

Old Woman Creek (OWC) NERR Water Quality Metadata

January – December, 2013

Latest Update: 03/26/2020

I. Data Set and Research Descriptors

1. Principal Investigator & contact person:

Kristin Arend, Research Coordinator
kristin.arend@dnr.state.oh.us

Old Woman Creek SNP and NERR
2514 Cleveland Road East
Huron, Ohio 44839
Phone: (419) 433-4601

2. Entry verification:

Deployment data are uploaded from a YSI PC6600 EDS data logger to a personal computer (IBM compatible). The data were graphed and visually checked for any obvious outliers. Notes were made of any unusual data or faulty probes. Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO where they undergo automated primary QAQC; automated depth/level corrections for changes in barometric pressure (cDepth or cLevel parameters); and become part of the CDMO's online provisional database. All pre- and post-deployment data are removed from the file prior to upload. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve for secondary QAQC where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove any overlapping deployment data, append files, and export the resulting data file for upload to the CDMO. Upload after secondary QAQC results in ingestion into the database as provisional plus data, recalculation of cDepth or cLevel parameters, and finally tertiary QAQC by the CDMO and assimilation into the CDMO's authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. For more information on QAQC flags and codes, see Sections 11 and 12. The files are archived at OWC. Andrea Tibbels and Dr. Kristi Arend were responsible for both data logger deployment and data management at Old Woman Creek NERR during the 2013 deployment.

3. Research Objectives:

Measurements are taken every 15 minutes over two or three-week periods at four sites within the Old Woman Creek. Three sites are located in the estuary proper: one in the upper reaches at Darrow Road (DR); one near the mouth, just south of State Route 6 (WM); and the third upstream from the WM site (OL). The final site (BR) is just upstream of the first riffle zone above the estuary in Old Woman Creek proper. Sampling occurs during ice-free conditions, typically from March through December. The purpose of this monitoring program is to

document the role of this Great Lakes estuary in the Lake Erie ecosystem, particularly the estuary's role in mitigating storm flow that passes through it. The role of the OL site is to document the degree of intrusion by lake water during northerly winds and subsequent seiche events.

4. Research methods:

The 2013 YSI monitoring program began at sites BR, DR, OL, and WM on 2 April 2013. Prior to deployment of the data loggers, a 4-inch diameter PVC pipe was clamped to an 8-foot long metal post that had been driven into the sediment. The logger trap at site DR was not clamped to an 8-foot metal post, but rather was suspended from the north side of the road bridge by metal chain. Each pipe had 4 vertical slits $\frac{3}{4}$ " wide drilled into it spanning the area of the probe guard on the data logger to insure that the probes would have direct contact with the surrounding waters. Additional field readings for dissolved oxygen, pH, temperature, turbidity, and specific conductance are taken when the instrument is changed at each site (see the Other Remarks Section). The data loggers were replaced in the field after a two or three-week deployment, depending on temperature and degree of fouling of the data loggers. All data loggers were the extended deployment loggers. The data were retrieved from each data logger and each data logger was recalibrated (according to the directions in the YSI Operations Manual) before being returned to the field. Conductivity, turbidity (2 point calibration using distilled water for zero turbidity and a YSI standard for the other turbidity point), and pH (2 point calibration) were calibrated using commercial standards. These standards were prepared prior to each deployment. The data loggers at site WM had a vented water level sensor while the loggers at sites BR, DR, and OL had non-vented depth sensors. At all four sites the ROX optical dissolved oxygen probe was used. The calibration logs provide sensor information. The 2013 YSI monitoring program ended at sites BR and DR on 25 November and at sites OL and WM on 4 December due to ice development (OL and WM loggers were frozen in place on 11/25).

In October 2014 the Data Management Committee determined that barometric pressure readings used for producing the depth offset during water quality data sonde calibration should be taken from the same weather station where barometric pressure is used to correct depth/level for the cDepth/cLevel parameters. This is a requirement for NERRS Reserves (like Old Woman Creek) where that weather station is located significantly above sea level. Please be aware that this protocol was not followed in 2013 which introduces some additional minor error to that calculated parameter.

A Sutron Sat-Link2 transmitter was installed at Site OL during October 2006. This system transmits data to the NOAA Goes satellite, NESDIS ID# 3B02849A. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen minute data sampling intervals. The Sutron cable was found to be frayed and non-functional in 2012; the cable was replaced and transmission restored around 19 June 2013. Upon receipt by the CDMO, the data undergo the same automated primary QAQC process detailed in Section 2 above. The "real-time" telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO's authoritative online database. Provisional and authoritative data are available at <http://cdmo.baruch.sc.edu>.

5. Site Location and Character:

Old Woman Creek National Estuarine Research Reserve is located on the southern shore of Lake Erie, east of the city of Huron, Ohio (Latitude 41° 23'N; Longitude 82° 33'W). Land use in the Old Woman Creek (OWC) watershed is primarily row crop agriculture. Other than the non-point source pollutants coming into the estuary from these agricultural practices and from the town of Berlin Heights, there are no other major pollution sources in the estuary. Salinity in Old Woman Creek is normally 1 ppt. or less, although it will rise, on occasion, to nearly 2 ppt. The tidal range in Lake Erie (and therefore in the estuary) is on the order of 4 cm or less. Water levels in the estuary and in the creek are extremely variable, with changes occurring daily, seasonally and annually due to changing lake levels, seiches on the lake, storm runoff, and the mouth closing and opening through the year.

The data logger at the State Route 6 (WM) site (Latitude 41° 22' 57" N, Longitude 82° 30'54" W) is very close to the mouth of Old Woman Creek. In this portion of the Reserve, the creek is very shallow but extends over a large surface area. This site frequently experiences influx of Lake Erie waters. The bottom sediments at this site are silty clay. At the beginning of the deployment for 2013, no rooted aquatic vegetation was present directly adjacent to the site, although both emergent and submerged vegetation were present within 3 meters of the site. The data logger is about .18 meters above the bottom sediments. With the deployment beginning on 2 April 2013, a small guard was used thus effectively lowering the logger 5 cm in the trap. From 8 July 2013 through 15 October 2013, a large guard was used thus effectively raising the logger 5 cm in the trap. Due to low water levels, beginning on 15 October 2013, a small guard was used thus effectively lowering the logger 5 cm in the trap once again. The data logger was removed on 4 December 2013 due to ice (logger was frozen in place on 11/25).

The data logger at site OL (Latitude 41° 22' 55" N, Longitude 82° 30'51" W) is in the lower reaches of the estuary. This site is not in direct sight of the mouth, so northerly winds and resulting seiche activities should be less noticeable at this site. The bottom sediments are silty clay. This site is located about 5 meters north of a *Nelumbo lutea* bed, but, there no plants were immediately adjacent to the data logger. In March 2009, a new logger site was established 5 meters north of the original site due to damage of the original site by a winter storm. In 2010, this temporary site became the OL site. At this site, the base of the logger is 26 cm above the sediment. One or two leaves of *N. lutea* are adjacent to this temporary logger site. This is the site that is telemetered to the GOES satellite. On 11 July 2013, a powerful rain storm and subsequent current broke the logger trap off of the post, causing the trap and logger to rest on the bottom of the water column. The logger was recovered and a new logger deployed on 12 July 2013; it is about 28 cm above the bottom. The data logger was removed on 4 December 2013 due to ice (logger was frozen in place on 11/25).

The data logger at site DR (Latitude 41° 21'54"N, Longitude 82° 30' 17"W) is at the southern boundary of the reserve. The logger trap is suspended from western most of the two center guard rail supports on the north side of the Darrow Road bridge near the deepest part of the creek channel. At this site the creek is relatively narrow. Although water direction and flow is influenced at this site by changes in Lake Erie water levels, this site doesn't have direct contact with Lake Erie waters. The bottom sediments at this site are silty clay. No rooted aquatic vegetation is present near or upstream from this site. The data logger is about 20 cm above the bottom at this site. Prior to deployment on 04/14/2011 (08:15) the trap was raised about 5 cm. Beginning with the deployment on 06/26/2011 (08:00) the longer guard was used on the logger thus effectively raising the logger 5 cm in the water column. The trap

was raised 6 cm on October 3, 2011 between 10:15 and 10:30. The trap was moved approximately 2 m to the east and lowered 22 cm on October 22, 2012 at about 10:50. With the deployment beginning on 24 October, 2012, a small guard was used thus effectively lowering the logger another 5 cm in the trap. Throughout 2013, the logger was deployed with the longer guard, thus raising the trap about 5 cm. The data logger was removed on 25 November 2013 due to ice.

The data logger at site BR (Latitude 41° 20' 54" N, Longitude 82° 30' 30" W) is located in the lower portion of the creek proper. Just upstream from the data logger, Berlin Road crosses Old Woman Creek. Site BR is just upstream of the first riffle above the estuary. Unlike the other three sites, Lake Erie water levels have no impact on this site. The bottom of the creek at this site is a combination of rocks interspersed with some clay-silt that has been washed in from upstream. No aquatic macrophytes are present at or near this site. The logger is 18 cm above the bottom at this site. Short guards were used on all loggers at this site through the year. Wire mesh fencing around the trap was installed to diminish debris build-up around the logger. The logger trap was destroyed by storm runoff during the last part of May and was reinstalled on 3 June, 2011 at about 10:15 am. The logger is now 22 cm above the bottom. The stream bottom under the logger was excavated on 17 July, 2011 at about 07:40 and the logger and trap were lowered about 18 cm. The bottom of the logger is now about 10 cm above the bottom of the creek. When the loggers were exchanged on 7 August, 2011 (about 07:55), the logger was lowered another 5 cm. The logger is 5 cm above the stream bottom. When the loggers were exchanged on 24 July, 2012, the logger trap was lowered 5 cm. Since 2011 year the streambed under the logger has been eroded out slightly and so the logger after this latest change was still about 5 cm above the bottom. The data logger was removed on 25 November 2013 due to ice.

6. Data collection periods:

Sampling at WM began on April 02 at 09:00 EST, and data were last downloaded on December 4 at 13:15 EST. The logger installed on May 30 failed to turn on, so no data were recovered on July 12; a new logger was installed on July 12 at around 10:00 EST. WM data loggers deployed from July 8, 2013 through early November 4, 2013 were treated as though they were non-vented (i.e., depth calibration was corrected for barometric pressure). Sampling at OL began on April 02 at 09:00 EST, and data were last downloaded on December 4 at 13:45 EST. Dewatering and low water periods in the estuary caused the loggers at the WM and OL sites to be partially or fully out of the water occasionally throughout the sampling period. Sampling at DR began on April 02 at 10:15 EST, and data were last downloaded on November 25 at 09:30 EST. Sampling at BR began on April 02 at 10:00 EST, and data were last downloaded on November 25 at 09:15 EST. Specific deployment dates are listed below.

Site	Deployed	Retrieved
WM	4/02/2013 (09:00)	05/01/2013 (08:15)
	05/01/2013 (08:30)	05/30/2013 (08:30)
	05/30/2013 (failed to turn on)	07/12/13
	07/12/13 (10:15)	08/06/2013 (13:00)
	08/06/2013 (13:30)	08/26/2013 (08:45)
	08/26/2013 (09:00)	09/09/2013 (08:30)
	09/09/2013 (08:45)	09/23/2013 (09:30)

	09/23/2013 (09:45)	10/15/2013 (08:45)
	10/15/213 (09:00)	11/4/2013 (09:30)
	11/04/2013 (09:45)	12/04/2013 (13:15)
OL	04/02/2013 (09:00)	05/01/2013 (08:15)
	05/01/2013 (08:30)	05/30/2013 (08:30)
	05/30/2013 (08:45)	07/12/2013 (09:30)
	07/12/2013 (10:00)	08/06/2013 (13:00)
	08/06/2013 (13:15)	08/26/2013 (08:30)
	08/26/2013 (08:45)	09/09/2013 (08:15)
	09/09/2013 (08:45)	09/23/2013 (09:15)
	09/23/2013 (09:30)	10/15/2013 (08:30)
	10/15/213 (08:45)	11/4/2013 (09:15)
	11/04/2013 (09:30)	12/04/2013 (13:45)
DR	04/02/2013 (10:15)	05/01/2013 (09:00)
	05/01/2013 (09:15)	05/30/2013 (09:45)
	05/30/2013 (10:00)	07/12/2013 (10:30)
	07/12/2013 (11:00)	08/06/2013 (07:30)
	08/06/2013 (07:45)	08/26/2013 (08:00)
	08/26/2013 (08:15)	09/09/2013 (08:00)
	09/09/2013 (08:15)	09/23/2013 (08:45)
	09/23/2013 (09:00)	10/15/2013 (07:45)
	10/15/213 (08:00)	11/4/2013 (08:30)
	11/04/2013 (10:15)	11/25/2013 (09:30)
BR	04/02/2013 (10:00)	05/01/2013 (09:00)
	05/01/2013 (09:30)	05/30/2013 (09:30)
	05/30/2013 (09:45)	07/15/2013 (07:45)
	07/15/2013 (08:00)	08/06/2013 (07:15)
	08/06/2013 (07:30)	08/26/2013 (07:45)
	08/26/2013 (08:30)	09/09/2013 (07:30)
	09/09/2013 (07:45)	09/23/2013 (08:15)
	09/23/2013 (8:45)	10/15/2013 (07:30)
	10/15/213 (07:45)	11/4/2013 (08:15)
	11/04/2013 (08:30)	11/25/2013 (09:15)

7. Distribution

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and process the data. Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the

Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

Requested citation format:

National Estuarine Research Reserve System (NERRS). 2012. System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: www.nerrsdata.org; accessed 12 October 2012.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal Investigators and Contact Persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page www.nerrsdata.org. Data are available in comma delimited format.

8. Associated projects:

Replicate samples for chemical analysis of the water are collected at each site every time the data loggers are changed. Samples for phytoplankton determination are collected at the same time at sites near two of the data logger deployment sites (DR and WM). Additionally, a 26 hour sampling regime (samples are collected at 2 hour intervals over the 26 hours) is conducted at the WM site once during each month. Meteorological data are also collected and reported at 15-minute intervals; these data are available for download from the CDMO website.

II. Physical Structure and Descriptors:

9. Sensor specifications:

YSI 6600EDS datalogger

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Thermistor

Model #: 6560

Range: -5 to 45 °C

Accuracy: +/-0.15 °C

Resolution: 0.01 °C

Parameter: Conductivity

Units: milli-Siemens per cm (mS/cm)

Sensor Type: 4-electrode cell with autoranging

Model #: 6560

Range: 0 to 100 mS/cm

Accuracy: +/-0.5% of reading + 0.001 mS/cm

Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependent)

Parameter: Salinity

Units: parts per thousand (ppt)

Sensor Type: Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: +/- 1.0% of reading or 0.1 ppt, whichever is greater

Resolution: 0.01 ppt

Parameter: Dissolved Oxygen % saturation

Units: percent air saturation (%)

Sensor Type: Rapid Pulse – Clark type, polarographic (YSI 6600 EDS loggers only)

Model #: 6562

Range: 0 to 500 % air saturation

Accuracy: 0-200 % air saturation, +/- 2 % of the reading or 2 % air saturation, whichever is greater; 200-500 % air saturation, +/- 6 % of the reading

Resolution: 0.1 % air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature and salinity)

Units: milligrams per Liter (mg/L)

Sensor Type: Rapid Pulse – Clark type, polarographic (YSI 6600 EDS loggers only)

Model #: 6562

Range: 0 to 50 mg/L

Accuracy: 0 to 20 mg/L, +/- 2 % of the reading or 0.2 mg/L, whichever is greater; 20 to 50 mg/L, +/- 6 % of the reading

Resolution: 0.01 mg/L

Parameter: Dissolved Oxygen % saturation

Units: percent air saturation (%)

Sensor Type: Optical probe with mechanical cleaning

Model #: 6150 ROX (YSI 6600 V2 loggers only)

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation- +/- 1% of the reading or 1% air saturation, whichever is greater; 200-500% air saturation- +/- 15% of the reading

Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature and salinity)

Units: milligrams per Liter (mg/L)

Sensor Type: Optical probe with mechanical cleaning

Model #: 6150 ROX (YSI 6600 V2 loggers only)

Range: 0-50 mg/L

Accuracy: 0-20 mg/L- +/- 2% of the reading or 0.2 mg/L, whichever is greater; 20-50 mg/L- +/- 6% of the reading

Resolution: 0.01 mg/L

Parameter: Non-Vented Level – Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge
Range: 0 to 30 ft (9.1 m)
Accuracy: +/- 0.06 ft (0.018 m)
Resolution: 0.001 ft (0.001 m)

Parameter: Vented Level – Shallow (Depth)
Units: feet or meters (ft or m)
Sensor Type: Stainless steel strain gauge
Range: 0 to 30 ft (9.1 m)
Accuracy 0-10 ft: +/- 0.01 ft (0.003 m)
Accuracy 10-30 ft: +/- 0.06 ft (0.018 m)
Resolution: 0.001 ft (0.001 m)

Parameter: pH (EDS probe)
Units: units
Sensor Type: Glass combination electrode
Model #: 6561
Range: 0 to 14 units
Accuracy: +/- 0.2 units
Resolution: 0.01 units

Parameter: Turbidity
Units: nephelometric turbidity units (NTU)
Sensor Type: Optical, 90 ° scatter, with mechanical cleaning
Model #: 6136
Range: 0 to 1000 NTU
Accuracy: +/- 5 % reading or 2 NTU (whichever is greater)
Resolution: 0.1 NTU

Dissolved Oxygen Qualifier (Rapid Pulse / Clark type sensor):

The reliability of dissolved oxygen (DO) data collected with the rapid pulse / Clark type sensor after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Some Reserves utilize the YSI 6600 EDS data sondes, which increase DO accuracy and longevity by reducing the environmental effects of fouling. Optical DO probes have further improved data reliability. The user is therefore advised to consult the metadata for sensor type information and to exercise caution when utilizing rapid pulse / Clark type sensor DO data beyond the initial 96-hour time period. Potential drift is not always problematic for some uses of the data, i.e. periodicity analysis. It should also be noted that the amount of fouling is very site specific and that not all data are affected. If there are concerns about fouling impacts on DO data beyond any information documented in the metadata and/or QAQC flags/codes, please contact the Research Coordinator at the specific NERR site regarding site and seasonal variation in fouling of the DO sensor.

Depth Qualifier:

The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either vented or non-vented depth/level sensors. Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.03 cm for every 1 millibar change in atmospheric pressure, and is eliminated for vented sensors because they are vented to the atmosphere throughout the deployment time interval.

Beginning in 2006, NERR SWMP standard calibration protocol calls for all non-vented depth sensors to read 0 meters at a (local) barometric pressure of 1013.25 mb (760 mm/hg). To achieve this, each site calibrates their depth sensor with a depth offset number, which is calculated using the actual atmospheric pressure at the time of calibration and the equation provided in the SWMP calibration sheet or digital calibration log. This offset procedure standardizes each depth calibration for the entire NERR System. If accurate atmospheric pressure data are available, non-vented sensor depth measurements at any NERR can be corrected.

In 2010, the CDMO began automatically correcting depth/level data for changes in barometric pressure as measured by the Reserve's associated meteorological station during data ingestion. These corrected depth/level data are reported as cDepth and cLevel, and are assigned QAQC flags and codes based on QAQC protocols. Please see sections 11 and 12 for QAQC flag and code definitions.

Salinity Units Qualifier:

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report salinity in parts per thousand (ppt) units, the EXO sondes report practical salinity units (psu). These units are essentially the same and for SWMP purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the NERR System will assign psu salinity units for all data regardless of sonde type.

Turbidity Qualifier:

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report turbidity in nephelometric turbidity units (NTU), the EXO sondes use formazin nephelometric units (FNU). These units are essentially the same but indicate a difference in sensor methodology, for SWMP purposes they will be considered equivalent. Moving forward, the NERR System will use FNU/NTU as the designated units for all turbidity data regardless of sonde type. If turbidity units and sensor methodology are of concern, please see the Sensor Specifications portion of the metadata.

Chlorophyll Fluorescence Disclaimer:

YSI chlorophyll sensors (6025 or 599102-01) are designed to serve as a proxy for chlorophyll concentrations in the field for monitoring applications and complement traditional lab extraction methods; therefore, there are accuracy limitations associated with the data that are detailed in the YSI manual including interference from other fluorescent species, differences in calibration method, and effects of cell structure, particle size, organism type, temperature, and light on sensor measurements.

10. Coded variable definitions:

Sampling Station	Sampling site code	Station code
State Route 6	WM	owcwmwq
Lower Estuary	OL	owcolwq
Darrow Road	DR	owcdrwq
Berlin Road	BR	owcbrwq

11. QAQC flag

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter's associated flag column (header preceded by an F_). During primary automated QAQC (performed by the CDMO), -5, -4, -2, 2, and 3 flags are applied automatically to indicate data that are above or below sensor range, missing, or outside 2 or 3 standard deviations from the historical seasonal mean. All remaining data are then flagged 0, as "good". During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

- 5 Outside High Sensor Range
- 4 Outside Low Sensor Range
- 3 Data Rejected due to QAQC
- 2 Missing Data
- 1 Open- reserved for later flag
- 0 Good Data
- 1 Suspect Data

- 2 Data Outside 2 Standard Deviations from the historical seasonal mean
- 3 Data Outside 3 Standard Deviations from the historical seasonal mean
- 4 Historical Data: Pre-Auto QAQC
- 5 Corrected Data

12. QAQC code definitions

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the deployment or YSI datasonde, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an * below) can be applied to the entire record in the F_Record column.

General Errors

GIC	No instrument deployed due to ice
GIM	Instrument malfunction
GIT	Instrument recording error; recovered telemetry data
GMC	No instrument deployed due to maintenance/calibration
GNF	Deployment tube clogged / no flow
GOW	Out of water event
GPF	Power failure / low battery
GQR	Data rejected due to QA/QC checks
GSM	See metadata

Corrected Depth/Level Data Codes

GCC	Calculated with data that were corrected during QA/QC
GCM	Calculated value could not be determined due to missing data
GCR	Calculated value could not be determined due to rejected data
GCS	Calculated value suspect due to questionable data
GCU	Calculated value could not be determined due to unavailable data

Sensor Errors

SBO	Blocked optic
SCF	Conductivity sensor failure
SCS	Chlorophyll spike

SDF	Depth port frozen
SDG	Suspect due to sensor diagnostics
SDO	DO suspect
SDP	DO membrane puncture
SIC	Incorrect calibration / contaminated standard
SNV	Negative value
SOW	Sensor out of water
SPC	Post calibration out of range
SQR	Data rejected due to QAQC checks
SSD	Sensor drift
SSM	Sensor malfunction
SSR	Sensor removed / not deployed
STF	Catastrophic temperature sensor failure
STS	Turbidity spike
SWM	Wiper malfunction / loss

Comments

CAB*	Algal bloom
CAF	Acceptable calibration/accuracy error of sensor
CAP	Depth sensor in water, affected by atmospheric pressure
CBF	Biofouling
CCU	Cause unknown
CDA*	DO hypoxia (<3 mg/L)
CDB*	Disturbed bottom
CDF	Data appear to fit conditions
CFK*	Fish kill
CIP*	Surface ice present at sample station
CLT*	Low tide
CMC*	In field maintenance/cleaning
CMD*	Mud in probe guard
CND	New deployment begins

CRE*	Significant rain event
CSM*	See metadata
CTS	Turbidity spike
CVT*	Possible vandalism/tampering
CWD*	Data collected at wrong depth
CWE*	Significant weather event

13. Post deployment information:

End of Deployment Post-calibration Readings in Standard Solutions: Date is the date logger was pulled. Dissolved oxygen standard is in parentheses following the DO reading. Depth is always 0.0 meters for the vented loggers. WM data loggers deployed from July 8, 2013 through early November 4, 2013 were treated as though they were non-vented (i.e., depth calibration was corrected for barometric pressure). For the unvented loggers, the depth reading in parentheses after the first depth reading is the expected depth reading when correcting for changes in barometric pressure. The specific conductivity standard is 1.413 mS/cm. If the conductivity ports were inhabited by Chironomid larvae, the sp cond reading after clearing the ports is in parentheses after the initial Sp. Cond reading. The pH standards are 7.00 and 10.00 (both are corrected for temperature). The primary turbidity standard is zero, and the second standard is in parentheses. An asterisk after the higher turbidity reading signifies problems with the wiper. The turbidity reading after cleaning is in parentheses. Complete post deployment data are in the calibration sheets.

Site	Date	Sp. Cond.	DO(%)	pH	Turb	Depth
WM	05/01/2013	1.40	95.1 (100.0)	7.06, 9.84	19.1, 19.9 (109)	0.001 (0.000)
	05/30/2013	1.38	97.5 (no data)	7.79, 1.66	1.3, 18.5 (109)	0.004 (0.000)
	07/12/2013	Data logger failed to turn on; no data				
	08/06/2013	1.418	97.9 (97.7)	7.03, 10.04	1.2, 109.5 (109)	-0.179 (-0.231)
	08/26/2013	1.343	97.3 (98.3)	6.98, 10.00	258.2 [¥] , 266.2 [¥] (109)	-0.254 (-0.177)
	09/09/2013	1.429	96.9 (98.3)	6.93, 9.90	0.8, 106.6 (109)	-0.100 (-0.186)
	09/23/2013	1.389	99.3 (98.5)	6.98, 9.99	0.6, 109.6 (109)	-0.199 (-0.155)
	10/15/2013	1.552	97.8 (97.6)	6.97, 9.95	0.5, 107.7 (109)	-0.239 (-0.249)
	11/04/2013	1.454	99.5 (99.5)	7.03, 9.99	-0.1, 105.8 (109)	-0.152 (-0.067)
	12/04/2103	1.425	99.6 (97.4)	7.04, 10.10	1.5, 110.4 (109)	-0.023 (0.000)
OL	05/01/2013	1.42	96.9 (99.1)	7.00, 9.94	3.9, 110.2 (109)	-0.036 (-0.117)
	05/30/2013	1.38	94.4 (98.3)	7.16, 10.04	16.0, 107.3 (109)	-0.170 (-0.175)
	7/12/2013	1.21	82.8 (98.8)	7.00, 10.00	-0.4, 106.2 (109)	-0.068 (-0.151)
	08/06/2013	1.488*	96.1 (97.9)	7.10, 10.03	0.3, 108.2 (109)	-0.227 (-0.223)
	08/26/2013	0.926 (1.468*)	97.5 (98.3)	7.04, 10.04	1.4, 101.3 (109)	-0.166 (-0.167)
	09/09/2013	1.504	96.9 (98.1)	6.96, 9.96	-0.2, 106.2 (109)	-0.184 (-0.184)
	09/23/2013	1.404	97.1 (98.8)	7.00, 10.02	0.3, 108.8 (109)	-0.140 (-0.147)
	10/15/2013	1.489	97.6 (97.7)	6.97, 9.9	0.7, 107.1 (109)	-0.246 (-0.245)
	11/04/2013	1.445	99.3 (99.3)	7.02, 10.03	-0.3, 106.4 (109)	-0.073 (-0.073)
	12/04/2013	1.404	100.1 (97.2)	7.02, 10.04	2.6, 112.3 (109)	-0.274 (-0.272)

DR	05/01/2013	1.41	93.6 (98.7)	7.03, 9.87	3.6, 110.2 (109)	-0.138 (-0.118)
	05/30/2013	1.46	91.4 (97.9)	7.46, 10.01	0.5, 104.1 (109)	-0.173 (-0.170)
	07/12/2013	1.48	95.0 (98.5)	7.04, 10.01	-1.1, 106.9 (109)	-1.560 (-0.151)
	08/06/2013	1.520	93.2 (98.0)	7.08, 10.05	0.7, 109.0 (109)	-0.220 (-0.220)
	08/26/2013	1.494	94.8 (98.5)	7.08, 10.14	-0.2, 106.9 (109)	-0.161 (-0.156)
	09/09/2013	1.349	94.4 (98.4)	6.96, 9.92	0.2, 96.2 (109)	-0.183 (-0.184)
	09/23/2013	1.412	94.7 (98.5)	6.99, 9.96	1.2, 106.7 (109)	-0.140 (-0.143)
	10/15/2013	1.518	96.1 (98.8)	7.06, 10.01	0.5, 106.4 (109)	-0.181 (-0.178)
	11/04/2013	1.47	98.9 (99.3)	7.01, 10.01	0.3, 106.9 (109)	-0.089 (-0.079)
	11/25/2013	1.38	100.6 (98.4)	7.14, 10.22	0.6, 110.7 (109)	-0.137 (-0.150)
BR	05/01/2013	1.21	90.6 (98.9)	7.05, 9.90	4.3, 106.8 (109)	-0.317 (-0.117)
	05/30/2013	1.17	88.0 (98.4)	5.33, 8.53	0.4, 54.8 (109)	-0.162 (-0.163)
	07/15/2013	1.79*	94.0 (99.0)	7.10, 1.17	0.3, 95.5 (109)	-0.082 (-0.084)
	08/06/2013	1.572	89.8 (97.9)	7.08, 10.07	0.3, 108.3 (109)	-0.229 (-0.228)
	08/26/2013	1.438	94.4 (98.5)	7.11, 10.18	1.1, 76.0 (109)	-0.142 (-0.145)
	09/09/2013	1.409	95.6 (98.2)	7.00, 9.96	0.3, 106.6 (109)	-0.190 (-0.184)
	09/23/2013	1.406	96.3 (98.6)	7.00, 10.00	0.2, 108.0 (109)	-0.159, -0.147
	10/15/2013	1.535	92.8 (98.9)	7.07, 9.99	0.7, 86.6 (109)	-0.168 (-0.173)
	11/04/2013	1.42	97.0 (99.2)	6.97, 9.95	0.3, 107.2 (109)	-0.080 (-0.075)
	11/25/2013	1.38	101.0 (98.6)	7.12, 10.13	0.2, 91.4 (109)	-0.137 (-0.150)

* after cleaning

‡ wiper was ripped and covering 1 of the optics on the probe

14. Other Remarks:

Tertiary QAQC Notes (for annual data submission):

Depth: For non-vented sondes, periods when a sonde depth sensor might have been out of water, whereas the other sensors were submerged, were identified by looking at the corrected depths generated by the CDMO. Time periods during which corrected depths were less than zero were marked either as rejected or suspect due to sensor being out of water (based on evaluation of adjacent data).

Lower Estuary (OL) depth sensor possible malfunction: One of the sondes deployed at the OL site recorded unusually low depth readings during 2-3 deployments. The sonde is #22 (serial number: 11B101283); readings were noticeably low for the 8/26 – 9/9 and 9/23 – 10/15 deployments and slightly low for the 5/1 – 5/30 deployment. Pre- and post-calibration data were fine for all deployments.

Lower Estuary (OL): The 5/30 deployment ran long going over the 4 weeks SOP length, ending on 7/12. The DO post for this deployment was 82.8. DO data after the 4 week mark is marked 1 SPC CSM. The F record column is marked CSM after the 4 week mark.

Lower Estuary (OL): The data logger was removed on 4 December 2013 due to ice. The data logger was frozen in place from 11/24 20:15 to 11/29 11:45.

Mouth (WM): WM data loggers which are vented, were deployed from July 8, 2013 through early November 4, 2013 were treated as though they were non-vented (i.e., depth calibration was corrected for barometric pressure). Depth data during this time was marked -3 SIC CSM.

Field data collected at time of data logger deployment are reported below.

Specific conductivity was taken in the laboratory immediately after returning from the field. Temperature is reported in Degrees C, specific conductivity in millimhos, and oxygen in milligrams/liter. Values reported are the means of two replicate samples.

<i>Site</i>	<i>Date</i>	<i>Temp (°C)</i>	<i>DO (mg/L)</i>	<i>pH</i>	<i>Cond (millimho)</i>	<i>Turbidity (NTU)</i>
WM	4/2/2013	1.1	12.67	7.86	0.572	34.9
	5/1/2013	18.0	8.77	7.41	0.495	97.2
	5/30/2013	27.4	5.34	7.41	0.324	65.5
	7/12/2013	23.6	7.44	7.83	0.276	30.2
	8/6/2013	24.6	10.81	8.29	0.419	16.4
	8/26/2013	24.5	5.08	7.35	0.526	17.4
	9/9/2013	20.5	5.79	7.62	0.434	25.0
	9/23/2013	18.2	6.84	7.55	0.563	11.9
	10/15/2013	15.0	6.17	7.47	0.434	38.8
	11/4/2013	5.3	10.50	7.62	0.468	50.1
	12/4/2013	-1.9	14.07	7.97	0.620	16.4
OL	4/2/2013	1.2	12.76	7.87	0.580	41.1
	5/1/2013	18.2	7.99	7.54	0.498	105.0
	5/30/2013	28.1	5.35	7.45	0.578	50.7
	7/12/2013	21.2	6.30	7.45	0.359	57.2
	8/6/2013	23.9	11.57	8.18	0.487	22.3
	8/26/2013	23.8	5.02	7.53	0.526	29.2
	9/9/2013	11.4	5.87	7.61	0.455	22.5
	9/23/2013	18.5	6.53	7.47	0.570	21.9
	10/15/2013	14.6	6.06	7.47	0.479	39.7
	11/4/2013	7.2	8.99	7.55	0.487	53.7
	11/25/2013		13.85	7.81	0.510	11.1
DR	4/2/2013	6.9	12.01	8.16	0.571	7.3
	5/1/2013	24.5	7.78	7.82	0.499	16.1
	5/30/2013	28.5	5.69	7.34	0.701	14.3
	7/12/2013	20.3	7.91	7.15	0.433	25.8
	8/6/2013	19.2	7.48	7.74	0.616	10.1
	8/26/2013	21.0	6.27	7.55	0.621	6.1
	9/9/2013	18.9	6.04	7.73	0.681	8.7
	9/23/2013	16.4	7.09	7.49	0.570	13.9
	10/15/2013	12.7	6.94	7.45	0.612	13.9
	11/4/2013	7.3	10.71	7.67	0.525	12.4
	11/25/2013	-3.8	14.30	8.00	0.611	7.7
BR	4/2/2013	7.6	11.82	8.18	0.581	3.5
	5/1/2013	22.2	10.20	7.95	0.510	9.4

	5/30/2013	27.8	6.97	7.38	0.680	10.2
	7/15/2013	20.0	8.27	7.60	0.413	19.2
	8/6/2013	18.7	8.72	7.93	0.641	8.4
	8/26/2013	19.7	6.84	7.53	0.646	7.2
	9/9/2013	17.4	6.81	7.73	0.742	6.0
	9/23/2013	15.5	8.29	7.58	0.557	9.8
	10/15/2013	12.0	8.91	7.69	0.629	5.2
	11/4/2013	6.8	11.55	7.67	0.547	9.6
	11/25/2013	0.0	14.59	7.91	0.623	7.7

Missing data

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

Turbidity spikes

Turbidity spikes at sites OL and WM, particularly from April through June, could be due to biological activity, especially activity of *Cyprinus carpio L.*