

Old Woman Creek (OWC) NERR Water Quality Metadata

January – December, 2016

Latest Update: May 4, 2018

I. Data Set and Research Descriptors

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2. Entry verification:

Deployment data were directly uploaded from a YSI EXO2 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 Kor (EXO2 loggers) 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.

Dr. Kristi Arend was responsible for both data logger deployment and data management at Old Woman Creek NERR during the 2016 deployment.

3. Research Objectives:

Measurements are taken every 15 minutes over two or three-week periods at four sites within 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 (Lower Estuary; OL). The final site (BR) is just upstream of the

first riffle zone above the estuary in Old Woman Creek proper. 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 2016 YSI monitoring program began at sites DR and WM on 25 March 2016, at BR on 26 March 2016, and at OL on 28 March 2016, shortly after ice out. Sampling has continued through 09 December 2016, when ice conditions required that the sondes be removed. EXO2 sondes were used at all four sites throughout this time period. Data loggers are deployed in 4-inch diameter PVC pipes, which are 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. On 1 December 2016, the deployment post for OL was switched to a deeply embedded steel pipe with a steel trap that had four vertical slits matching in length and width to the EXO 2 sonde guard slits. Additional field readings for dissolved oxygen, pH, temperature, turbidity, and specific conductance were taken using a 6600V2 or EXO2 sonde when the instruments were 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. 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. Sonde readings were checked against these standards within 24 hours of retrieval. The data loggers at all sites had non-vented depth sensors and optical DO sensors. The calibration logs provide sensor information.

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 began being followed in March 2015 at the start of sampling and was following throughout the 2016 field season.

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. Upon receipt by the CDMO, the data undergoes 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. Changes to the status of the mouth (open versus closed) during a quarter or year are included in the comments section.

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 2014, 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 0.18 meters above the bottom sediments. With the deployment beginning on 31 March 2014, a small guard was used thus effectively lowering the logger 5 cm in the trap. On 27 April, 2016, a new, longer PVC trap was installed next to the PVC pipe that was being used, because that pipe had become submerged due to higher Lake Erie and estuary water levels. The new pipe was installed approximately 0.35 m to the NW at about 0.19 m shallower depth (the sonde is still positioned about 0.13 m above the bottom sediments). On 17 August 2016, the sonde depth was remeasured due to concern that the pipe had either dropped or sediment had accumulated at its base. The sonde height was measured to be 0.12 m above the bottom. Between 12:30-12:50 EST, the pipe was raised to increase the sonde distance from the bottom. The sonde was re-measured at approximately 0.28 m above the bottom. This is the new depth for the site, WM is well mixed and other parameters are not affected by this difference.

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 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. On 16 July 2014, a longer post was driven into the sediment approximately 66 cm to the southwest of the current logger post. The post was set a vertical as possible, using a level. The logger housing and logger were transferred to the new post between 8:55-9:15 EST. The logger was located at about 27 cm above the bottom. On 1 December 2016 the deployment fencepost and PVC trap were replaced with a

steel pipe equipped with a steel trap to achieve a more vertically stable deployment platform. The height of the logger above the sediment increased by 15 cm, and should now be approximately 42 cm off the bottom. This is the new depth for the site, OL is well mixed and other parameters are not affected by this difference.

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 his 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 14 April, 2011 (08:15) the trap was raised about 5 cm. Beginning with the deployment on 26 June, 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 3 October, 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. Starting in 2013, the logger was always deployed with the longer guard, thus raising the trap about 5 cm. The logger trap was repositioned in March 2014 and the logger sensors were measured to be at about 0.50 m above the bottom. The PVC trap suspension wire broke on 23 November 2015; the trap was suspended using the chain only, which caused raised the sensors in the water column 0.3 m. The trap was re-deployed in March 2016 and was measured to be at about 0.45 m above the bottom.

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 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 trap was partially detached from the fence post during winter 2014. The trap was reattached and the logger distance above bottom re-measured to account for any difference in positioning and the use of an EXO2 sonde, which has a longer guard and longer sensors. The logger sensors are now about 14 cm above the stream bottom.

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
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owcbrwq		Berlin Road	41° 20'54'' N, 82° 30'30''W	03/01/2002 00:00 -	NA	NA
owcdrwq		Darrow Road	41° 21'54''N, 82° 30' 17''W	08/01/2007 00:00 -	NA	NA
owcolwq		Lower Estuary	41° 22' 55'' N, 82° 30'51'' W	04/01/2002 00:00 -	NA	NA
owcwmwq		State Route 6	41° 22' 57'' N, 82° 30'54'' W	05/01/1995 00:00 -	NA	NA
owcsuwq		State Route 2	41° 22'02''N, 82° 30' 26''W	05/01/1995 00:00 - 08/23/2007 13:15	Bridge repair; couldn't access site	

6. Data collection periods:

Sampling Dates:

WM began on 25 March at 13:45 EST and ended on 09 December at 10:30 EST

OL began on 28 March at 16:00 EST and ended on 09 December at 10:15 EST.

DR began on 28 March at 16:00 EST and ended 09 December at 9:45 EST.

BR began on 26 March at 15:15 EST and ended 09 December at 09:30 EST.

Specific deployment dates are listed below.

Site	Deploy Date	Deploy Time	Retrieve Date	Retrieve Time	Sonde
BR	12/21/2015	10:15	01/05/2016	9:30	EXO2 (BR2)
BR	3/26/2016	15:15	4/13/2016	13:00	EXO2 (BR1)
BR	4/13/2016	13:15	5/4/2016	11:45	EXO2 (BR2)
BR	5/4/2016	12:00	5/24/2016	8:15	EXO2 (BR1)
BR	5/24/2016	8:30	6/14/2016	8:00	EXO2 (BR2)
BR	6/14/2016	8:15	7/5/2016	8:45	EXO2 (BR1)
BR	7/5/2016	9:00	7/27/2016	7:30	EXO2 (BR2)
BR	7/27/2016	7:45	8/17/2016	8:15	EXO2 (BR1)
BR	8/17/2016	8:30	9/7/2016	8:45	EXO2 (BR2)
BR	9/7/2016	9:00	9/20/2016	8:15	EXO2 (BR1)
BR	9/20/2016	8:30	10/5/2016	8:15	EXO2 (BR2)
BR	10/5/2016	8:30	10/26/2016	8:45	EXO2 (BR1)
BR	10/26/2016	9:00	11/8/2016	9:30	EXO2 (BR2)
BR	11/8/2016	9:45	11/29/2016	8:45	EXO2 (BR1)
BR	11/29/2016	9:00	12/9/2016	9:30	EXO2 (BR2)

DR	12/21/2015	10:30	01/05/2016	9:30	EXO2 (DR1)
DR	3/25/2016	16:00	4/12/2016	8:15	EXO2 (DR2)
DR	4/12/2016	8:30	5/3/2016	8:15	EXO2 (DR1)
DR	5/3/2016	8:30	5/24/2016	8:45	EXO2 (DR2)
DR	5/24/2016	9:00	6/14/2016	10:00	EXO2 (DR1)
DR	6/14/2016	8:45	7/5/2016	9:00	EXO2 (DR2)
DR	7/5/2016	9:15	7/27/2016	7:45	EXO2 (DR1)
DR	7/27/2016	8:15	8/17/2016	8:30	EXO2 (DR2)
DR	8/17/2016	9:00	9/7/2016	9:15	EXO2 (DR1)
DR	9/7/2016	9:30	9/20/2016	8:30	EXO2 (BR2)
DR	9/20/2016	8:45	10/5/2016	8:45	EXO2 (DR1)
DR	10/5/2016	9:00	10/26/2016	9:15	EXO2 (DR1)
DR	10/26/2016	9:30	11/8/2016	9:45	EXO2 (DR1)
DR	11/8/2016	10:00	11/29/2016	9:15	EXO2 (DR2)
DR	11/29/2016	9:30	12/9/2016	9:45	EXO2 (DR1)
OL	12/22/2015	12:15	01/05/2016	11:00	EXO2 (OL1)
OL	3/28/2016	16:00	4/12/2016	9:15	EXO2 (OL2)
OL	4/12/2016	9:30	5/3/2016	9:00	EXO2 (OL1)
OL	5/3/2016	9:15	5/24/2016	9:30	EXO2 (OL2)
OL	5/24/2016	10:00	6/14/2016	10:00	EXO2 (OL1)
OL	6/14/2016	10:15	7/5/2016	9:45	EXO2 (OL2)
OL	7/5/2016	10:00	7/27/2016	8:45	EXO2 (OL1)
OL	7/27/2016	9:00	8/17/2016	9:45	EXO2 (OL2)
OL	8/17/2016	10:15	9/7/2016	10:45	EXO2 (OL1)
OL	9/7/2016	11:00	9/20/2016	9:00	EXO2 (OL2)
OL	9/20/2016	9:30	10/5/2016	9:15	EXO2 (OL1)
OL	10/5/2016	9:45	10/26/2016	9:45	EXO2 (OL2)
OL	10/26/2016	10:15	11/8/2016	10:15	EXO2 (OL1)
OL	11/8/2016	10:30	11/29/2016	9:45	EXO2 (OL2)
OL	11/29/2016	10:00	12/9/2016	10:15	EXO2 (OL1)
WM	12/22/2015	12:15	01/05/2016	11:15	6600 V2 (15)
WM	3/25/2016	13:45	4/12/2016	9:30	EXO2 (WM1)
WM	4/12/2016	9:45	5/3/2016	9:30	EXO2 (WM2)
WM	5/3/2016	9:45	5/24/2016	10:00	EXO2 (WM1)
WM	5/24/2016	10:15	6/14/2016	10:15	EXO2 (WM2)
WM	6/14/2016	10:30	7/5/2016	10:00	EXO2 (WM1)
WM	7/5/2016	10:15	7/27/2016	9:00	EXO2 (WM2)
WM	7/27/2016	9:15	8/17/2016	9:30	EXO2 (WM1)
WM	8/17/2016	10:00	9/7/2016	11:00	EXO2 (WM2)
WM	9/7/2016	11:15	9/20/2016	9:30	EXO2 (WM1)
WM	9/20/2016	9:45	10/5/2016	9:45	EXO2 (WM2)
WM	10/5/2016	10:00	10/26/2016	10:15	EXO2 (WM1)

WM	10/26/2016	10:30	11/8/2016	10:30	EXO2 (WM2)
WM	11/8/2016	10:45	11/29/2016	10:00	EXO2 (WM1)
WM	11/29/2016	10:15	12/9/2016	10:30	EXO2 (WM2)

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:

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

Also include the following excerpt in the metadata which will address how and where the data can be obtained.

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.

II. Physical Structure and Descriptors:

9. Sensor specifications:

OWC NERR deployed eight EXO2 sondes in 2016. A YSI 6600 V2 sonde was used for the WM site from 01/01/2016-01/05/2016 and for simultaneous field measurements when sondes were exchanged, until 10/05/2016, when it was replaced by an EXO2 sonde.

YSI 6600EDS data sonde:

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Thermistor
Model#: 6560
Range: -5 to 50 C
Accuracy: +/- 0.15
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 dependant)

Parameter: Salinity
Units: parts per thousand (ppt)
Sensor Type: Calculated from conductivity and temperature
Range: 0 to 70 ppt
Accuracy: +/- 1.0% of reading pr 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
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 to 500% air saturation: +/- 6% of the reading
Resolution: 0.1% air saturation

or

Sensor Type: Optical probe w/ mechanical cleaning
Model#: 6150 ROX
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% or reading
Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)
Units: milligrams/Liter (mg/L)
Sensor Type: Rapid Pulse - Clark type, polarographic
Model#: 6562

Range: 0 to 50 mg/L
Accuracy: 0-20 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

or

Units: milligrams/Liter (mg/L)
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 6150 ROX
Range: 0 to 50 mg/L
Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater
20 to 50 mg/L: +/- 15% 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: pH – bulb probe or EDS flat glass probe
Units: pH units
Sensor Type: Glass combination electrode
Model#: 6561 or 6561FG
Range: 0 to 14 units
Accuracy: +/- 0.2 units
Resolution: 0.01 units

Parameter: Turbidity
Units: nephelometric turbidity units (NTU)
Sensor Type: Optical, 90 degree scatter, with mechanical cleaning
Model#: 6136
Range: 0 to 1000 NTU
Accuracy: +/- 2% of reading or 0.3 NTU (whichever is greater)
Resolution: 0.1 NTU

Parameter: Chlorophyll Fluorescence
Units: micrograms/Liter
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 6025
Range: 0 to 400 ug/Liter
Accuracy: Dependent on methodology
Resolution: 0.1 ug/L chl a, 0.1% FS

YSI EXO Sonde:

Parameter: Temperature
Units: Celsius (C)
Sensor Type: CT2 Probe, Thermistor
Model#: 599870
Range: -5 to 50 C
Accuracy: -5 to 35: +/- 0.01, 35 to 50: +/- .005
Resolution: 0.01 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: CT2 Probe, 4-electrode cell with autoranging
Model#: 599870
Range: 0 to 200 mS/cm
Accuracy: 0 to 100: +/- 0.5% of reading or 0.001 mS/cm; 100 to 200: +/- 1% of reading
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

Parameter: Salinity
Units: practical salinity units (psu)/parts per thousand (ppt)
Sensor Type: CT2 probe, Calculated from conductivity and temperature
Range: 0 to 70 psu
Accuracy: +/- 1.0% of reading pr 0.1 ppt, whichever is greater
Resolution: 0.01 psu

OR

Parameter: Temperature
Units: Celsius (C)
Sensor Type: Wiped probe; Thermistor
Model#: 599827
Range: -5 to 50 C
Accuracy: ± 0.2 C
Resolution: 0.001 C

Parameter: Conductivity
Units: milli-Siemens per cm (mS/cm)
Sensor Type: Wiped probe; 4-electrode cell with autoranging
Model#: 599827
Range: 0 to 100 mS/cm
Accuracy: $\pm 1\%$ of the reading or 0.002 mS/cm, whichever is greater
Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity
Units: practical salinity units (psu)/parts per thousand (ppt)
Model#: 599827
Sensor Type: Wiped probe; Calculated from conductivity and temperature
Range: 0 to 70 ppt
Accuracy: $\pm 2\%$ of the reading or 0.2 ppt, whichever is greater
Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
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: +/- 5% or reading
Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)
Units: milligrams/Liter (mg/L)
Sensor Type: Optical probe w/ mechanical cleaning
Model#: 599100-01
Range: 0 to 50 mg/L
Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater
20 to 50 mg/L: +/- 5% 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 33 ft (10 m)
Accuracy: +/- 0.013 ft (0.004 m)
Resolution: 0.001 ft (0.001 m)

Parameter: pH
Units: pH units
Sensor Type: Glass combination electrode
Model#: 599701(guarded) or 599702(wiped)
Range: 0 to 14 units
Accuracy: +/- 0.01 units within +/- 10° of calibration temperature, +/- 0.02 units for entire temperature range
Resolution: 0.01 units

Parameter: Turbidity
Units: formazin nephelometric units (FNU)
Sensor Type: Optical, 90 degree scatter
Model#: 599101-01
Range: 0 to 4000 FNU
Accuracy: 0 to 999 FNU: 0.3 FNU or +/-2% of reading (whichever is greater); 1000 to 4000 FNU +/-5% of reading
Resolution: 0 to 999 FNU: 0.01 FNU, 1000 to 4000 FNU: 0.1 FNU

Parameter: Chlorophyll
Units: micrograms/Liter
Sensor Type: Optical probe
Model#: 599102-01
Range: 0 to 400 ug/Liter
Accuracy: Dependent on methodology

Resolution: 0.1 ug/L chl a, 0.1% FS

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 1.02 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.

NOTE: older depth data cannot be corrected without verifying that the depth offset was in place and whether a vented or non-vented depth sensor was in use. No SWMP data prior to 2006 can be corrected using this method.
The following equation is used for corrected depth/level data provided by the

CDMO beginning in 2010:
 $((1013-BP)*0.0102)+Depth/Level = cDepth/cLevel$.

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, and -2 flags are applied automatically to indicate data that is missing and above or below sensor range. All remaining data are then flagged 0, passing initial QAQC checks. 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 Optional SWMP Supported Parameter
- 0 Data Passed Initial QAQC Checks
- 1 Suspect Data
- 2 *Open - reserved for later flag*
- 3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
- 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 Readings in Standard Solutions

Date is the date logger was deployed. Dissolved oxygen readings are the readings pre and post-calibration (after retrieval). All loggers were unvented; therefore, 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. Turbidity is in FNU. An asterisk after a turbidity reading is the reading after wiping the sensor. A ¥ after a turbidity or DO reading signifies problems with the wiper partially or fully obscuring the sensor during post-calibration. Complete post deployment data are in the calibration sheets.

Site	Deploy Date	SpCond	ODO1	ODO2	pH7	pH10	Turb	Turb	Depth
BR	01/01/2016	1.412(1.413)	102.3	102.1	6.94	9.94	0.12(0.0)	119.8(124.0)	0.209(0.222)
BR	3/26/2016	1.368(1.413)	102.0	101.3	7.07	10.07	-0.02(0.0)	123.17(124.0)	0.112(0.13)
BR	4/13/2016	1.392(1.413)	99.3	98.9	6.95	9.94	-0.2(0.0)	123.6(124.0)	-0.11(-0.115)
BR	5/4/2016	1.428(1.413)	100.2	100.3	7.04	10.02	0.04(0.0)	122.8(124.0)	0.027(0.038)
BR	5/24/2016	1.417(1.413)	96.7	100.3	6.88	10.00	2.7(0.0)	124.15(124.0)	0.027(0.038)
BR	6/14/2016	1.422(1.413)	98.4	100.0	7.10	10.07	0.07(0.0)	121.4(124.0)	0.0050(-0.0030)
BR	7/5/2016	1.484(1.413)	96.7	100.3	7.03	10.05	0.3(0.0)	121.8(124.0)	0.026(0.028)
BR	7/27/2016	1.41(1.413)	97.6	100.7	7.06	10.00	0.23(0.0)	121.7(124.0)	0.056(0.069)
BR	8/17/2016	1.415(1.413)	97.3	99.9	7.02	10.00	0.01(0.0)	116.4(124.0)	-0.0010(-0.0030)
BR	9/7/2016	1.443(1.413)	100.6	100.5	6.99	9.96	0.12(0.0)	128.1(124.0)	0.054(0.049)
BR	9/20/2016	1.418(1.413)	101.4	100.7	7.11	10.14	0.02(0.0)	121.74(124.0)	0.063(0.069)
BR	10/5/2016	1.453(1.413)	101.6	101.3	7.06	10	0.45(0.0)	118.2(124.0)	0.122(0.14)
BR	10/26/2016	1.417(1.413)	100.3	100.7	7.01	10.02	0.07(0.0)	121.04(124.0)	0.066(0.079)
BR	11/8/2016	1.414(1.413)	98.9	99.2	7.03	10.09	0.38(0.0)	123.4(124.0)	-0.09(-0.084)
BR	11/29/2016	1.414(1.413)	104.1	101.1	7.01	9.97	0.07(0.0)	129.7(124.0)	0.181(0.16)
DR	01/01/2016	1.365(1.413)	103.4	102.1	7.02	9.98	0.28(0.0)	120.4(124.0)	0.205(0.222)
DR	3/25/2016	1.369(1.413)	101.4	101.3	7.00	10.00	-1.0(0.0)	122.55(124.0)	0.139(0.14)
DR	4/12/2016	1.41(1.413)	98.9	99.7	7.06	10.06	-0.35(0.0)	143.4(124.0)	-0.035(-0.033)
DR	5/3/2016	1.422(1.413)	99.8	100.3	7.04	10.05	0.18(0.0)	123.0(124.0)	0.031(0.028)
DR	5/24/2016	1.413(1.413)	96.1	100.2	6.97	10.01	2.81(0.0)	126.99(124.0)	0.034(0.028)
DR	6/14/2016	1.409(1.413)	96.8	100.0	7.09	10.03	1.48(0.0)	96.65(124.0)	-0.0030(-0.0030)
DR	7/5/2016	1.432(1.413)	96.4	100.3	7.08	9.97	0.96(0.0)	121.33(124.0)	0.035(0.028)
DR	7/27/2016	1.381(1.413)	97.3	100.6	7.05	9.92	0.43(0.0)	125.5(124.0)	0.051(0.069)
DR	8/17/2016	1.341(1.413)	98.6	100.0	6.99	9.96	0.49(0.0)	115.6(124.0)	-0.0050(-0.0030)
DR	9/7/2016	1.403(1.413)	99.4	100.5	6.88	9.98	0.08(0.0)	128.5(124.0)	0.061(0.049)
DR	9/20/2016	1.41(1.413)	101.2	100.7	7.06	10.08	0.29(0.0)	121.97(124.0)	0.058(0.069)
DR	10/5/2016	1.467(1.413)	101.2	101.4	6.98	10.03	1.16(0.0)	118.9(124.0)	0.115(0.14)
DR	10/26/2016	1.416(1.413)	99.5	100.8	6.93	9.88	2.02(0.0)	118.3(124.0)	0.056(0.079)
DR	11/8/2016	1.415(1.413)	98.7	99.2	7.08	10.07	-0.39(0.0)	123.3(124.0)	-0.074(-0.084)
DR	11/29/2016	1.41(1.413)	104.5	101.5	6.99	10.04	0.14(0.0)	125.4(124.0)	0.178(0.16)
OL	01/01/2016	1.434(1.413)	102.2	101.6	7.0	9.98	0.1(0.0)	120.35(124.0)	0.176(0.171)
OL	3/28/2016	1.37(1.413)	102.0	101.3	6.99	10.03	-0.11(0.0)	124.5(124.0)	0.128(0.14)
OL	4/12/2016	1.36(1.413)	99.5	99.6	7.09	10.02	0.12(0.0)	125.3(124.0)	-0.032(-0.033)
OL	5/3/2016	1.384(1.413)	99.8	100.3	7.00	10.01	0.26(0.0)	122.1(124.0)	0.025(0.028)
OL	5/24/2016	1.412(1.413)	96.5	100.2	7.06	10.08	4.13(0.0)	122.45(124.0)	0.033(0.028)
OL	6/14/2016	1.36(1.413)	97.5	99.7	7.01	10.03	0.63(0.0)	118.8(124.0)	-0.043(-0.043)
OL	7/5/2016	1.445(1.413)	96.6	100.3	7.02	9.97	1.5(0.0)	123.02(124.0)	0.03(0.028)
OL	7/27/2016	1.31(1.413)	95.9	100.7	6.99	9.87	4.25(0.0)	117.52(124.0)	0.044(0.069)
OL	8/17/2016	1.179(1.413)	98.5	100.0	7.06	10.00	1.4(0.0)	117.6(124.0)	-0.011(-0.0030)
OL	9/7/2016	1.438(1.413)	98.2	100.4	6.79	9.96	1.47(0.0)	116.08(124.0)	0.065(0.049)
OL	9/20/2016	1.428(1.413)	100.7	100.4	7.06	10.18	0.41(0.0)	121.94(124.0)	0.031(0.038)

OL	10/5/2016	1.433(1.413)	103.5	101.3	7.03	10.04	1.38(0.0)	124.6(124.0)	0.04(0.131)
OL	10/26/2016	1.414(1.413)	100.6	100.6	6.99	10.04	0.3(0.0)	120.81(124.0)	0.033(0.058)
OL	11/8/2016	1.411(1.413)	99.5	99.1	7.01	10.01	0.19(0.0)	122.3(124.0)	-0.074(-0.084)
OL	11/29/2016	1.413(1.413)	103.8	101.5	6.99	10.03	0.07(0.0)	127.8(124.0)	0.176(0.16)
WM	01/01/2016	1.452(1.413)	102.1	101.7	6.92	9.98	0.4(0.0)	123.5(126.0)	-0.039(0.0)
WM	3/25/2016	1.450(1.143)	101.9	101.3	7.04	10.02	2.79(0.0)	116.38(124.0)	0.137(0.13)
WM	4/12/2016	1.406(1.413)	100.6	99.7	7.10	10.07	0.63(0.0)	128.8(124.0)	-0.026(-0.033)
WM	5/3/2016	1.464(1.413)	99.0	100.3	7.06	10.06	0.5(0.0)	120.81(124.0)	0.022(0.028)
WM	5/24/2016	1.39(1.413)	98.3	100.0	7.05	10.06	4.6(0.0)	110.45(124.0)	-0.01(-0.013)
WM	6/14/2016	1.32(1.413)	-49.7	97.3	7.10	10.08	0.11(0.0)	117.07(124.0)	-0.021(-0.023)
WM	7/5/2016	1.245(1.413)	97.0	100.2	7.09	9.96	2.7(0.0)	119.47(124.0)	0.035(0.028)
WM	7/27/2016	1.258(1.413)	98.7	100.6	7.01	9.92	0.25(0.0)	122.54(124.0)	0.056(0.069)
WM	8/17/2016	1.374(1.413)	98.6	100.0	7.04	9.92	1.6(0.0)	115.5(124.0)	-0.012(-0.0030)
WM	9/7/2016	1.42(1.413)	97.0	100.5	6.91	9.95	1.1(0.0)	114.8(124.0)	0.07(0.049)
WM	9/20/2016	1.437(1.413)	100.8	100.4	7.02	10.06	0.87(0.0)	120.4(124.0)	0.028(0.038)
WM	10/5/2016	1.411(1.413)	104.4	101.3	6.93	10.04	1.66(0.0)	125.45(124.0)	0.122(0.131)
WM	10/26/2016	1.377(1.413)	100.4	100.6	7.02	10.02	0.66(0.0)	119.48(124.0)	0.044(0.058)
WM	11/8/2016	1.411(1.413)	100.1	99.2	6.96	10.02	0.12(0.0)	122.4(124.0)	-0.072(-0.084)
WM	11/29/2016	1.409(1.413)	104.4	101.6	6.91	10.01	0.03(0.0)	126.5(124.0)	0.185(0.16)

[§] sensor malfunction

14. Other Remarks:

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 began being followed in March 2015 at the start of sampling and was following throughout the 2016 field season.

QAQC Flagging notes

Barrier Beach Status and Water Exchange

The water quality of the OL and WM sites at OWC are influenced by whether or not the barrier beach is open (i.e., surface exchange is occurring between the estuary and the lake). When the barrier is open, wind-driven surface water exchange usually results in cycles of water inflow from the lake and outflow to the lake that can be detected in the water quality data. The change from closed to open can be rapid and dramatic, usually as a result of precipitation. Sometimes, this can be followed by seiche events, depending on winds during the storm. The transition from open to closed is gradual and usually marked by a gradual increase in water depth and specific conductivity. The opening of the mouth (and sometimes closing) and seiche events are indicated in the “F_Record” column as “CSM” (see metadata). Mouth status data for Q1-Q4 are below.

Changes to mouth status, Jan. 1, 2016 – Jun. 30, 2016

Jan. 01 – Jan. 19: open

Jan. 19 – Jan. 31: open, frozen
Feb. 1 – Feb. 13: open, flowing
Feb. 14 – Feb. 20: open, frozen
Feb. 21 – Apr. 16: open
Apr. 17 – Apr. 22: closed
Apr. 23 – Apr 25: open
Apr. 26 – May 1: closed
May 2 – May 21: open
May 22 – May 26: closed
May 27 – Jun. 9: open*
June 8 – Dec. 09: closed

*mouth was opened by hand (unauthorized) on May 26, 2016, at approximately 20:15.

Rain and weather events

For rain events that affect water quality parameters, the “F_Record” column is flagged for the time period over which the precipitation occurred (not the time period over which the parameters were affected). Sometimes, the parameters themselves are flagged during the time period over which they were affected.

Weather events include periods of high wind, which can result in the inflow of water from Lake Erie into the estuary (e.g., true seiche, wind-induced water exchange). Seiche events are usually evident at the OL and WM sites and can be most easily detected by plotting both specific conductivity and water depth. The intrusion of lake water into the estuary both increases depth and decreases conductivity. Other parameters may or may not change. These are labeled as a weather event in the “F_Record” column for the duration of the event, in 24-hour periods (i.e., full days are marked because of difficulty in identifying the exact start and end times of seiche events). Impacted parameter “F_” column(s) may also be marked, as deemed useful (e.g., if a seiche coincides with retrieval and deployment of sondes, causing the data to look like the retrieved and deployed sondes weren’t reading similar values).

Darrow Road (DR): large storm events can cause the sonde to swing up or to swing up and down, alternately, due to high flows. As a result shallower depths or more variable depths are recorded. This may have occurred on the following dates and approximate times:

- 4/07 06:00 – 4/08 13:00
- 4/11 00:00 – 4/12 07:45 (directly observed on 4/11)
- 5/2 14:45 – 5/3 8:15

Depth (non-weather related)

Corrected depths for BR throughout the Q3 deployments indicate the depth sensor was in the water the majority of the time. Field notes indicate that the depth sensor was likely out of the water the majority of the quarter, starting with the 7/27 deployment, if not sooner.

On 7/18 the DR sonde was raised to set up telemetry.

On 8/17 the WM site sonde depth was remeasured due to concern that the pipe had either dropped or sediment had accumulated at its base. The sonde height was measured to be 0.12 m above the bottom. Between 12:30-12:50 EST, the pipe was raised to increase the sonde distance from the bottom. The sonde was re-measured at approximately 0.28 m above the

bottom. Data after this point is marked 1 GSM CWD for depth and 0 GSM CWD for other parameters. The 0.28m above the bottom is the new depth for the site. WM is well mixed and no remarkable changes should be seen in data based on this change.

The OL sonde was equipped with a copper guard beginning with the 8/17 deployment; the weight of the guard caused the sonde to descend below the bolt stoppers at the bottom of the pipe. This was noticed on 8/26 when the sonde was removed for cleaning, and the sonde was secured at the correct depth in the pipe. Data is marked 1 GSM CWD for depth and 0 GSM CWD for other parameters during this time period. The site is well mixed and no visible changes were seen in other parameters based on this change in depth.

On 1 December 2016 the deployment fencepost and PVC trap were replaced with a steel pipe equipped with a steel trap to achieve a more vertically stable deployment platform. The height of the logger above the sediment increased by 15 cm, and should now be approximately 42 cm off the bottom. Data after this point is marked 1 GSM CWD for depth and 0 GSM CWD for other parameters. The 0.42m above the bottom is the new depth for the site. OL is well mixed and no remarkable changes should be seen in data based on this change.

Turbidity

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

DO

The WM2 sonde's DO sensor malfunctioned at the end of the 06/14 deployment at site WM. The sensor was diagnosed as having failed and replaced under warranty. The new sensor was in place for the following deployment of that sonde (07/27).

pH

EXO2 sonde pH sensors appear to drift ≤ 0.1 pH units during deployment. These are flagged at the new deployment date-time as 0 GSM CND.

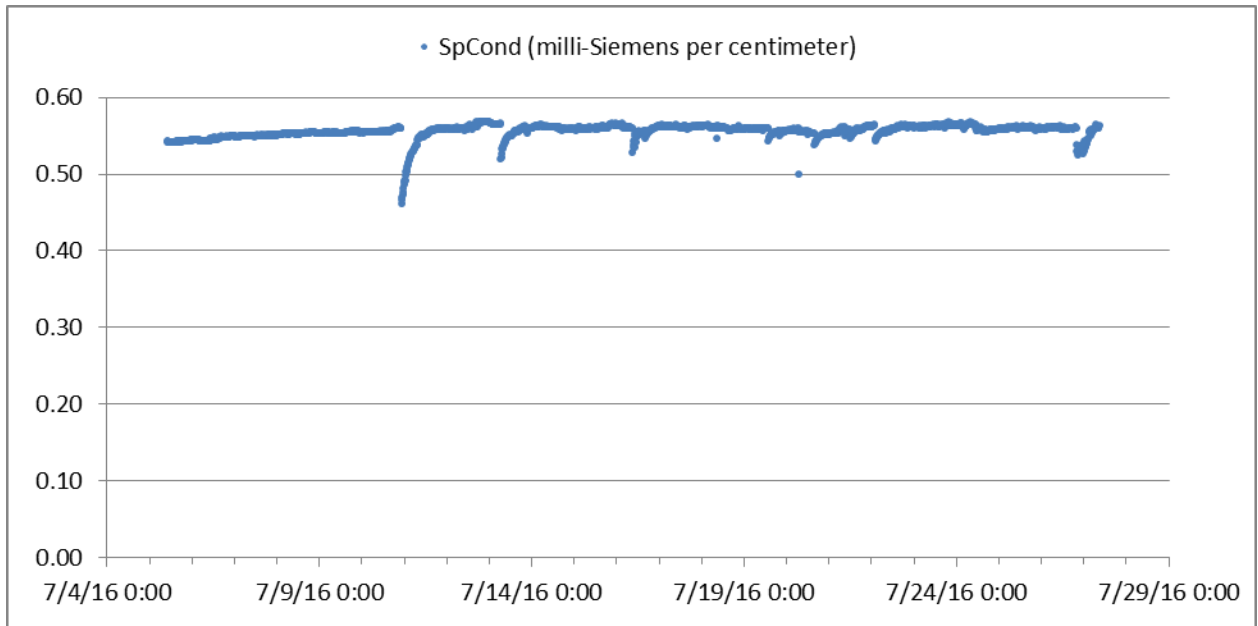
The first deployment (9/20) of pH sensors that had been equipped with new electrode tips at the BR and DR sites appeared to measure slightly high. These are noted as <1>[SIC](CSM).

Specific conductivity / Salinity

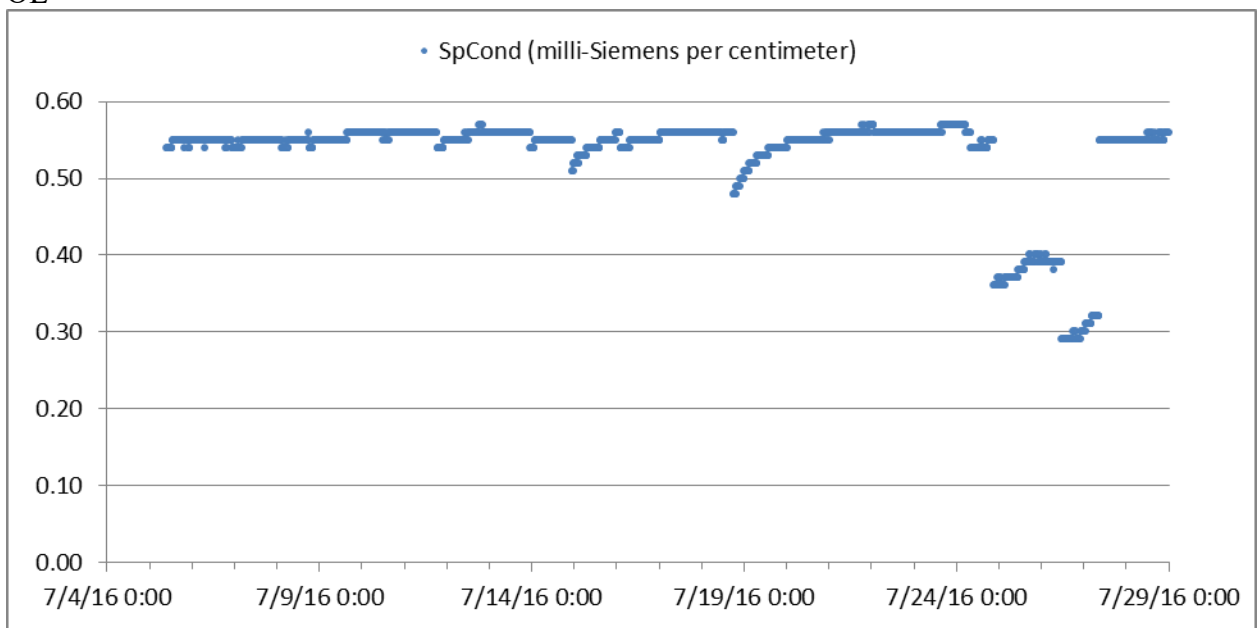
Minor drift in specific conductivity and salinity is marked on the final data point of the deployment as 1 SSD.

SpC and salinity show odd drops and rises during the 7/05 deployments at both the OL and WM sites. The cause is unknown as diagnostics appeared fine. Data were marked as <1> CSM.

WM



OL



Multiple parameters

Between 7/29 – 8/4 at the DR site, pH and DO and, to a lesser extent, SpC and temperature all demonstrated sporadic high values; the cause of this is unknown.

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.

Darrow Road data are missing from 5/25/2016 11:30 – 6/14/2016 08:45, because logging was accidentally terminated when the sonde was temporarily connected to a data

transmission system during system set-up.

Field verification

Field data collected at time of data logger retrieval and deployment are reported below. The data were collected using a field sonde (YSI 6600V2) that was deployed simultaneous to the retrieved and newly deployed sondes.

<i>Site</i>	<i>Data sonde</i>	<i>Date (m/d/y)</i>	<i>Time (hh:mm:ss)</i>	<i>Temp (C)</i>	<i>SpCond (mS/cm)</i>	<i>Sal (ppt)</i>	<i>pH</i>	<i>Turbid (NTU, FNU)</i>	<i>ODOsat (%)</i>	<i>ODO (mg/L)</i>	<i>Depth (meters)</i>
BR	retrieved	01/05/2016	9:30	-0.03	0.617	0.29	8.13	4.5	97.0	14.17	
BR	deployed	3/26/2016	15:15:16	8.41	0.477	0.23	8.22	36.1	115.2	13.48	0.346
BR	retrieved	4/13/2016	13:00:52	8	0.469	0.23	8.11	20.5	115.6	13.68	0.546
BR	deployed	4/13/2016	13:03:16	8.03	0.469	0.23	8.12	21.7	117.5	13.89	0.548
BR	retrieved	5/4/2016	11:51:16	11.63	0.515	0.25	7.89	17.3	101	10.96	0.363
BR	deployed	5/4/2016	11:54:16	11.64	0.515	0.25	7.87	19.2	103.6	11.24	0.363
BR	retrieved	5/24/2016	8:18:31	14.77	0.607	0.3	7.65	12.9	84.5	8.55	0.175
BR	deployed	5/24/2016	8:27:31	14.78	0.608	0.3	7.65	8.9	83.5	8.45	0.165
BR	retrieved	6/14/2016	8:05:07	18.07	0.706	0.35	7.63	19.3	71.9	6.78	0.074
BR	deployed	6/14/2016	8:10:31	18.06	0.706	0.35	7.62	65.4	70.2	6.62	0.074
BR	retrieved	7/5/2016	8:44:16	19.3	0.713	0.35	7.55	17.1		6.04	0.001
BR	deployed	7/5/2016	8:47:52	19.2	0.713	0.35	7.56	29.5		6.01	0
BR	retrieved	7/27/2016	7:36:31	21.57	0.789	0.39	7.54	20.3	58.5	5.15	0.063
BR	deployed	7/27/2016	7:38:31	21.6	0.789	0.39	7.52	22.4	57.8	5.08	0.063
BR	retrieved	8/17/2016	8:18:31	22.74	0.716	0.35	7.57	8.1	72.8	6.27	0.074
BR	deployed	8/17/2016	8:21:31	22.74	0.716	0.35	7.55	22.4	72	6.2	0.074
BR	retrieved	9/7/2016	8:48:31	20.62	0.716	0.35	7.45	73.6	61.5	5.51	0.095
BR	deployed	9/7/2016	8:51:31	20.61	0.716	0.35	7.48	79.1	63.6	5.7	0.095
BR	retrieved	9/20/2016									
BR	deployed	9/20/2016									
BR	retrieved	10/5/2016	8:24:15	15.802	0.8243	0.41	7.75	5.19	80.9	8	0.112
BR	deployed	10/5/2016	8:29:15	15.762	0.8243	0.41	7.75	5.88	80.6	7.98	0.111
BR	retrieved	10/26/2016	8:50:00	9.185	0.6684	0.33	7.71	4.39	79.1	9.08	0.242
BR	deployed	10/26/2016	8:53:00	9.186	0.6686	0.33	7.71	4.61	78.9	9.06	0.242
BR	retrieved	11/8/2016	9:34:00	9.595	0.8054	0.4	7.51	2.97	60.1	6.83	0.161
BR	deployed	11/8/2016	9:35:00	9.594	0.8054	0.4	7.51	5.2	60	6.83	0.161
BR	retrieved	11/29/2016	8:53:00	6.534	0.945	0.47	7.7	3.81	83.3	10.2	0.074
BR	deployed	11/29/2016	8:55:00	6.531	0.9444	0.47	7.71	3.91	83.2	10.19	0.075
BR	retrieved	12/9/2016	9:31:00	0.125	0.6545	0.31	7.89	26.67	95.6	13.9	0.316
DR	retrieved	01/05/2016	9:45	0.14	0.548	0.26	7.94	5.9	91.6	13.32	
DR	deployed	3/28/2016	16:00:16	9.08	0.363	0.17	7.56	357.7	91.7	10.58	0.45
DR	retrieved	4/12/2016	8:15:08	5.63	0.337	0.16	7.51	115.2	93.8	11.78	0.542
DR	deployed	4/12/2016	8:20:31	5.61	0.338	0.16	7.5	113.8	93.2	11.71	0.552
DR	retrieved	5/3/2016	8:21:31	10.54	0.411	0.2	7.5	98.9	90.8	10.11	0.435
DR	deployed	5/3/2016	8:30:07	10.52	0.413	0.2	7.49	102.6	89.8	10	0.459

DR	retrieved	5/24/2016	8:43:31	15.7	0.608	0.3	7.56	9.2	75.4	7.48	0.692
DR	deployed	5/24/2016	8:55:31	15.68	0.608	0.3	7.56	9.4	74.1	7.35	0.701
DR	retrieved	6/14/2016	8:22:31	20.2	0.689	0.34	7.58	9.5	69.6	6.29	0.403
DR	deployed	6/14/2016	8:31:31	20.3	0.689	0.34	7.56	9.8	65.6	5.92	0.409
DR	retrieved	7/5/2016	9:03:16	20.75	0.692	0.34	7.46	22.2		4.73	0.585
DR	deployed	7/5/2016	9:10:16	20.78	0.692	0.34	7.47	22.6		4.93	0.589
DR	retrieved	7/27/2016	7:57:31	24.33	0.677	0.33	7.46	23.7	33.9	2.83	0.708
DR	deployed	7/27/2016	8:03:31	24.33	0.676	0.33	7.45	30.4	31.9	2.66	0.71
DR	retrieved	8/17/2016	8:44:31	24.03	0.698	0.34	7.35	9.4	22.7	1.91	0.737
DR	deployed	8/17/2016	8:48:31	24.03	0.699	0.34	7.35	12.2	21.5	1.8	0.737
DR	retrieved	9/7/2016	9:10:06	21.97	0.662	0.32	7.29	8.8	35.2	3.08	0.547
DR	deployed	9/7/2016	9:20:06	21.98	0.662	0.32	7.28	8.5	28.1	2.45	0.551
DR	retrieved	9/20/2016									
DR	deployed	9/20/2016									
DR	retrieved	10/5/2016	8:45:15	15.858	0.7535	0.37	7.42	20.01	34.5	3.4	0.95
DR	deployed	10/5/2016	8:53:15	15.825	0.7539	0.37	7.4	19.89	31.3	3.09	0.953
DR	retrieved	10/26/2016	9:08:00	10.593	0.5605	0.27	7.4	40.5	48.4	5.38	1.658
DR	deployed	10/26/2016	9:21:00	10.756	0.56	0.27	7.39	42.34	46.9	5.19	1.66
DR	retrieved	11/8/2016	9:48:00	10.759	0.6932	0.34	7.27	8.43	27.6	3.06	1.08
DR	deployed	11/8/2016	9:52:00	10.752	0.693	0.34	7.27	8.07	25.8	2.86	1.08
DR	retrieved	11/29/2016	9:13:00	5.509	0.799	0.39	7.67	3.52	74.8	9.4	1.138
DR	deployed	11/29/2016	9:21:00	5.468	0.7966	0.39	7.66	3.92	73.3	9.23	1.143
DR	retrieved	12/9/2016	9:52:00	3.285	0.6522	0.32	7.77	34.46	79.4	10.59	1.522
OL	retrieved	01/05/2016	11:00	0.65	0.485	0.23	7.72	88.2	12.64	18.9	
OL	deployed	3/25/2016	14:00:08	9.14	0.498	0.24	7.61	80.9	80.3	9.24	0.669
OL	retrieved	4/12/2016	9:15:31	6.36	0.337	0.16	7.5	91.6	87.4	10.77	0.685
OL	deployed	4/12/2016	9:22:31	6.43	0.336	0.16	7.5	101.6	87.3	10.74	0.698
OL	retrieved	5/3/2016	9:10:08	11.68	0.376	0.18	7.37	164.9	78.5	8.51	0.705
OL	deployed	5/3/2016	9:13:31	11.65	0.371	0.18	7.4	140	80.3	8.71	0.704
OL	retrieved	5/24/2016	9:41:31	18.75	0.522	0.25	8.04	35.5	128.3	11.94	0.849
OL	deployed	5/24/2016	9:47:31	18.99	0.518	0.25	8.04	40	124.6	11.54	0.859
OL	retrieved	6/14/2016	9:58:31	22.73	0.46	0.22	7.51	31.4	59	5.08	0.539
OL	deployed	6/14/2016	10:05:07	22.76	0.462	0.22	7.47	32.7	58.9	5.07	0.542
OL	retrieved	7/5/2016	9:54:52	22.98	0.539	0.26	7.33	39.1		3.44	0.575
OL	deployed	7/5/2016	9:58:16	23.01	0.538	0.26	7.29	40.6		2.74	0.596
OL	retrieved	7/27/2016	8:48:31	26.29	0.548	0.26	7.35	29.6	37.4	3.02	0.594
OL	deployed	7/27/2016	8:52:31	26.32	0.548	0.26	7.33	29.1	35.6	2.87	0.65
OL	retrieved	8/17/2016	9:57:31	25.46	0.51	0.24	7.27	30.2	27	2.21	0.622
OL	deployed	8/17/2016	10:02:31	25.42	0.51	0.24	7.26	38.6	24.7	2.02	0.631
OL	retrieved	9/7/2016	10:46:06	24.2	0.496	0.24	7.3	22.5	49.8	4.17	0.524
OL	deployed	9/7/2016	10:56:06	24.17	0.495	0.24	7.26	22.4	47.1	3.95	0.525
OL	retrieved	9/20/2016									
OL	deployed	9/20/2016									
OL	retrieved	10/5/2016	9:25:15	17.329	0.4953	0.24	7.46	29.01	47.5	4.55	0.693

OL	deployed	10/5/2016	9:33:15	17.359	0.4953	0.24	7.45	26.66	47.5	4.55	0.69
OL	retrieved	10/26/2016	9:53:00	11.163	0.5234	0.25	7.68	13.97	64.9	7.12	0.965
OL	deployed	10/26/2016	10:03:00	11.157	0.5241	0.25	7.67	16.91	64.9	7.12	0.976
OL	retrieved	11/8/2016	10:21:00	12.294	0.5746	0.28	7.74	14.45	88.8	9.49	0.756
OL	deployed	11/8/2016	10:30:00	12.36	0.5745	0.28	7.73	15.58	89.1	9.51	0.758
OL	retrieved	11/29/2016	9:48:00	6.18	0.5738	0.28	7.96	14.18	98.9	12.23	0.703
OL	deployed	11/29/2016	9:55:00	6.196	0.5737	0.28	7.97	14.1	99.1	12.25	0.704
OL	retrieved	12/9/2016	10:28:00	0.405	0.5802	0.28	7.99	5.78	89.8	12.96	0.807
WM	retrieved	01/05/2016	11:15	0.78	0.505	0.24	7.89	67.3	88.3	12.61	
WM	deployed	3/25/2016	13:42:31	7.25	0.39	0.19	7.88	64.7	96.4	11.62	0.386
WM	retrieved	4/12/2016	9:35:08	6.98	0.332	0.16	7.53	120.1	87.2	10.58	0.889
WM	deployed	4/12/2016	9:45:08	6.88	0.332	0.16	7.53	116.2	88.5	10.76	0.886
WM	retrieved	5/3/2016	9:30:31	12.08	0.386	0.19	7.37	115.5	82.2	8.83	0.613
WM	deployed	5/3/2016	9:32:31	11.92	0.376	0.18	7.44	113.4	81.8	8.82	0.613
WM	retrieved	5/24/2016	10:05:07	18.86	0.518	0.25	8.16	18.7	133	12.36	0.917
WM	deployed	5/24/2016	10:10:07	18.94	0.517	0.25	8.17	26.1	136	12.61	0.919
WM	retrieved	6/14/2016	10:12:31	22.73	0.458	0.22	7.44	35.2	59.5	5.12	0.602
WM	deployed	6/14/2016	10:17:31	22.75	0.46	0.22	7.43	33.5	55.7	4.8	0.603
WM	retrieved	7/5/2016	10:07:16	22.94	0.538	0.26	7.28	31.7		2.6	0.58
WM	deployed	7/5/2016	10:09:52	22.96	0.538	0.26	7.29	37.6		2.86	0.581
WM	retrieved	7/27/2016	9:06:31	26.38	0.552	0.27	7.31	28.3	29	2.34	0.77
WM	deployed	7/27/2016	9:11:06	26.38	0.552	0.27	7.3	26.1	28.4	2.29	0.771
WM	retrieved	8/17/2016	9:37:31	25.53	0.518	0.25	7.29	29.4	20.5	1.68	0.719
WM	deployed	8/17/2016	9:57:31	25.46	0.51	0.24	7.27	30.2	27	2.21	0.622
WM	retrieved	9/7/2016	11:03:31	24.24	0.497	0.24	7.33	21.2	52.2	4.37	0.717
WM	deployed	9/7/2016	11:13:31	24.11	0.497	0.24	7.31	25.4	49.6	4.16	0.715
WM	retrieved	9/20/2016									
WM	deployed	9/20/2016									
WM	retrieved	10/5/2016	9:45:15	17.272	0.4872	0.24	7.47	24.36	47.2	4.53	0.821
WM	deployed	10/5/2016	9:52:15	17.286	0.4871	0.24	7.47	22.73	47.6	4.57	0.821
WM	retrieved	10/26/2016	10:15:00	11.26	0.5251	0.26	7.66	13.12	63.2	6.92	0.981
WM	deployed	10/26/2016	10:23:00	11.266	0.5251	0.26	7.66	14.76	63.2	6.91	0.192
WM	retrieved	11/8/2016	10:38:00	12.205	0.5727	0.28	7.72	16.77	85.5	9.15	0.912
WM	deployed	11/8/2016	10:42:00	12.178	0.5728	0.28	7.69	17.37	83.2	8.92	0.916
WM	retrieved	11/29/2016	10:03:00	6.089	0.5741	0.28	8.05	12.02	100.6	12.47	0.82
WM	deployed	11/29/2016	10:10:00	6.114	0.574	0.28	8.03	11.32	100.8	12.49	0.82
WM	retrieved	12/9/2016	10:38:00	1.062	0.5831	0.28	7.92	6.07	84.7	12	1.14