusted forecast model data, per the NWS SHEF Code Manual [REF 5].
- The final set of characters in the header, **DIN30**, indicates a time increment of thirty minutes between each data measurement.

The remaining values are the water level guidance reported in feet. The date and time of the first value is **11/19/2012 12:00**. Thirty minutes needs to be added to this time to determine the timestamp of the next value, and so on. Therefore, the model guidance for Sewells Point in this example is:

Date/time (GMT)	Water Level Guidance (MLLW)
<b>11/19/2012 12:00</b>	1.537 ft
<b>11/19/2012 12:30</b>	1.644 ft
<b>11/19/2012 13:00</b>	1.809 ft
.	
.	
.	
<b>11/21/2012 10:30</b>	2.548 ft
<b>11/21/2012 11:00</b>	2.246 ft
<b>11/21/2012 11:30</b>	1.987 ft





## **5.1 Station Status**

CO-OPS maintains an interface on its Web Services home page that provides a convenient view of the sensor dissemination status for each CO-OPS and CO-OPS partner station. This sensor status display is located at <http://opendap.co-ops.nos.noaa.gov/stations/index.jsp>. If dissemination of a sensor is stopped by the CORMS quality control operators, then the data will not be included in the SHEF and CREX bulletins. Dissemination will be turned off if stations or sensors are not transmitting data, are malfunctioning, are undergoing maintenance, or an event has temporarily or permanently impacted the operation of the station. If an entire station is not operating, the station will not be listed in the CREX and SHEF bulletins. Stations are listed by a seven-digit NOS identifier. To determine the associated NWS Location Identifier (NWSLI, or sometimes referred to as a SHEF ID) associated with the station, see Appendix 1, or the Web Services XML file of active water level/meteorological stations located here: <http://opendap.co-ops.nos.noaa.gov/axis/webservices/activestations/response.jsp?v=2&format=xml&Submit=Submit>

## **5.2 Product Changes/Updates**

Any changes to CREX or SHEF products will be communicated through a Service Change Notice (SCN), per NWS Directive 10-1805 [REF 7], which will be posted on the NWS Office of Climate, Water and Weather Services website: <http://www.nws.noaa.gov/om/notif.htm>. The SCN will provide a thirty-day lead time for users to adjust their decoders or applications. Users who subscribe to these notices will automatically receive the updates, and they are also ingested into AWIPS. In addition to the SCN, CREX changes will be posted to the GTS thirty days ahead of time. All notifications will include the product WMO header, and if applicable, AWIPS header, as well as an implementation date.

## **5.3 Reporting Problems**

It is expected that from time to time there may be questions regarding the operation of these various products or suggestions for improvement. Users should contact CO-OPS User Services (Tide.Predictions@noaa.gov, 301-713-2890) for any questions related to the data or products.

## REFERENCES

1. CO-OPS Sensor Specifications and Measurement Algorithms, July 2013  
[http://tidesandcurrents.noaa.gov/publications/CO-OPS\\_Measure\\_Spec\\_07\\_July\\_2013.pdf](http://tidesandcurrents.noaa.gov/publications/CO-OPS_Measure_Spec_07_July_2013.pdf)
2. World Meteorological Organization Manual on Codes (WMO-No. 306)  
<http://www.wmo.int/pages/prog/www/WMOCodes.html>
3. World Meteorological Organization BUFR/CREX Tables  
[http://www.wmo.int/pages/prog/www/WMOCodes/WMO306\\_vI2/PrevVERSIONS/20121107/20121107.html](http://www.wmo.int/pages/prog/www/WMOCodes/WMO306_vI2/PrevVERSIONS/20121107/20121107.html)
4. CO-OPS website: <http://tidesandcurrents.noaa.gov/>
5. NWS SHEF Code Manual  
[http://www.nws.noaa.gov/om/water/resources/SHEF\\_CodeManual\\_5July2012.pdf](http://www.nws.noaa.gov/om/water/resources/SHEF_CodeManual_5July2012.pdf)
6. World Meteorological Organization Manual on the Global Telecommunication System (WMO – No. 386)  
[http://www.wmo.int/pages/prog/www/ois/Operational\\_Information/Publications/WMO\\_386/WMO\\_386\\_Vol\\_I\\_2009\\_en.pdf](http://www.wmo.int/pages/prog/www/ois/Operational_Information/Publications/WMO_386/WMO_386_Vol_I_2009_en.pdf)
7. National Weather Service Directive 10-1805 National Service Change and Technical Implementation Notices  
<http://www.nws.noaa.gov/directives/sym/pd01018005curr.pdf>
8. National Weather Service Directive 10-101 Change Management Process  
<http://www.nws.noaa.gov/directives/sym/pd01001001curr.pdf>

## APPENDIX 1: STATION LIST

Below is a list of the stations included in the CREX and SHEF messages. Both the NOS and NWS identifiers are given, along with the common station name, and its latitude and longitude. NOS station identifiers have been assigned by NOS, and are always 7 digits in length. The NWS Location Identifiers are assigned by NWS and are 5 alphanumeric characters in length. Latitude and Longitude (decimal degrees) are the historical positions identified when the station was first established, and were used to determine the NOS ID. However, some stations that were destroyed and rebuilt, or relocated, might have different positions than what is listed below. Please contact [tide.predictions@noaa.gov](mailto:tide.predictions@noaa.gov) with any questions.

To see any changes made to this listing between revision releases of this document, connect to CO-OPS Web Services Data Inventory page and select an NOS ID:

<http://opendap.co-ops.nos.noaa.gov/axis/webservices/datainventory/index.jsp>

### Active stations:

NOS ID	NWSLI	LAT	LON	LOCATION	Has 1-min WL Data
1611400	NWWH1	21.95440	-159.35610	Nawiliwili, HI	✓
1612340	OOUH1	21.30669	-157.86700	Honolulu, HI	✓
1612480	MOKH1	21.43303	-157.78989	Mokuoloe, HI	✓
1615680	KLIH1	20.89500	-156.47669	Kahului, HI	✓
1617433	KWHH1	20.03660	-155.82940	Kawaihae, HI	✓
1617760	ILOH1	19.73031	-155.05589	Hilo, HI	✓
1619910	SNDP5	28.21170	-177.36000	Sand Island, Midway Islands	✓
1630000	APRP7	13.44310	144.65560	Apra Harbor, Guam	✓
1631428	PGBP7	13.42830	144.79890	Pago Bay, Guam	✓
1770000	NSTP6	-14.27661	-170.68931	Pago Pago, American Samoa	✓
1820000	KWJP8	8.73200	167.73439	Kwajalein, Marshall Islands	✓
1890000	WAKP8	19.29067	166.61758	Wake Island, Pacific Ocean	✓
2695540	BEPB6	32.37331	-64.70331	Bermuda Esso Pier	✓
8311030	OBSG6	44.70286	-75.49444	Ogdensburg, NY	
8311062	ALXN6	44.33111	-75.93453	Alexandria Bay, NY	
8410140	PSBM1	44.90331	-66.98500	Eastport, ME	✓
8411060	CFWM1	44.65703	-67.20467	Cutler Farris Wharf, ME	✓
8413320	ATGM1	44.39219	-68.20428	Bar Harbor, ME	✓
8418150	CASM1	43.65670	-70.24670	Portland, ME	✓
8419317	WELM1	43.32000	-70.56331	Wells, ME	✓
8423898	FTPN3	43.07170	-70.71170	Fort Point, NH	
8443970	BHBM3	42.35480	-71.05340	Boston, MA	✓
8447386	FRVM3	41.70430	-71.16410	Fall River, MA	✓
8447387	BLTM3	41.70500	-71.17330	Borden Flats Light, MA	

8447930	BZBM3	41.52330	-70.67170	Woods Hole, MA	✓
8449130	NTKM3	41.28500	-70.09670	Nantucket Island, RI	✓
8452660	NWPR1	41.50500	-71.32670	Newport, RI	✓
8452944	CPTR1	41.71670	-71.34330	Conimicut Light, RI	✓
8452951	PTCR1	41.63717	-71.33928	Potter Cove, RI	
8454000	FOXR1	41.80710	-71.40120	Providence, RI	✓
8454049	QPTR1	41.58680	-71.41100	Quonset Point, RI	✓
8461490	NLNC3	41.36139	-72.08997	New London, CT	✓
8465705	NWHC3	41.28330	-72.90830	New Haven, CT	✓
8467150	BRHC3	41.17330	-73.18170	Bridgeport, CT	✓
8510560	MTKN6	41.04830	-71.96000	Montauk, NY	✓
8516945	KPTN6	40.81030	-73.76490	Kings Point, NY	✓
8518750	BATN6	40.70060	-74.01420	The Battery, NY	✓
8519483	BGNN4	40.63670	-74.14170	Bergen Point West Reach, NY	
8530973	ROBN4	40.65670	-74.06500	Robbins Reef, NJ	
8531680	SDHN4	40.46690	-74.00940	Sandy Hook, NJ	✓
8534720	ACYN4	39.35500	-74.41830	Atlantic City, NJ	✓
8536110	CMAN4	38.96833	-74.96000	Cape May, NJ	✓
8537121	SJSN4	39.30500	-75.37500	Ship John Shoal, NJ	✓
8538886	TPBN4	40.01194	-75.04300	Tacony-Palmyra Bridge, NJ	✓
8539094	BDRN4	40.08170	-74.86970	Burlington, NJ	✓
8540433	MRCP1	39.81170	-75.41000	Marcus Hook, PA	✓
8545240	PHBP1	39.93333	-75.14167	Philadelphia, PA	✓
8548989	NBLP1	40.13670	-74.75170	Newbold, PA	✓
8551762	DELD1	39.58170	-75.58830	Delaware City, DE	✓
8551910	RDYD1	39.55831	-75.57331	Reedy Point, DE	✓
8557380	LWSD1	38.78169	-75.12000	Lewes, DE	✓
8570283	OCIM2	38.32833	-75.09167	Ocean City Inlet, MD	✓
8571421	BISM2	38.22000	-76.03830	Bishops Head, MD	✓
8571892	CAMM2	38.57330	-76.06830	Cambridge, MD	✓
8573364	TCBM2	39.21333	-76.24500	Tolchester Beach, MD	✓
8573927	CHCM2	39.52670	-75.81000	Chesapeake City, MD	✓
8574680	BLTM2	39.26667	-76.57833	Baltimore, MD	✓
8574728	FSKM2	39.22000	-76.52830	Francis Scott Key Bridge, MD	
8575512	APAM2	38.98328	-76.48156	Annapolis, MD	✓
8577018	COVM2	38.40436	-76.38550	Cove Point LNG Pier, MD	
8577330	SLIM2	38.31667	-76.45167	Solomons Island, MD	✓
8578240	PPTM2	38.13330	-76.53330	Piney Point, MD	
8594900	WASD2	38.87333	-77.02167	Washington, DC	✓
8631044	WAHV2	37.60778	-75.68583	Wachapreague, VA	✓
8632200	KPTV2	37.16519	-75.98844	Kiptopeke, VA	✓
8632837	RPLV2	37.53830	-76.01500	Rappahannock Light, VA	
8635750	LWTV2	37.99611	-76.46444	Lewisetta, VA	✓

8636580	WNDV2	37.61620	-76.29000	Windmill Point, VA	✓
8637611	YKRV2	37.25000	-76.33330	York River East Rear Range Light, VA	
8637689	YKTV2	37.22667	-76.47833	Yorktown USCG Training Center, VA	✓
8638511	DOMV2	36.96232	-76.42421	Dominion Terminal Associates, VA	
8638595	CRYV2	36.88830	-76.33830	South Craney Island, VA	
8638610	SWPV2	36.94667	-76.33000	Sewells Point, VA	✓
8638614	WDSV2	36.98170	-76.32170	Willoughby Degaussing Station, VA	
8638863	CBBV2	36.96667	-76.11333	Chesapeake Bay Bridge Tunnel, VA	✓
8638999	CHYV2	36.93000	-76.00670	Cape Henry, VA	
8639348	MNPV2	36.77830	-76.30170	Money Point, VA	✓
8651370	DUKN7	36.18331	-75.74669	Duck, NC	✓
8652587	ORIN7	35.79500	-75.54830	Oregon Inlet Marina, NC	✓
8654467	HCGN7	35.20864	-75.70417	USCG Station Hatteras, NC	✓
8656483	BFTN7	34.72000	-76.67000	Beaufort, NC	✓
8658120	WLON7	34.22670	-77.95330	Wilmington, NC	✓
8658163	JMPN7	34.21330	-77.78670	Wrightsville Beach, NC	✓
8661070	MROS1	33.65500	-78.91830	Springmaid Pier, SC	✓
8662245	NITS1	33.35170	-79.18670	Oyster Landing, SC	✓
8665530	CHTS1	32.78170	-79.92500	Charleston, SC	✓
8670870	FPKG1	32.03330	-80.90170	Fort Pulaski, GA	✓
8720030	FRDF1	30.67170	-81.46500	Fernandina Beach, FL	✓
8720218	MYPF1	30.39670	-81.43000	Mayport (Bar Pilots Dock), FL	✓
8720357	BKBF1	30.19170	-81.69170	I-295 Bridge, St Johns River, FL	
8721604	TRDF1	28.41580	-80.59310	Trident Pier, FL	✓
8722670	LKWF1	26.61170	-80.03330	Lake Worth Pier, FL	✓
8723214	VAKF1	25.73140	-80.16180	Virginia Key, FL	✓
8723970	VCAF1	24.71170	-81.10500	Vaca Key, FL	✓
8724580	KYWF1	24.55570	-81.80790	Key West, FL	✓
8725110	NPSF1	26.13170	-81.80750	Naples, FL	✓
8725520	FMRF1	26.64770	-81.87120	Fort Myers, FL	✓
8726384	PMAF1	27.63870	-82.56210	Port Manatee, FL	
8726413	CCUF1	27.66330	-82.61830	C-Cut, FL	
8726520	SAPF1	27.76060	-82.62690	St. Petersburg, FL	✓
8726607	OPTF1	27.85778	-82.55269	Old Port Tampa, FL	
8726667	MCYF1	27.91333	-82.42500	Mckay Bay Entrance, FL	
8726669	ERTF1	27.91720	-82.44380	Berth 223, FL	
8726673	SBLF1	27.92330	-82.44500	Seabulk, FL	
8726679	TSHF1	27.92889	-82.42575	East Bay Causeway, FL	
8726694	TPAF1	27.93330	-82.43330	TPA Cruise Terminal 2, FL	
8726724	CWBF1	27.97830	-82.83170	Clearwater Beach, FL	✓
8727520	CKYF1	29.13500	-83.03170	Cedar Key, FL	✓
8728690	APCF1	29.72670	-84.98170	Apalachicola, FL	✓
8729108	PACF1	30.15228	-85.66694	Panama City, FL	✓

8729210	PCBF1	30.21330	-85.87830	Panama City Beach, FL	✓
8729840	PCLF1	30.40440	-87.21120	Pensacola, FL	✓
8732828	WBYA1	30.41670	-87.82500	Weeks Bay, AL	✓
8734673	FMOA1	30.22830	-88.02500	Fort Morgan, AL	
8735180	DILA1	30.25000	-88.07500	Dauphin Island, AL	✓
8735391	BYSA1	30.56517	-88.08800	Dog River Bridge, AL	✓
8735523	EFRA1	30.44369	-88.11392	East Fowl River Bridge, AL	✓
8736163	MBPA1	30.52711	-88.08656	Middle Bay Port, AL	
8736897	MCGA1	30.64830	-88.05830	Coast Guard Sector Mobile, AL	✓
8737005	PTOA1	30.67114	-88.03106	Pinto Island, AL	
8737048	OBLA1	30.70830	-88.04330	Mobile State Docks, AL	✓
8737138	CIKA1	30.78189	-88.07361	Chickasaw Creek, AL	
8738043	WFRA1	30.37664	-88.15856	West Fowl River Bridge, AL	✓
8739803	BLBA1	30.40567	-88.24769	Bayou La Batre Bridge, AL	
8741003	PTBM6	30.21330	-88.50000	Petit Bois Island, MS	
8741041	ULAM6	30.34770	-88.50540	Dock E, MS	✓
8741094	RARM6	30.34330	-88.51170	Range A Rear, MS	
8741501	DKCM6	30.35500	-88.56670	Dock C, MS	
8741533	PNLM6	30.36790	-88.56300	Pascagoula NOAA Lab, MS	✓
8747437	WYCM6	30.32639	-89.32578	Bay Waveland Yacht Club, MS	✓
8760721	PILL1	29.17830	-89.25830	Pilottown, LA	
8760922	PSTL1	28.93220	-89.40750	Pilots Station East, SW Pass, LA	✓
8761305	SHBL1	29.86811	-89.67325	Shell Beach, LA	✓
8761724	GISL1	29.26333	-89.95667	Grand Isle, LA	✓
8761927	NWCL1	30.02717	-90.11342	New Canal Station, LA	✓
8761955	CARL1	29.93289	-90.13547	Carrollton, LA	✓
8762075	PTFL1	29.11425	-90.19925	Port Fourchon, LA	
8762482	BYGL1	29.78856	-90.42019	West Bank, Bayou Gauche, LA	✓
8764044	TESL1	29.66750	-91.23761	Berwick, LA	✓
8764227	AMRL1	29.44958	-91.33811	LAWMA, Amerada Pass, LA	✓
8766072	FRWL1	29.55500	-92.30500	Freshwater Canal Locks, LA	✓
8767816	LCLL1	30.22364	-93.22167	Lake Charles, LA	✓
8767961	BKTL1	30.19031	-93.30069	Bulk Terminal, LA	✓
8768094	CAPL1	29.76817	-93.34289	Calcasieu Pass, LA	✓
8770475	PORT2	29.86670	-93.93000	Port Arthur, TX	
8770520	RBBT2	29.98000	-93.88170	Rainbow Bridge, TX	
8770570	SBPT2	29.72840	-93.87010	Sabine Pass North, TX	✓
8770613	MGPT2	29.68170	-94.98500	Morgans Point, TX	
8770777	NCHT2	29.72628	-95.26581	Manchester, TX	
8770822	TXPT2	29.67806	-93.83694	Texas Point, Sabine Pass, TX	✓
8770971	RLOT2	29.51500	-94.51330	Rollover Pass, TX	
8771013	EPTT2	29.48000	-94.91830	Eagle Point, TX	✓
8771341	GNJT2	29.35733	-94.72483	Galveston Bay Entrance, North Jetty, TX	✓

8771450	GTOT2	29.31000	-94.79330	Galveston Pier 21, TX	✓
8772447	FCGT2	28.94331	-95.30250	USCG Freeport, TX	✓
8773037	SDRT2	28.40830	-96.71170	Seadrift, TX	
8773259	VCAT2	28.64000	-96.59500	Port Lavaca, TX	
8773701	PCNT2	28.45170	-96.38830	Port O'Connor, TX	
8774513	CPNT2	28.11830	-97.02170	Copano Bay, TX	
8774770	RCPT2	28.02170	-97.04670	Rockport, TX	✓
8775237	RTAT2	27.83830	-97.07330	Port Aransas, TX	
8775283	NGLT2	27.82170	-97.20330	Port Ingleside, TX	
8775296	TAQT2	27.81170	-97.39000	USS Lexington, TX	
8775792	PACT2	27.63330	-97.23670	Packery Channel, TX	
8775870	MQTT2	27.58000	-97.21670	Bob Hall Pier, TX	✓
8776139	IRDT2	27.48000	-97.32170	S. Bird Island, TX	
8776604	BABT2	27.29500	-97.40500	Baffin Bay, TX	
8777812	RSJT2	26.82500	-97.49170	Rincon Del San Jose, TX	
8779748	PCGT2	26.07670	-97.17670	South Padre Island, TX	
8779770	PTIT2	26.06000	-97.21500	Port Isabel, TX	✓
9014070	AGCM4	42.62100	-82.52690	Algonac, MI	
9014080	SCRM4	42.81240	-82.48581	St Clair State Police, MI	
9014087	PHXM4	42.94530	-82.44350	Dry Dock, MI	
9014090	MBRM4	42.97380	-82.42040	Mouth of the Black River, MI	
9014096	DUPM4	43.00250	-82.42240	Dunn Paper, MI	
9014098	FTGM4	43.00690	-82.42250	Fort Gratiot, MI	
9034052	SCSM4	42.47322	-82.87925	St Clair Shores, MI	
9044020	GRTM4	42.09090	-83.18600	Gibraltar, MI	
9044030	WDTM4	42.20240	-83.14750	Wyandotte, MI	
9044036	FWNM4	42.29894	-83.09258	Fort Wayne, MI	
9044049	WMPM4	42.35778	-82.92994	Windmill Point, MI	
9052000	CAVN6	44.13019	-76.33197	Cape Vincent, NY	
9052030	OSGN6	43.46417	-76.51183	Oswego, NY	
9052058	RCRN6	43.26903	-77.62575	Rochester, NY	
9052076	OCTN6	43.33839	-78.72733	Olcott, NY	
9063007	NGAN6	43.09992	-79.05992	Ashland Ave., NY	
9063009	AMFN6	43.08106	-79.06136	American Falls, NY	
9063012	NIAN6	43.07692	-79.01389	Niagara Intake, NY	
9063020	BUFN6	42.87744	-78.89047	Buffalo, NY	
9063028	PSTN6	42.69131	-79.04733	Sturgeon Point, NY	
9063038	EREP1	42.15400	-80.09250	Erie, PA	
9063053	FAIO1	41.75975	-81.28106	Fairport, OH	
9063063	CNDO1	41.54086	-81.63547	Cleveland, OH	
9063079	MRHO1	41.54364	-82.73139	Marblehead, OH	
9063085	THRO1	41.69356	-83.47228	Toledo, OH	
9063090	FPPM4	41.96010	-83.25690	Fermi Power Plant, OH	

9075002	LKPM4	43.14039	-82.49389	Lakeport, MI	
9075014	HRBM4	43.84619	-82.64311	Harbor Beach, MI	
9075035	ESVM4	43.64040	-83.84680	Essexville, MI	
9075065	LPNM4	45.06300	-83.42860	Alpena, MI	
9075080	MACM4	45.77789	-84.72533	Mackinaw City, MI	
9075099	DTLM4	45.99250	-83.89820	De Tour Village, MI	
9076024	RCKM4	46.26480	-84.19120	Rock Cut, MI	
9076027	WNEM4	46.28469	-84.20981	West Neebish Island, MI	
9076033	LTRM4	46.48572	-84.30183	Little Rapids, MI	
9076060	USSM4	46.50100	-84.34030	U.S. Slip, MI	
9076070	SWPM4	46.50111	-84.37261	S.W. Pier, MI	
9087023	LDTM4	43.94736	-86.44161	Ludington, MI	
9087031	HLNM4	42.76811	-86.20119	Holland, MI	
9087044	CMTI2	41.72986	-87.53839	Calumet Harbor, IL	
9087057	MLQW3	43.00200	-87.88760	Milwaukee, WI	
9087068	KWNW3	44.46397	-87.50103	Kewaunee, WI	
9087069	KWNW3	44.46500	-87.49572	Kewaunee MET, WI	
9087072	SBCW3	44.79558	-87.31433	Sturgeon Bay Canal, WI	
9087079	GBWW3	44.54106	-88.00719	Green Bay, WI	
9087088	MNMM4	45.09589	-87.58994	Menominee, MI	
9087096	PNLM4	45.96989	-85.87150	Port Inland, MI	
9099004	PTIM4	46.48450	-84.63089	Point Iroquois, MI	
9099018	MCGM4	46.54558	-87.37908	Marquette C.G., MI	
9099044	OGOM4	46.87433	-89.32417	Ontonagon, MI	
9099064	DULM5	46.77570	-92.09200	Duluth, MN	
9099090	GDMM5	47.74783	-90.34133	Grand Marais, MN	
9410170	SDBC1	32.71419	-117.17358	San Diego, CA	✓
9410172	IIWC1	32.71394	-117.17533	USS Midway, CA	
9410230	LJAC1	32.86670	-117.25800	La Jolla, CA	✓
9410647	AGXC1	33.71583	-118.24611	Angels Gate, CA	
9410660	OHBC1	33.72000	-118.27200	Los Angeles, CA	✓
9410665	PRJC1	33.73300	-118.18569	Los Angeles Pier J, CA	
9410666	PFDC1	33.73519	-118.24131	Los Angeles Pier 400, CA	
9410670	PFXC1	33.74830	-118.26800	Los Angeles Pier F, CA	
9410690	PXAC1	33.76361	-118.26542	Los Angeles Berth 161, CA	
9410691	BAXC1	33.76631	-118.24011	Los Angeles Badger Ave Bridge, CA	
9410692	PSXC1	33.76831	-118.22569	Los Angeles Pier S, CA	
9410840	ICAC1	34.00830	-118.50000	Santa Monica, CA	✓
9411340	NTBC1	34.40830	-119.68500	Santa Barbara, CA	✓
9411406	HRVC1	34.46830	-120.67300	Oil Platform Harvest, CA	
9412110	PSLC1	35.17670	-120.76000	Port San Luis, CA	✓
9413450	MTYC1	36.60500	-121.88800	Monterey, CA	✓
9414290	FTPC1	37.80669	-122.46500	San Francisco, CA	✓



9414311	PXOC1	37.79800	-122.39297	San Francisco Pier 1, CA	
9414523	RTYC1	37.50670	-122.21000	Redwood City, CA	✓
9414750	AAMC1	37.77167	-122.29833	Alameda, CA	✓
9414763	LNDC1	37.79500	-122.28300	Oakland Berth 67, CA	
9414769	OMHC1	37.80000	-122.33000	Oakland Middle Harbor, CA	
9414776	OKXC1	37.81061	-122.33311	Oakland Berth 34, CA	
9414797	OBXC1	37.80444	-122.34167	Oakland Berth 38, CA	
9414847	PPXC1	37.90581	-122.36503	Point Potrero Richmond, CA	
9414863	RCMC1	37.92830	-122.40000	Richmond, CA	✓
9415020	PRYC1	37.99610	-122.97670	Point Reyes, CA	✓
9415102	MZXC1	38.03464	-122.12519	Martinez-Amorco Pier, CA	
9415115	PSBC1	38.04156	-121.88667	Pittsburg, CA	
9415118	UPBC1	38.03828	-122.12053	Union Pacific Rail Road Bridge, CA	
9415141	DPXC1	38.05669	-122.25961	Davis Point, CA	
9415144	PCOC1	38.05600	-122.03950	Port Chicago, CA	✓
9416841	ANVC1	38.91330	-123.70800	Arena Cove, CA	✓
9418767	HBVC1	40.76670	-124.21700	North Spit, CA	✓
9419750	CECC1	41.74500	-124.18300	Crescent City, CA	✓
9431647	PORO3	42.73897	-124.49828	Port Orford, OR	✓
9432780	CHAO3	43.34500	-124.32200	Charleston, OR	✓
9435380	SBEO3	44.62500	-124.04300	South Beach, OR	✓
9437540	TLBO3	45.55453	-123.91894	Garibaldi, OR	✓
9439011	HMDO3	46.20170	-123.94500	Hammond, OR	✓
9439040	ASTO3	46.20731	-123.76831	Astoria, OR	✓
9439099	WAUO3	46.16000	-123.40500	Wauna, OR	✓
9439201	SHNO3	45.86500	-122.79700	St. Helens, OR	✓
9440083	VAPW1	45.63170	-122.69700	Vancouver, WA	✓
9440422	LOPW1	46.10611	-122.95417	Longview, WA	✓
9440569	SKAW1	46.26670	-123.45200	Skamokawa, WA	✓
9440910	TOKW1	46.70747	-123.96692	Toke Point, WA	✓
9441102	WPTW1	46.90431	-124.10508	Westport, WA	✓
9442396	LAPW1	47.91330	-124.63700	La Push, WA	✓
9443090	NEAW1	48.36667	-124.61167	Neah Bay, WA	✓
9444090	PTAW1	48.12500	-123.44000	Port Angeles, WA	✓
9444900	PTWW1	48.11170	-122.75800	Port Townsend, WA	✓
9446482	TCMW1	47.27583	-122.41778	Tacoma MET, WA	
9446484	TCNW1	47.26667	-122.41333	Tacoma, WA	✓
9447130	EBSW1	47.60264	-122.33931	Seattle, WA	✓
9449424	CHYW1	48.86330	-122.75800	Cherry Point, WA	✓
9449880	FRDW1	48.54667	-123.01000	Friday Harbor, WA	✓
9450460	KECA2	55.33183	-131.62619	Ketchikan, AK	✓
9451054	PLXA2	56.24670	-134.64700	Port Alexander, AK	✓
9451600	ITKA2	57.05170	-135.34200	Sitka, AK	✓

9452210	JNEA2	58.29830	-134.41200	Juneau, AK	✓
9452400	SKTA2	59.45000	-135.32700	Skagway, AK	✓
9452634	ELFA2	58.19472	-136.34694	Elfin Cove, AK	✓
9453220	YATA2	59.54850	-139.73340	Yakutat, AK	✓
9454050	CRVA2	60.55830	-145.75300	Cordova, AK	✓
9454240	VDZA2	61.12500	-146.36200	Valdez, AK	✓
9455090	SWLA2	60.12000	-149.42667	Seward, AK	✓
9455500	OVI A2	59.44053	-151.71994	Seldovia, AK	✓
9455760	NKTA2	60.68330	-151.39800	Nikiski, AK	✓
9455920	ANTA2	61.23831	-149.89000	Anchorage, AK	✓
9457292	KDAA2	57.73170	-152.51200	Kodiak Island, AK	✓
9457804	ALIA2	56.89830	-154.24700	Alitak, AK	✓
9459450	SNDA2	55.33669	-160.50200	Sand Point, AK	✓
9459881	KGCA2	55.06170	-162.32700	King Cove, AK	✓
9461380	ADKA2	51.86330	-176.63200	Adak Island, AK	✓
9461710	ATKA2	52.23170	-174.17300	Atka, AK	✓
9462450	OLSA2	52.94061	-168.87131	Nikolski, AK	✓
9462620	UNLA2	53.88000	-166.53700	Unalaska, AK	✓
9463502	PMOA2	55.99000	-160.56200	Port Moller, AK	✓
9464212	VCVA2	57.12531	-170.28517	Village Cove, AK	✓
9468756	NMTA2	64.50000	-165.43000	Nome, AK	✓
9491094	RDDA2	67.57670	-164.06500	Red Dog Dock, AK	✓
9497645	PRDA2	70.40000	-148.52700	Prudhoe Bay, AK	✓
9751364	CHSV3	17.75000	-64.70500	Christiansted Harbor, VI	✓
9751381	LAMV3	18.31825	-64.72422	Lameshur Bay, VI	✓
9751401	LTBV3	17.69472	-64.75381	Lime Tree Bay, VI	✓
9751639	CHAV3	18.33583	-64.92000	Charlotte Amalie, VI	✓
9752619	VQSP4	18.15253	-65.44381	Isabel Segunda, PR	✓
9752695	ESPP4	18.09386	-65.47136	Esperanza, PR	✓
9753216	FRDP4	18.33522	-65.63111	Fajardo, PR	✓
9754228	YABP4	18.05508	-65.83300	Yabucoa Harbor, PR	✓
9755371	SJNP4	18.45894	-66.11642	San Juan, PR	✓
9757809	AROP4	18.48053	-66.70236	Arecibo, PR	✓
9758053	PLSP4	17.97253	-66.76178	Penuelas, PR	✓
9759110	MGIP4	17.97008	-67.04642	Magueyes Island, PR	✓
9759394	MGZP4	18.22000	-67.16000	Mayaguez, PR	✓
9759938	MISP4	18.08992	-67.93850	Mona Island, PR	✓
9761115	BARA9	17.59069	-61.82056	Barbuda	✓

### Historical stations used only in OFS bulletins:

NOS ID	NWSLI	LAT	LON	LOCATION
8517276	CLGN6	40.78331	73.85669	College Point, NY
8518668	HHKN6	40.77669	73.94169	Horns Hook, NY
8518905	RIVN6	40.90331	73.91669	Riverdale, NY
8519024	FTWN6	40.60669	74.05500	Fort Wadsworth, NY
8530528	CARN4	40.80669	74.06000	Carlstadt, NJ
8530882	LIZN4	40.67331	74.14000	Port Elizabeth, NJ
8530985	CHKN4	40.65500	74.08500	Constable Hook, NJ
8531232	SMBN4	40.49169	74.28169	South Amboy, NJ
8720219	DMSF1	30.38669	81.55831	Dames Point, FL
8720226	MSBF1	30.32000	81.65831	Main Street Bridge, FL
8720242	LNBF1	30.36000	81.62000	Longbranch, FL
8720503	GCVF1	29.97831	81.62831	Red Bay Point, FL
8720625	RCYF1	29.80169	81.54831	Racy Point, FL
8720767	BUFF1	29.59500	81.68169	Buffalo Bluff, FL
8720774	PLQF1	29.64331	81.63169	Palatka, FL
8725858	VENF1	27.07169	82.45331	Venice Pier, FL
8726217	CTZF1	27.46669	82.68831	Cortez, FL
8726243	AMOF1	27.49669	82.71331	Anna Maria Outside, FL
8726347	EGMF1	27.60169	82.76000	Egmont Key, FL
8726364	MUQF1	27.61500	82.72669	Mullet Key, FL
8726428	TRVF1	27.68831	82.71831	Tierra Verde, FL
8726537	ALOF1	27.78669	82.42669	Apollo Beach, FL
8726641	GNDF1	27.89331	82.53831	Gandy Bridge, FL
8726657	DVSF1	27.90831	82.45169	Davis Island, FL
8726689	BAVF1	27.94169	82.72000	Bay Aristocrat Village, FL
8726738	SFHF1	27.98831	82.68500	Safety Harbor, FL
8745557	GHBM6	30.36000	89.08169	Gulfport Harbor, MS
8770743	BTLT2	29.75669	95.09000	Battleship Texas S.P, TX
9075059	HSVM4	44.66000	83.28669	Harrisville, MI
9439011	HMDO3	46.20453	123.95081	Hammond NMFS Pier, OR
9440571	ALTW1	46.26500	123.65300	Altoona, WA
9440572	ILWW1	46.26831	124.03700	Jetty A, WA
9440574	NJYW1	46.27331	124.07200	North Jetty, WA

## APPENDIX 2: CREX BULLETIN DESCRIPTIONS

One of the formats used for the relay of CO-OPS data to the Global Telecommunications System is called CREX (Character Form for the Representation and EXchange of data). A formal description of CREX code is available in the WMO FM 95 CREX edition 1 Manual on Codes [REF 2]. The major component of CREX messages is a series of elements (or sequences, which are composed of elements) that reference a lookup table. The referenced table provides the element name, units, scale, and data width. The following is a CREX message example for a single station, and Figure 3 describes each section.

```
SZPA37 KWBC 091500
CREX++
T000119 A001 D01021 D06019 R01006 B22038++
1343872 14465394 APRP7 2013 08 09 14 46 3033 00 07 00 01
00780 00776 00771 00767 00760 00758++
7777
```

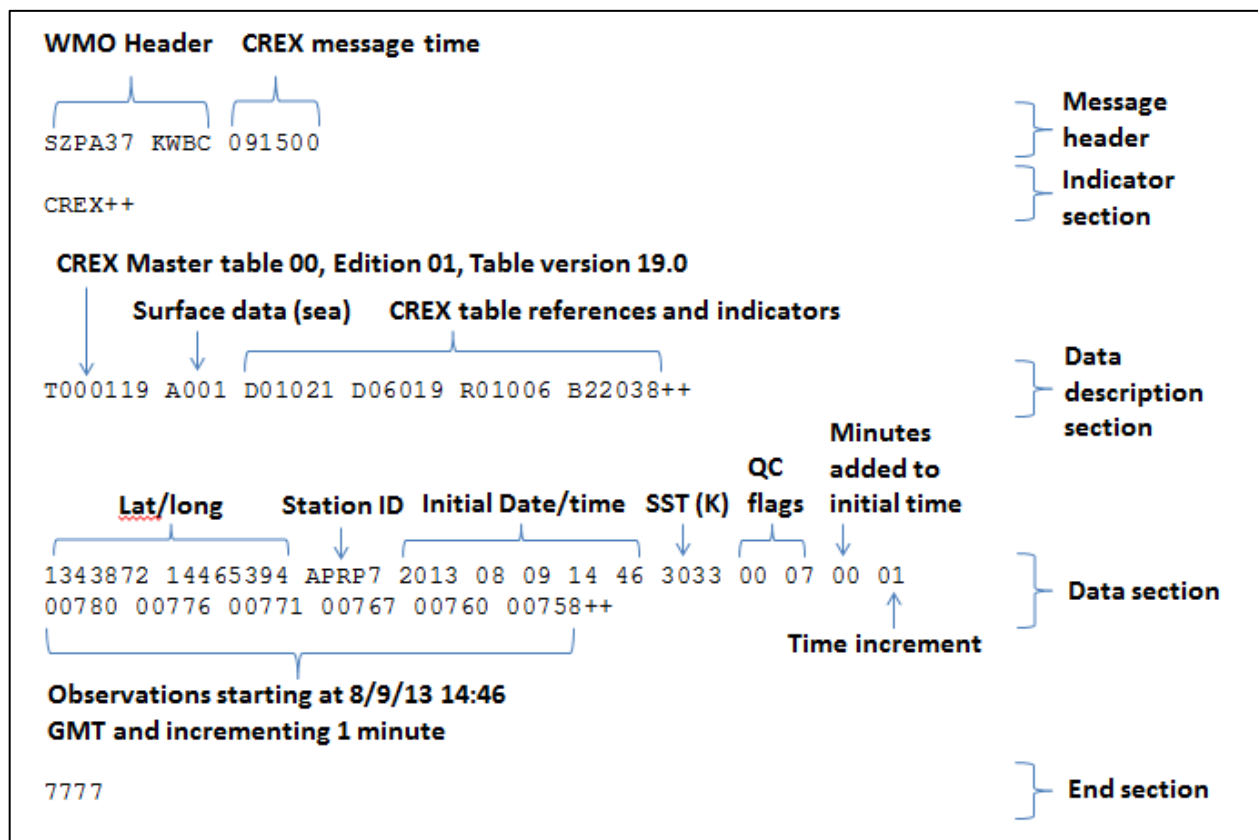


Fig.3. Identification of CREX message sections and elements.

Throughout the bulletin each subset (a station report) ends with the terminator (+) and two plus signs (++) indicate the end of a section. Numerous stations can be included in a single bulletin, which is organized by geographic region.

The **message header** contains the WMO header for that bulletin, which identifies the geographic WMO region in which the data were collected. See Appendix 4 (WMO and AWIPS Headers) for a list of all the region identifiers and a description of the WMO headers. The message time specifies, in GMT, the day, hour, and minute the bulletin was created.

The **Indicator section** marks the beginning of the **CREX** message.

The **Data Description section** provides message metadata and information on the form and content of the data included in the following data section. Each string of characters in the data description section begins with a letter that corresponds to a CREX lookup table. The CREX tables provide information on the data types and operators [REF 3]. The string of characters is a sequence, which can refer to a single data type, or in some cases a group of data types.

- **T000119** indicates that the message uses CREX Master Table number 00, Edition 1 CREX formats, and version **19** of the CREX tables. CREX Editions rarely change, but recently the WMO upgraded to Edition 2, which includes more message metadata in the data description section. Since CO-OPS will eventually retire CREX messages (based on WMO requirements) forcing existing users to upgrade their decoders to Edition 2 was not considered prudent at this time. Table version numbers, however, change frequently based on validation of newer proposed sequences.
- Table **A** provides the data category, and every CO-OPS message contains **A001**, indicating sea surface data.
- Table **B** classifies elements such as identifiers, station position, and data parameters.
- Table **D** provides a list of sequences common to types of observation reporting, or metadata information.
- The **R** indicator for replication specifies that the following x descriptors (in this case B22038) shall be repeated y number of times. This creates a time-series.

The **Data section** provides the station data values corresponding to the data descriptors in the previous section. Station header information is followed by the measurement values. One or more slashes (///) mean a value was not available. Each set of station data ends with +. The last station data set ends with ++ indicating the end of the data section.

The **End section** marks the end of the CREX message, and is always **7777**.

## APPENDIX 3: SHEF BULLETIN DESCRIPTIONS

A format used for the relay of NOS data to NWS is called SHEF (Standard Hydrometeorological Exchange Format). A formal description of SHEF code is available in the NWS SHEF Code Manual [REF 5].

The following is a SHEF message example, and Figure 4 describes each section.

```

SOUS41 KWBC 041830
TIDCB
:SHEF ENCODED 30 MINUTE WATER LEVEL MODEL GUIDANCE
:WATER LEVEL VALUES REFERENCED TO MLLW IN FEET (HMIFU)
:TIME ZONE IS UTC
:WATER LEVEL MODEL GUIDANCE IS FOR TOTAL WATER LEVELS
:PROVIDED BY DOC/NOAA/NOS/CO-OPS
:corms@noaa.gov 301-713-2540
.E SWPV2 20121204 Z DH1200/DC12041200/HMIFU/DIN30/ 0.406 / 0.834 / 1.148 / 1.429 /
1.724 / 1.975
    
```

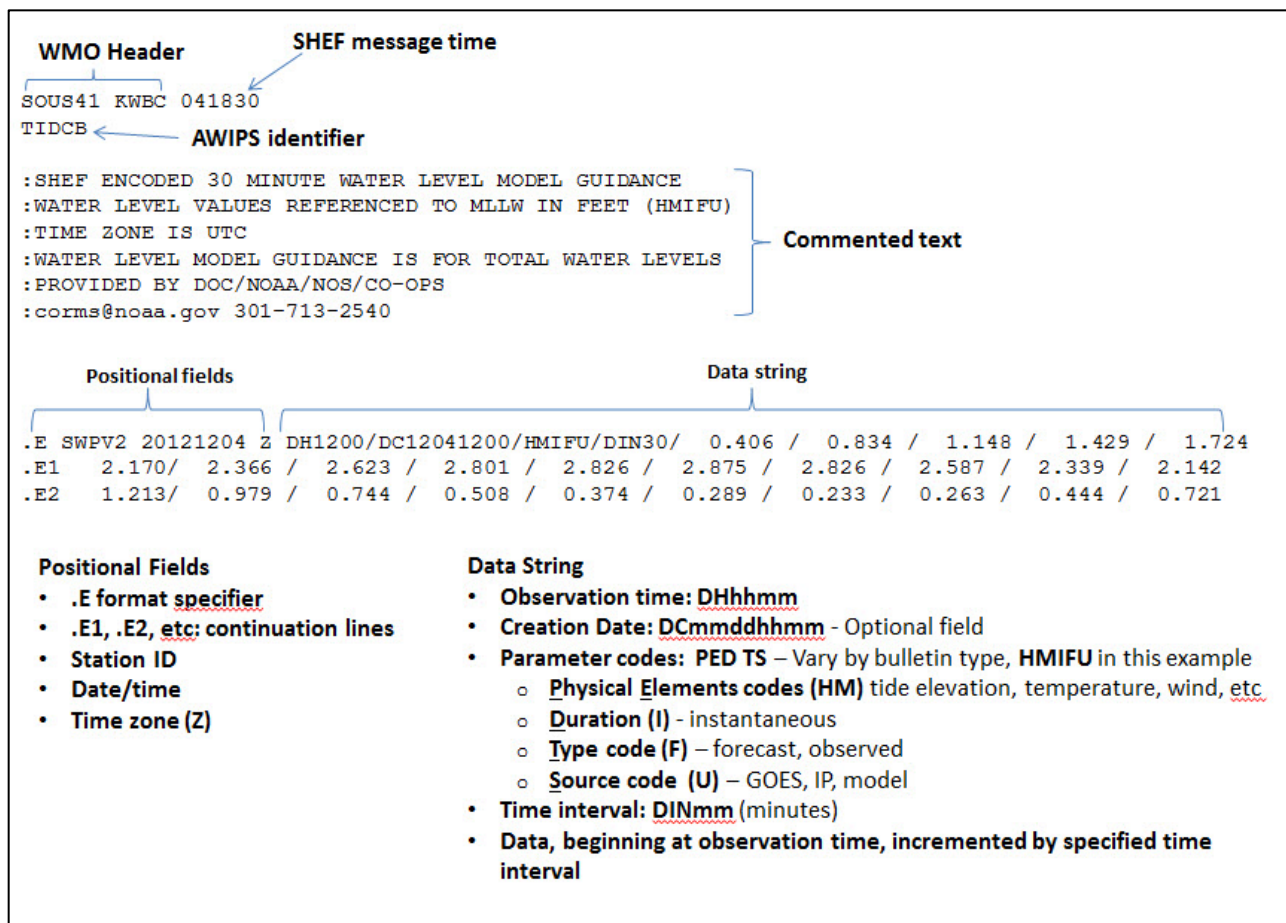


Fig.4. An explanation of SHEF message syntax and elements.

The message header contains the **WMO header**, which identifies the geographic WMO region in which the data were collected, and the **AWIPS header**, which also identifies the geographic

region but is read specifically by AWIPS systems. See Appendix 4 for a list of all the region headers. The message time specifies in GMT, the day, hour, and minute the bulletin was created. The lines that begin with a colon (:) are comment lines.

There are three possible SHEF formats available that can be used depending on the number of stations or data parameters provided in the message: .A, .B, and .E, but CO-OPS only uses .A and .E formats. The .A format is used to display data from multiple data types at a single station, and there will be only one data value associated with each data type. The .E format is used to display a time-series from a single data type at a single station. There can be both .A and .E records for a given station within a single bulletin. The .A and .E formats following the comment lines are specific to each station for which data are being reported. Both formats comprise positional fields and the data string. These components are illustrated in Figure 4, and described below.

### **Positional Fields:**

The positional fields are used for all SHEF formats. These include the format specifier, NWSLI, date, and time zone. The .E1, .E2, .E3, etc. indicate continuation data lines for the .E formatted message. When the station data ends and the next station data sequence begins, the line will reset to .E. Continuation lines are also used in .A formatted messages.

### **Data String:**

The major elements of this section are the observation time, a creation date, parameter codes, a time interval, and the parameter values. A slash (/) is used to separate information. The observation time applies to the first data value in the sequence. The creation date is an optional field mainly used in messages containing forecast data to indicate the time that the data elements were created. CO-OPS uses this field in the OFS Water Level Guidance and the Astronomical Tide bulletins.

The parameter codes describe the data types, and definitions can be found in the SHEF Code Manual [REF 5]. These codes are the Physical Elements (PE), Duration (D) and Type and Source codes (TS), Extremum (E) and Probability (P), or PEDTSEP. CO-OPS does not use E or P.

- Physical Elements: The first two characters designate the data type. The first character is the basic data type, and the second character provides more detail.
- Duration: CO-OPS always uses **I** because all data are instantaneous.
- Type and Source codes indicate whether the data are received directly from the station or have been computed. The type code specifies the type of data within the message, and the source code differentiates model data versus observed data.

The time interval is used only in the .E format, provides information on what interval to apply to the time-series. The data then follow. The observation time is applied to the first value, and the time interval is used to determine the time stamps of the subsequent values. An F after a water level value means that a parity error occurred during the transmission of that value and that the value should be considered suspect. A water level value of -9999 indicates either the value was never received or the received value was flagged during the quality control process and is not to be reported.

## APPENDIX 4: WMO AND AWIPS HEADERS

WMO headers are determined using WMO definitions [REF 6]. Both WMO and AWIPS headers contain characters pertaining to the data type and the geographical region. Each CO-OPS station falling within the WMO and AWIPS region is included in a bulletin, provided that public dissemination was not stopped by CORMS operators. The first two characters of the WMO header identify the data type, the next two characters identify the region, and the numbers differentiate between bulletins but do not hold a specific meaning. After the WMO header a 4-character Civil Aviation Organization identifier specifies the originating center. CO-OPS uses KWBC, which is the Washington Regional Telecommunication Hub, and indicates that the data are coming from the NWSTG.

AWIPS header syntax is different but provides similar information. The first three characters of the AWIPS header is the product category, and the next two characters specify the region or the Operational Forecast System (OFS).

CO-OPS requests new or revised WMO and AWIPS headers from the NWS Office of Operational Systems Operations Support & Performance Monitoring Branch (OPS31) by completing the Data Product Request for Change (RC) process [REF 8]. For CREX products, CO-OPS works with the Data Review Group (DRG) directly to obtain or revise WMO headers.

### CREX One-minute Water Level Headers

WMO Header	Geographic Area
SZNT31 KWBC	Atlantic Coast
SZGX32 KWBC	Gulf of Mexico Coast
SZCA33 KWBC	Caribbean Islands
SZPZ34 KWBC	Pacific Coast
SZAK35 KWBC	Alaskan Coast and Bays
SZHW36 KWBC	Hawaii
SZPA37 KWBC	Pacific Islands



**CREX Six-minute Water Level and Meteorological Headers**

<b>WMO Header</b>	<b>Geographic Area</b>
KSAA30 KWBC	Atlantic Coast (0 - 90 W Northern Hemisphere)
KSAA31 KWBC	Gulf of Mexico Coast (0 - 90 W Northern Hemisphere)
KSAA32 KWBC	Great Lakes (0 - 90 W Northern Hemisphere)
KSAB30 KWBC	Great Lakes (90 W - 180 Northern Hemisphere)
KSAB31 KWBC	Gulf of Mexico Coast (90 W - 180 Northern Hemisphere)
KSAB32 KWBC	Pacific Coast
KSAB33 KWBC	Alaska
KSAE30 KWBC	Caribbean Islands
KSAF30 KWBC	Hawaii
KSAG30 KWBC	Pacific Islands (180 - 90 E Tropical)
KSAJ30 KWBC	Pacific Islands (90 W - 180 Southern Hemisphere)

**SHEF Observed Water Level Headers**

<b>AWIPS Header</b>	<b>WMO Header</b>	<b>Geographic Area</b>
TIDNT	SOUS41 KWBC	North Atlantic
TIDGX	SOUS42 KWBC	Gulf of Mexico
TIDGT	SOUS44 KWBC	Great Lakes
TIDPZ	SOUS43 KWBC	Pacific
TIDAK	SOUS45 KWBC	Alaska
TIDHW	SOPA46 KWBC	Hawaii

**SHEF Meteorological Headers**

<b>AWIPS Header</b>	<b>WMO Header</b>	<b>Geographic Area</b>
OSONT	SXUS51 KWBC	North Atlantic
OSOGX	SXUS52 KWBC	Gulf of Mexico
OSOGT	SXUS54 KWBC	Great Lakes
OSOPZ	SXUS53 KWBC	Pacific
OSOAK	SXAK55 KWBC	Alaska
OSOHW	SXPA56 KWBC	Hawaii

**SHEF Predicted Water Level Headers**

<b>AWIPS Header</b>	<b>WMO Header</b>	<b>Geographic Area</b>
TIDNT	SOUS61 KWBC	North Atlantic
TIDGX	SOUS62 KWBC	Gulf of Mexico
TIDPZ	SOUS63 KWBC	Pacific
TIDAK	SOUS64 KWBC	Alaska
TIDHI	SOUS65 KWBC	Hawaii

**SHEF Operational Forecast System Water Level Model Guidance Headers**

<b>AWIPS Header</b>	<b>WMO Header</b>	<b>OFS</b>
TIDCB	SOUS41 KWBC	Chesapeake Bay
TIDDB		Delaware Bay
TIDNY		New York/New Jersey
TIDSJ		St. Johns River
TIDTB	SOUS42 KWBC	Tampa Bay
TIDNG		Northern Gulf of Mexico
TIDCR	SOUS43 KWBC	Columbia River Estuary
TIDSB*		San Francisco Bay*
TIDLE	SOUS44 KWBC	Lake Erie
TIDLH		Lake Huron
TIDLM		Lake Michigan
TIDLO		Lake Ontario
TIDLS		Lake Superior

\*Coming soon

## APPENDIX 5: CREX AUTOMATED WATER LEVEL CHECKS

NUMERIC CODE	MEANING
00	Good data
01	Maximum (high) water level limit exceeded
02	Minimum (low) water level limit exceeded
03	Rate-of-change limit for water level exceeded
04	Flat limit for water level exceeded
05	Observed water level minus predicted water level value limit
06	Observed primary water level value minus backup water level value limit exceeded
07	Value exceeded specified tolerance from expected value
08	Water level QA parameter (sigmas and/or outliers) limits
09	Sea temperature outside of expected range
10	Multiple QC checks listed above failed