

Tivoli Bays North Hydrological Metadata  
Latest Update: October, 2011

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**Distribution**

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The National Estuarine Research Reserve, which operates this station, also requires compliance with the NOAA Ocean and Coastal Resource Management Data Ownership and Dissemination Policy for the NERRS System-wide National Monitoring Program ([cdmo.baruch.sc.edu/data/policy.cfm](http://cdmo.baruch.sc.edu/data/policy.cfm)).

**Entry Verification:**

Data collection and verification were performed according to the HRECOS Quality Management Plan and the HRECOS Estuary Stations Quality Assurance Project Plan. Both are available at [www.hrecos.org](http://www.hrecos.org). This station is quality level B; the data are verified once per quarter.

**Site Location and Character:**

Tivoli North Bay (latitude 42° 02' 11.56464" N, longitude 73° 55' 31.16645" W) is a freshwater tidal marsh with emergent marsh vegetation dominated by the cattail *Typha angustifolia*. Tivoli North Bay has a tidal range of 1.19 meters, a soft, silt/clay bottom type, and a depth range from 0.5 to 3.0 meters at the sampling location. At Tivoli North, sensors are deployed in a solidly affixed PVC tube lashed to an abandoned pile such that the sonde would sample 0.5 meters from the substrate and the top of the tube would barely be exposed at low tide. The datalogger contains sensors for temperature, conductivity, pH, dissolved oxygen, turbidity, chlorophyll, and depth. The depth sensor at Tivoli North Bay is non-vented to the atmosphere. GOES telemetry equipment includes a larger solar panel and battery, a larger enclosure to house the battery, a Sutron Satlink 2 transmitter, associated GPS for time synchronization and a Yagi antenna.

The deployment tube was destroyed in the winter of 2010. The sonde was deployed at this location, however, it was deployed in a cage until a new tube could be reinstalled. This deployment method was utilized until 5/11/10 when a new sonde tube was attached to an existing piling in the same vicinity of the original tube placement. This deployment tube was used for the remainder of the 2010 sampling season.

Tivoli South Water Quality Station is located within the NYS DEC Tivoli Bays Wildlife Management Area and within the boundary of the Hudson River National Estuarine Research Reserve. Permission for research work can be obtained through Nathan Ermer, Manager of Tivoli Bays Wildlife Management Area ([nmermer@gw.dec.state.ny.us](mailto:nmermer@gw.dec.state.ny.us), 845-256-3047)

**Data collection period:**

Sampling at Tivoli North Bay (TN) began in July 1996 but ceased in 1997-1998 due to instrument exposure at low tide. In 1999, an alternate site was established for TN and sampling began again in July of 1999. Sampling is continuous from April through December but is not conducted from approximately mid-December through the end of March due to winter storms and ice on the Hudson River and the tributaries. Transmission to the HRECOS network began 4/10/2008. A Chlorophyll probe was added to the sonde at Tivoli North Bay from 10/7/09.

Dates and times for site deployments and retrievals:

Deployment	Retrieval
4/9/2008 11:45	4/28/2008 13:45
4/28/2008 14:00	5/22/2008 09:30
5/22/2008 09:45	6/9/2008 12:30
6/9/2008 12:45	6/26/2008 13:45
6/26/2008 14:00	7/25/2008 14:00
7/25/2008 14:15	8/20/2008 11:30
8/20/2008 11:15	9/8/2008 14:00
9/8/2008 14:45	10/2/2008 10:45
10/2/2008 11:00	10/20/2008 12:15
10/20/2008 12:30	11/5/2008 13:00
11/5/2008 13:15	11/17/2008 12:00
11/17/2008 12:15	12/3/2008 11:15
4/8/2009 09:30	4/29/2009 10:30
4/29/2009 11:00	5/13/2009 10:45
5/13/2009 11:15	5/27/2009 11:15
5/27/2009 11:30	6/10/2009 09:30
6/10/2009 09:45	6/23/2009 09:00
6/23/2009 09:15	7/9/2009 10:00
7/9/2009 10:30	7/22/2009 9:15
7/22/2009 9:30	8/5/2009 9:15
8/5/2009 9:30	8/20/2009 9:30
8/20/2009 9:45	9/8/2009 11:30
9/8/2009 12:00	9/24/2009 12:30

9/24/2009 12:45	10/7/2009 9:30
10/7/2009 9:45	10/20/2009 9:30
10/20/2009 9:45	11/11/2009 14:45
11/11/2009 15:00	11/24/2009 13:30
11/24/2009 13:45	12/08/2009 13:00
4/1/2010 10:30	4/19/2010 09:38
4/19/2010 09:38	5/11/2010 08:40
5/11/2010 08:40	6/9/2010 08:25
6/9/2010 08:25	6/29/2010 09:35
6/29/2010 09:35	7/19/2010 13:07
7/19/2010 13:07	8/10/2010 10:03
8/10/2010 10:03	9/08/2010 10:20
9/08/2010 10:20	9/28/2010 10:15
9/28/2010 10:15	10/12/2010 11:50
10/12/2010 11:50	11/9/2010 10:43
11/9/2010 10:43	11/30/2010 12:36
11/30/2010 12:36	12/10/2010 11:30

### **Post deployment information**

Deployment	DO 100%	SpCond	pH	Turb
<i>expected values</i>	<i>100%</i>	<i>1.0 uS/cm</i>	<i>7</i>	<i>0 NTU</i>
04/09/08 to 04/28/08	100.6	0.992	6.89	0.9
04/28/08 to 05/22/08	104.8*	0.995	6.9	0.2
05/22/08 to 06/09/08	98.1	0.997	7.21	0.3
06/09/08 to 06/26/08	98.4	0.985	7.05	-1.2*
06/26/08 to 07/25/08	96.3	1.007	7.09	0.9
07/25/08 to 08/20/08	99.5	0.992	6.92	0.9
08/20/08 to 09/08/08	101.4	1.004	7.01	2.2*
09/08/08 to 10/02/08	98.8	0.983	6.99	-0.9
10/02/08 to 10/20/08	98.1	0.993	7.13	0.6
10/20/08 to 11/05/08	103.5	1.000	7.08	0.3
11/05/08 to 11/17/08	107.7*	0.974	7.16	1.0
11/17/08 to 12/03/08	104.5*	0.996	7.00	11.7*
04/08/09 to 04/29/09	104.9*	0.99	7.09	-1.2*
04/29/09 to 05/13/09	105	0.947	7.13	0.1
05/13/09 to 05/27/09	100.2	1.004	7.09	1.5*
05/27/09 to 06/10/09	100.2	0.99	7.04	-0.2
06/10/09 to 06/23/09	101.4	0.991	6.99	-0.1
06/23/09 to 07/09/09	101.3	0.977	7.05	1.4*
07/09/09 to 07/22/09	101.9	0.964	6.98	
07/22/09 to 08/05/09	101.4	0.992	7.03	0
08/05/09 to 08/20/09	101.4	0.957	6.93	-17.9*
08/20/09 to 09/08/09	103.8	1	7.08	2.6*
09/08/09 to 09/24/09	101.6	0.989	6.94	1.2*
09/24/09 to 10/07/09	99.6	0.968	7.07	-0.1
10/07/09 to 10/19/09	106.2*	0.936	7.1	0.6

10/19/09 to 11/11/09	106.1*	1.016	7.14	1.1
11/11/09 to 11/24/09	99.3	0.974	6.95	-0.8
11/24/09 to 12/08/09	99.5	0.979	7.11	2.1*
04/01/10 to 04/19/10	98.3	0.975	7.16	50.9*
04/19/10 to 05/11/10	104.5*	1.010	7.00	-0.5
05/11/10 to 06/09/10	101.5	0.999	6.98	-0.6
06/09/10 to 06/29/10	101.7	0.989	7.02	0.3
06/29/10 to 07/19/10	97.5	1.048	7.24	1.5*
07/19/10 to 08/10/10	100.2	0.977	7.16	0.1
08/10/10 to 09/08/10	102.6	1.066	7.04	0.0
09/08/10 to 09/28/10	104.8*	0.977	7.09	0.1
09/28/10 to 10/12/10	101.4	0.978	7.17	0.6
10/12/10 to 11/09/10	101.7	1.001	7.07	-0.6
11/09/10 to 11/30/10	98.0	0.994	7.07	2.6*
11/30/10 to 12/10/10	103.0	0.895	6.95	0.1

\* indicates post deployment values exceeded alarm levels as defined by the HRECOS Estuary Station Quality Assurance Project Plan

**Other remarks / notes including data coded “see Metadata”:**

- 05/22/08 09:45 - Data corrected for period 5/22/08 09:45 up to and including 6/9/08 12:30. Depth offset incorrectly set as 0.173; it should have been -0.173. Therefore 0.346 subtracted from depth readings.
- 08/20/08 11:45 - Depth data for period 8/20/08 up to and including 9/8/08 14:30 were rejected due to vented sonde being erroneously deployed at a non-vented site
- 08/05/09 09:30 - Turbidity data for deployment period 8/5/09 09:30 up to and including 8/20/09 09:30 is corrected. Incorrect calibration led to negative turbidity values down to -15 NTU. Therefore 15 NTU added to all turbidity readings.
- 11/05/08 13:00 - Data missing due to swapping of instruments
- 11/18/08 02:30 - Instrument power failure. No more data collected for this deployment period (up until 12/3/08 11:15)
- 12/3/08 - Sonde was retrieved for the winter due to rapid freezing of the water. Sonde deployment will resume after the spring thaw in April 2009.
- 04/29/09 10:45 - Data missing due to instrument swap.
- 05/13/09 11:00 - Data missing due to instrument swap.
- 07/09/09 10:15 - Data missing due to instrument swap.
- 09/08/09 11:45 - Data missing due to instrument swap.
- 10/07/09 09:45 - Chlorophyll added to parameters collected at from 10/7/09 09:45. During deployment period 10/7/09 09:45 up to and including 10/20/09 09:30, the sonde was incorrectly set to record data every 15 secs instead of every 15mins. Thus extra data (recordings every 15 secs) are held by the reserve for period 10/7/09 09:45 up to and including 10/11/09 03:00. Data are missing for the period 10/11/09 03:15 up to and including

- 10/20/09 09:30 due to sonde memory depletion. In addition, sonde clock was not set correctly, so all times are corrected.
- 10/20/09 09:45 - For deployment period 10/20/09 09:45 up to and including 11/11/09 14:45, sonde clock was not set correctly. All times were corrected manually.
- 11/11/09 - Dissolved oxygen data missing for period 11/11/09 15:15 up to and including 11/24/09 13:30 due to probe malfunction in the field.
- 12/8/09 - Sondes at Tivoli North & South Bays were retrieved for the winter due to imminent snow /ice storm.
- 4/1/10 10:30 Initial instrument deployment for 2010
- 4/18/10 13:15 Turbidity data for the period of 4/18/10 13:15 up to and including 4/19/10 9:15 am reported as negative and “suspect” values. A turbidity probe malfunction was cited as the cause for the error during this time period. The data has been coded as suspect based on the inference that the quality of data cannot be guaranteed.
- 5/6/10 18:00 Turbidity data for the period of 5/6/10 18:00 up to and including 5/11/10 08:15 am was reported as suspect. Elevated turbidity levels were detected during this sampling period and were contributed to a sensor malfunction. A new sonde tube was deployed on 5/11/10 and was utilized for future instrument deployment.
- 4/19/10 09:30 Data missing due to instrument swap.
- 5/29/10 13:15 Turbidity spike recorded at 13:15, may coincide with chlorophyll spike at 0:45 on 5/29/10.
- 6/3/10 03:30 Turbidity spike recorded at 03:30 may coincide with chlorophyll spike at 03:00 on 6/3/10.
- 6/6/10 21:15 Turbidity spike recorded at 21:15 may coincide with chlorophyll spike at 21:15 on 6/6/10. Three instances of turbidity and chlorophyll spikes coinciding with each other occurred throughout this instrument's deployment 5/29/10, 6/3/10, and 6/6/10. Data was rejected based on the reoccurrence of the spikes throughout the instrument's deployment.
- 6/9/10 08:30 Data missing due to instrument swap.
- 8/10/10 10:00 Data missing due to instrument swap.
- 9/28/10 10:00 Data missing due to instrument swap.
- 11/9/10 10:00 Data missing due to instrument swap.

Sonde deployment will resume after the spring thaw in April 2011.

## Sensor Specifications

General Information	Date first operational	7/1/96	Dissolved Oxygen mg/L	Units	milligrams/ Liter (mg/L)
	Date of first transmission	4/10/2008		Sensor type	Calculated from % air saturation, temperature, and salinity
	Data Logger Model	YSI 6600		Model #	YSI 6150 ROX
	Data Transmitter	Sutron Model #SL2-G312-1 geo-stationary satellite data transmitter		Range	0 to 50 mg/L
	Vented to Atmosphere?	non-vented		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
	Collection Interval	15 min		Resolution	0.01 mg/L
Conductivity	Units	mS/cm	Water Level (shallow depth)	Units	meters (m)
	Sensor type	4-electrode cell with autoranging		Sensor type	Stainless steel strain gauge
	Model #	YSI 6560		Vented to Atmosphere	non-vented
	Range	0 to 100 mS/cm		Range	0 to 30 ft (9.1 m)
	Accuracy	+/-0.5% of reading + 0.001 mS/cm		Accuracy	+/- 0.06 ft (0.018 m)
	Resolution	0.001 mS/cm to 0.1 mS/cm (range dependent)		Resolution	0.001 ft (0.001 m)
Salinity	Units	parts per thousand (ppt)	pH	Units	pH units
	Sensor type	Calculated from conductivity and temperature		Sensor type	Glass combination electrode
	Range	0 to 70 ppt		Model #	YSI 6561 Flat Glass
	Accuracy	+/- 1.0% of reading or 0.1 ppt, whichever is greater		Range	0 to 14 units
	Resolution	0.01 ppt		Accuracy	+/- 0.2 units
Dissolved Oxygen % Saturation	Units	percent air saturation (%)	Turbidity	Resolution	0.01 units
	Sensor type	Optical probe w/ mechanical cleaning		Units	nephelometric turbidity units (NTU)
	Model #	YSI 6150 ROX		Sensor type	Optical, 90 ° scatter, with mechanical cleaning
	Range	0 to 500% air saturation		Model #	YSI 6136
	Accuracy	0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 15% or reading		Range	0 to 1000 NTU
	Resolution	0.1% air saturation		Accuracy	+/- 2 % of reading or 0.3 NTU (whichever is greater)
Temperature	Resolution	0.1% air saturation	Temperature	Resolution	0.1 NTU
				Units	Celsius (°C)
				Sensor type	Thermistor
				Model #	YSI 6560
				Range	-5 to 45 °C
				Accuracy	+/-0.15 °C
		Resolution	0.01 °C		

### QAOC flag definitions:

	Flag	Description
Automatic Data Flags	0	Acceptable data
	5	Data that demonstrate a dramatic increase or decrease from the previous value. This flag will be applied to all parameters except chlorophyll, radiation, rainfall, wind direction, and wind direction standard deviation where dramatic increases and decreases are expected. The boundaries for these flags are: <ul style="list-style-type: none"> <li>○ <math>x &gt; 3(\text{previous value})</math> for Acidity, Dissolved Oxygen, Water Level, Water Temperature, Barometric Pressure, and Absolute Pressure.</li> <li>○ <math>x &lt; 1/3(\text{previous value})</math> for Specific Conductivity, Salinity, and Relative Humidity.</li> <li>○ <math>x &gt; 10 + 3(\text{previous value})</math> for Turbidity, Wind Gusts, and Wind Speed.</li> <li>○ <math> x  &gt; 10 + 3(\text{previous value})</math> for Air Temperature</li> </ul>
	6	Flat lined data (20 or more repeated records of the same value). This flag will be applied to all parameters except specific conductivity, chlorophyll, radiation, and rainfall where flat lined data is expected. For the same reason, this flag will not be applied to salinity data from Norrie Point.
	30	Hydrological data outside three standard deviations of the seasonal mean. The seasons will be defined by the solstices and equinoxes.
	40	Hydrological data outside four standard deviations of the seasonal mean. The seasons will be defined by the solstices and equinoxes.
	100	Data outside the range of the instrument.
Added by Site Manager	0	Data determined to be acceptable after a final review by the site manager.
	10,000	Suspicious data according to a final review by the site manager
	20,000	Corrected Data
	500,000	Rejected data according to a final review by the site manager.
Added by HRECOS Coordinator	5,000	Data from instruments that exceed the post-deployment warning level as defined by the HRECOS quality management plan
	9,000	Data from instruments that exceed the post-deployment alarm level as defined by the HRECOS quality management plan

**QAQC Comment Code definitions:**

Comment Codes Added By Site Managers	General Errors	Hyd + Met	[GIM]	instrument malfunction	[GPF]	power failure/low battery	
			[GIT]	instrument recording error, recovered telemetry data	[GQR]	rejected due to QAQC checks	
			[GMC]	no instrument deployed due to maintenance/calibration	[GSM]	see metadata	
		Hyd	[GIC]	no instrument deployed due to ice	[GOW]	out of water event	
			[GNF]	deployment tube clogged/no flow			
		Met	[GMT]	instrument maintenance	[GIM]	program reload	
			[GPD]	power down			
		Sensor Errors	Hyd	[SBO]	blocked optic	[SPC]	post calibration out of range
				[STF]	catastrophic temperature sensor failure	[SSDN]	sensor drift, record not corrected
	[SCF]			conductivity sensor failure	[SSDC]	sensor drift, record corrected	
	[SDF]			depth port frozen	[SSM]	sensor malfunction	
	[SDP]			DO membrane puncture	[SOW]	sensor out of water	
	[SDO]			DO suspect	[SSR]	sensor removed (not deployed)	
	[SIC]			incorrect calibration/contaminated standard	[STS]	turbidity spike	
	[SNV]			negative value	[SWM]	wiper malfunction/loss	
	Met		[SIC]	incorrect calibration constant, multiplier or offset	[SOC]	out of calibration	
			[SNV]	negative value	[SSM]	sensor malfunction	
			[SSN]	not a number/unknown value	[SSR]	sensor removed	
	Comments		Hyd	[CAF]	acceptable calibration/accuracy error of sensor	[CRE]	significant rain event
		[CBF]		biofouling	[CSM]	see metadata	
		[CCU]		cause unknown	[CTS]	turbidity spike	
		[CDA]		DO hypoxia <28 percent saturation	[CWD]	data collected at wrong depth	
		[CDB]		disturbed bottom	[CAP]	depth sensor in water, affected by atmospheric pressure	
		[CDF]		data appear to fit conditions	[CAB]	algal bloom	
		[CFK]		fish kill	[CVT]	possible vandalism/tampering	
		[CIP]		surface ice present at sample station	[CMC]	in field maintenance/cleaning	
		[CLT]		low tide	[CMD]	mud in probe guard	
		[CND]		new deployment begins			
		Met	[CAF]	acceptable calibration/accuracy error of sensor	[CSM]	see metadata	
			[CDF]	data appear to fit conditions	[CVT]	possible vandalism/tampering	
	[CRE]		significant rain event				