

## I. Data Set & Research Descriptors

### 1) Principal investigator & contact persons:

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### 2) Entry verification:

The data are uploaded in three file formats (each to separate files identified with the same file name but with unique extensions) from the YSI 6600 data loggers to a PC with the YSI 6600 EcoWatch software. Two of these (PC6000 and ASCII text formats) are kept on file in the WBNERR archive. The comma delimited format data file (.csv) is imported to the EXCEL spreadsheet program (version 5.0) where it is processed according to standard NERRS CDMO protocol using the CDMO Excel 5.0 macros. File contents initially are examined for anomalies (e.g., sensor malfunction, battery failure, spurious values, etc.) by visualization of data with the Ecowatch Software provided by YSI. The exported csv. files are opened in Microsoft Excel for pre-processing with the EQWin format macro that was developed by the CDMO to reformat the header columns, insert station codes, insert a corrected time column and allow the technician to remove any pre- and post- deployment data from the file. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is accepted as being the most accurate. The pre-processed file is then ready to be copied into the EQWin water.eqi file where the data are QA/QC checked and archived in a database. EQWin queries, reports, and graphs are used to discover data set outliers (values which fall outside the range that the instrument is designed to measure) and large changes in the data. Missing data (data logger malfunction or maintenance periods) are represented by a blank space. Outliers (data values not within the design range of the respective sensors except for turbidity and depth) are deleted or noted as anomalous. EQWin is also used to generate statistics, view graphs, create customized queries and reports of the data, cross query the water, weather, and nutrient data, and finally export the data to the CDMO. A record of changes is documented in the Data Anomalies section of the metadata file.

Copies of all files are retained at the Reserve. During Deployment Year 2004, due to position turnover several persons were responsible for performing all instrument calibrations, maintenance and data management: 1) RA Kelly Chapman January to April, 2) RA Jen Dealteris April through June, 3) RC Chris Weidman July to mid-November, and 4) RA Heather Tschaekofske from mid-November through December.

### 3) Research objectives:

For the NERR System-Wide Monitoring Program (SWMP), the YSI data loggers are programmed to record water quality parameters every 30 minutes. A total of four SWMP sites were located in the Waquoit Bay estuarine system during 2004. These four are: 1) Metoxit Point (MP) is located in the middle of Waquoit Bay's main basin; 2) Menauhant (MH), in operation since March 2001, is located adjacent to Eel Pond Inlet on Vineyard Sound – one of the two tidal inlets into the Waquoit Bay estuary; 3) Child's River (CR), in operation since May 2002, located near the head of the tidal section of Child's River— one of the two main surface fresh water sources to Waquoit Bay; and 4) Sage Lot (SL), in operation since May 2002, located in Sage Lot Pond—a relatively pristine tidal pond surrounded by salt marsh and barrier beach, possessing one of the bay's few remaining eelgrass stands.

The main purpose of water quality monitoring program is to aid Waquoit Bay NERR in one of its priority missions - to perform as a natural laboratory and platform for coastal and estuarine research. The long term, continuous detailed monitoring of the estuary's basic hydrophysical parameters is an essential tool and context for any research activities located here. Besides this overarching mission, there are also several specific research interests. One primary issue for the Waquoit Bay ecosystem is the influence of anthropogenic induced alterations by nitrogen enrichment. Waquoit Bay receives nitrogen from several sources, such as septic systems (their leachate percolates into groundwater which then enters the bay), run off from roads, run off containing domestic and agricultural fertilizer and animal waste, and atmospheric sources. This elevated nitrogen loading to the bay has resulted in enhanced eutrophication that has contributed to the alteration of the bay's habitats. For example, thick mats of seaweeds (macroalgae) now cover the bottom where eelgrass meadows thrived in the 1970's. Unfortunately, there are few definitive records of the bay's water quality conditions during that period, which makes it difficult to evaluate the rates of change. To facilitate future evaluation, long-term records from SWMP can be used to track water column conditions. Of particular interest, in this regard are measurements of dissolved oxygen (DO) and turbidity, as well as dissolved nitrogen and chlorophyll concentration (this data is available by contacting the reserve). Such records will facilitate evaluation of changes which may come about from a continuation of watershed alteration that result from current development patterns (i.e., non-sewered residential areas served by private septic systems typically consisting of septic tanks and leach fields) as well as non-industrial commercial development, such as golf courses, cranberry bogs, and retail shopping outlets. The records will be useful for evaluating the efficacy of remediation efforts intended to reduce the nitrogen loading from these sources to Waquoit Bay.

Another focus of long-term research interest is the detection of climate change and the determination of its effects on the estuarine environment. Characterizing the variability of the

various water column parameters, such as their scale, magnitude and frequency, is likely to be an important aspect of the estuarine ecosystem that may be sensitive to climate change. Related to this focus is an interest in the impact of storms (hurricanes and northeasters) and other extreme meteorological events on the estuary. For example, what temperature and wind field thresholds exist that might bring about or trigger certain conditions within the bay? The observations recorded by the SWMP will allow for these types of studies.

#### 4) Research methods:

YSI 6600 series sondes are deployed at each permanent water quality monitoring station at the Waquoit Bay Reserve. Since in-situ instrumentation can only record conditions at a specific location, permanent monitoring stations for SWMP are chosen to be in some way representative of the overall estuary. This is difficult in practice since estuaries by their very definition are coastal regions where large physical, chemical and biological variations tend to occur in space and time, so that often no particular location within the system is “typical” of the overall system. Establishing a number of stations can overcome this problem somewhat, and as of 2002 four permanent stations were established in the Waquoit Bay estuaries. Our current SWMP stations are situated so as to be as representative as much as possible of the estuary and its inputs/outputs. Additional details concerning the station characteristics are discussed in the next section.

The YSI sondes measure and record ambient water temperature, specific conductivity (and calculate salinity), dissolved oxygen (mg/L and % saturated), turbidity (NTU), water level (m), and pH at 30 minute intervals during deployment periods extending for approximately two to four weeks. Note that the pressure sensors we currently use are un-vented and so variations in atmospheric pressure are recorded as changes in water depth (atmospheric data are available from our SWMP meteorological station (as of 1/2002) and other nearby meteorological observatories), so it is possible to make this correction to the depth data (approximately +1 cm of depth is equal to +1 mb of air pressure), for increased accuracy. Also, at our Metoxit Point site (from 12/2000 to 12/2004) and our Child's River site (from 3/2003 through 12/2004), we have been using a YSI chlorophyll 6025 sensor and these data are available by contacting us directly at the reserve (and included in the raw files sent to CDMO).

Sondes are deployed and retrieved every two to four weeks. The “old” sonde is retrieved and a “new” replacement sonde is deployed immediately so that ideally no record gap occurs. The 2-4 week deployment duration is constrained by a combination of battery life (shorter life in colder waters) and fouling of the DO sensor (and other sensors to a lesser degree) during the warm summer months. Prior to deployment (usually within 24 hrs), each instrument is checked and its sensors re-calibrated using standard YSI (Operating Manual) protocols. Similarly, after a deployment, each sonde is brought back to the laboratory for a post-deployment check, data downloading, instrument and sensor cleaning. Salinity sensors are calibrated with reference seawater that had been previously analyzed with a Guildline salinometer at the Woods Hole Oceanographic Institution (David Wellwood is currently the technician for this instrument). pH sensors are calibrated with 7.0 and 10.0 pH standard solutions (2-point calibrations). The turbidity standard used was YSI 6073G turbidity standard for 123.0 NTU, and distilled water (DI) for 0 NTU. Temperature sensors are checked periodically against a calibrated mercury

thermometer. Oxygen sensor membranes are inspected before and after each deployment. Oxygen sensor membranes were replaced 24 hours prior to each deployment when the sensor seemed to need reconditioning. Final DO calibration was not done until the membrane had been in place for at least 8 hours. As another check on instrument performance, in-situ measurements of air and water temperature, DO, salinity, water temperature, and pH are made using a hand-held YSI 650 at deployment/retrieval times.

In 2004, SWMP water quality data were collected more or less continuously at our two dockside sites, Child's River and Menauhant, from January through December, while no data were collected at our open water sites, Metoxit Point and Sage Lot, from January until late March owing to heavy sea ice conditions on the bay. Winter 2003 / 2004 was an even more extreme sea ice year than the previous 2002 / 2003 winter, and ice thickness (+30 cm) and extent were the most extreme in twenty years since the early 1980s and late 1970s. Duration of significant sea ice cover lasted from early December 2003 in Sage Lot Pond, and from early January 2004 in the open waters of the main bay (Metoxit) until late March in Sage Lot Pond and mid-March 2004 in the main bay (Metoxit). The empty sonde moorings / silos at the two open water sites were also removed during ice over to prevent damage to them. Cold and sea ice conditions returned in mid- December 2004 and both Sage Lot and Metoxit sites were moderately iced-in (2-6 cm thickness) for about 1-2 weeks. However, milder weather returned before we pulled the data loggers allowing us to maintain operation at these two sites until mid-January 2005.

Two types of mooring silos are used to hold the sondes. The Metoxit Point and Sage Lot stations are located offshore and away from shore structures. The sonde moorings for these stations consist of a vertical PVC pipe tower (2" ID), about 1.5 meters in height extending from a 120 lb cast concrete base resting on the bottom. Attached to this tower is a 0.7 m PVC pipe section (4" ID), referred to as the silo, that holds the sonde and is adjustable for setting the depth of the sensor package. The sondes are lowered and inserted into the 4" PVC silo from the surface at low water, when the top of the tower is only about 0.3 m below the surface. The lower part of the silo section is perforated with numerous 1.5 " holes to allow the YSI sonde's sensors direct exposure to the flow of ambient waters. The Metoxit Point and Sage Lot silos are set so that the sensor package is 0.7 m and 0.5 off the bottom, respectively. This ensures that the sensors are above the macro algal mats in the case of Metoxit Point, and sufficiently into the water column because of the thick eelgrass meadow in Sage Lot. The Menauhant and Child's River stations are dock-side locations and their moorings are a more typical type of silo – a single PVC section (4" ID) mounted vertically on a pier piling. The Menauhant site, located at a yacht club dock, is adjacent to a tidal inlet, and the Child's River site, located at commercial marina and boat yard, is adjacent to the upper reaches of a tidal river. The base of the these silos are also ventilated with large holes (1.5" diameter) and their sensor packages (bottom of the sonde) are both mounted about 0.4 m off the bottom. All mooring silos are painted with antifouling paint at the beginning of the spring season, and periodically checked and scrubbed during the summer season.

##### 5) Site location and character:

General description of Waquoit Bay estuarine system:

The Waquoit Bay National Estuarine Research Reserve (WBNERR) is located in the northeastern United States on the southern coast of Cape Cod, Massachusetts. About 8,000 people maintain permanent residency in Waquoit Bay's drainage area, which covers parts of the towns of Falmouth, Mashpee, and Sandwich. During summer months, the population swells 2-3 times with the greatest housing concentrations immediate to the coastline (water views and frontage). In addition, the upper portions of the watershed include a military base, Otis Air Force Base and the Massachusetts Military Reservation, portions of which have been designated by the EPA as Superfund sites due to past practices of dumping jet fuel and other volatile groundwater contaminants.

WBNERR's estuaries are representative of shallow tidal lagoons that occur from Cape Cod to Sandy Hook, New Jersey. WBNERR is within the northern edge of the Virginian biogeographic province, on the transitional border (Cape Cod) with the Acadian biogeographic province to the north and east. Like many embayments located on glacial outwash plains, Waquoit Bay is shallow (< 5 m), fronted by prominent barrier beaches (i.e., those of South Cape Beach State Park and Washburn Island), and is backed by salt marshes and upland coastal forests of scrub pine and oak. Two narrow, navigable inlets, reinforced with granite jetties, pass through two barrier beaches to connect Waquoit Bay with Vineyard Sound to the south. A third shallow and generally un-navigable inlet opened through the Washburn Island barrier beach during Hurricane Bob in August 1991, and closed up in February 2002.

Bottom sediments in the bay are organic rich (Corg conc. ~ 3-4%) silts and medium sands. Sediment cores taken in summer of 2002 indicate that the depth of these estuarine sediments is up to 9 m thick in places. Dating work on these sediment cores suggests that the Waquoit Bay basin has been inundated by the sea for about 5000 years, and sedimentation rates over the past 500 years are estimated to be range from 1.6 to 4.9 mm/yr. Thick (up to 0.3 m) macroalgae (seaweed) mats overlie much of the bottom of the bay, and largely consist of species *Cladophora vagabunda*, *Gracilaria tikvahiae*, and *Enteromorpha*. The dominant marsh vegetation in Waquoit Bay is *Spartina alterniflora* and *Spartina patens*. Dominant upland vegetation includes mixed forests of red oak, white oak, and pitch pine, and other shrubs and plants common to coastal New England. Land-use in the bay's watershed is about 60% natural vegetation, but the remaining land is largely residential housing, with some commercial (retail malls), and minor amounts of agriculture (~3%) (cranberry bogs).

Dense housing developments cover the two peninsulas that form the western shore of the Waquoit Bay estuarine system. Although the developments themselves are outside of the Reserve boundaries, dissolved nitrogen in discharges from their septic systems (via groundwater) and in fertilizer run-off from their lawns has significant effects on the functioning of the Waquoit Bay ecosystem. These impacts have been a primary subject of study at the Reserve since its designation (1988). One outcome of this research has been the delineation of sub-watersheds within the overall drainage area for Waquoit Bay, of which WBNERR is a small part. This knowledge allows for the design of experiments based on the spatial variation of nutrient loading and other land-use related impacts.

At the northern end of the bay, an area comprising a separate sub-watershed, coastal bluffs of glacial till rise 30 feet above sea level. The northern basin of the bay, just below these bluffs, is

its deepest area (approximately 3 m MLW), while much of the remainder of the bay is about 1.5 m. Bourne, Bog, and Caleb Ponds are freshwater kettle hole ponds on the northern-most shore of the bay. As components of the same sub-watershed, they have a common albeit minor freshwater outflow into the bay's northern basin via a narrow channel through a brackish marsh. To the east and south, other sub-watersheds surround several tidal and freshwater ponds, including Hamblin and Jehu Ponds, brackish salt ponds that are connected to the main bay by the tidal waters of Little and Great Rivers, respectively. The shorelines of the ponds are developed with residences that are occupied both seasonally and year round. Hamblin Pond and Little River are components of one sub-watershed, and Jehu Pond and Great River are elements of a separate sub-watershed. Further south lies Sage Lot Pond. It is in the least developed sub-watershed and also contains a barrier beach and salt marsh ecosystem of the reserve's South Cape Beach State Park. To the east of Sage Lot Pond and within the same sub-watershed, lies the highly brackish Flat Pond. It receives minimal tidal flows of salt water from Sage Lot Pond through a narrow, excavated and culverted channel. The preponderance of the input to Flat Pond is groundwater and run off, both of which are likely affected (e.g., nutrients, pesticides, bacteria) by an adjacent golf course and near-by upper-scale residential development.

The largest source of surface freshwater to Waquoit Bay is the Quashnet / Moonakis River. Although named "river", this and Child's River are more appropriately described as "streams" because of their small channels and discharge ~1.0 CFS. A component of yet another sub-watershed, it originates in Johns Pond situated north of the bay and traverses forests, cranberry bogs, residential areas, and the Quashnet Valley Golf Course before entering the bay near the southern "boundary" of the northern basin. ("Quashnet" applies to that portion of the river within the town of Mashpee, and "Moonakis" refers to the brackish estuary at the river's mouth, lying in the town of Falmouth. Quashnet will be used hereafter to refer to the entire river.) The Quashnet River's tidal portion has sufficient numbers of coliform bacteria to cause it to be closed to shell fishing most of the time. The source(s) of this bacteria (human or avian) is unknown at this time.

The Childs River is the second largest input of surface freshwater to the bay. A component of another sub-watershed, it runs through densely developed residential areas. The Childs River sub-watershed receives the highest nitrogen loading and is the largest nitrogen contributor to the Waquoit Bay system of all the sub-watersheds. In the upper tidal portions of the river we have consistently recorded the highest nutrient and chlorophyll levels and the lowest dissolved oxygen readings of any region in the bay and so this location represents an end-member for looking at anthropogenic inputs and impacts on the system. Another, albeit smaller, source of freshwater is the discharge of Red Brook through brackish marshlands into Hamblin Pond. Additional freshwater enters the bay elsewhere through groundwater seepage (perhaps up to 50% of all freshwater input into the bay), precipitation and the flows of smaller brooks. There is relatively little surface water runoff entering directly into the bay due to the high percolation rates of Cape Cod's coarse, sandy soils.

Knowledge of the homo/heterogeneity of the water masses in Waquoit Bay was originally derived from measurements made by reserve staff and from data obtained by the reserve's volunteer water quality monitoring group, the Waquoit Bay Watchers who have collected depth profiles of Waquoit Bay water quality since 1993. Subsequent research by reserve staff

(including some numerical modeling by T. Isaji) has revealed that lateral mixing has considerable influence because tidal currents follow a general course through the bay. This results in an overall structure to horizontal patterns of water quality characteristics. The pattern it produces is a gyre in the central portion of the main bay whereby currents follow a generally counter-clockwise flow around a central area that exhibits reduced exchange with the remainder of the bay. The flushing rate within the gyre is diminished when compared with other more peripheral areas of the bay. The location of the gyre meanders slightly, apparently under the influence of tides and wind). Because of the shallow conditions, restricted tidal inlets, and low amplitude tidal forcing of Vineyard Sound here (tides are semi-diurnal with a range about 0.5 m) water levels in the bay are also strongly influenced by wind forcing. Southerly winds increase tidal heights and advance the phase of the flood and retard the phase of ebb (Northerly winds have the opposite effect).

The Metoxit Point station (MP) ( $41^{\circ} 34.131' N$   $70^{\circ} 31.294' W$ , 2.2 m deep) initiated in 1998, is located in the main basin of Waquoit Bay and was selected to be within or near the outer regions of the gyre (described above) and more or less represents “typical” water mass conditions and residence times for the bay. The location is at least a half mile from shore, well flushed by tides, and is in an area that is minimally disturbed by routine activities on the bay (e.g. boat traffic, shell fishing, etc.). Bottom sediments at the site are organic rich muds often overlain by thick agal (*Cladophora*) mats. Because of this site’s fairly open exposure to south (greatest fetch over the bay), we have observed that when sustained southerly winds are greater than about 20 kts, the Metoxit Point site experiences increased turbidity (sediment suspension events). Last year (autumn 2003) for the first time, the absolute elevation of the station to relative to NGVD (National Geodetic Vertical Datum, sometimes referred to as 1929 Sea Level) was calibrated. Precision is uncertain at this time (but estimated to be within 0.1 m). Depth to base of the sonde (base of the sensor guard) at the Metoxit Point site is -1.02 m NGVD. The calibrated mean depth sensor height above the guard base for our YSI 6600 instruments is 0.26 m ( $SD < 0.01m$ ). Therefore depth readings (uncorrected for air pressure) at this station for this year should be interpreted as water surface heights above -0.76 m NGVD. A mean tidal range of 0.46m ( $SD = 0.17$ ) is calculated based on one month of data (May 2003), with a minimum of 0.13 m and a maximum of 0.91 m. A mean monthly salinity range of 4.2 ppt, from a mean monthly min of 27.8 ppt to a mean monthly max of 32.0 ppt, has been calculated for this site based on one year of observations (2002).

The Menauhant station (MH) ( $41^{\circ} 33.156' N$   $70^{\circ} 32.912' W$ , 1.2 m deep), initiated in March 2001, is located within the Eel Pond Inlet at the Menauhant Yacht Club dock. Eel Pond Inlet is the westernmost of the two main tidal inlets into the Waquoit Bay system. The site was chosen because it occupies one of the strategic locations for gauging the system’s water mass characteristics. Entering waters represent the marine end-member while outflows represent the final product of estuarine water mass modification and export to shelf waters. The site also has easy walk-in access to a secure private pier that extends into the throat of the inlet. Also, because of the turbulent tidal flow within the inlet, conditions are vertically well mixed, and the site can be maintained year round even through ice-over conditions in the rest of the bay. Bottom sediments at this site are clean sands and gravels with almost no attached bottom vegetation. Since inception, we have noted that strong south to southeast (onshore) winds tend to produce turbidity events at this site from the wave induced suspension of fine sediments and organic material in the upstream near-shore zone. While we have found that these type of

turbidity events are localized to windward near-shore areas in the bay, the transport of these sediments at inlet mouths during such times is perhaps a dominant sedimentation process within the estuarine system. In other words while the choice of our location may be producing a localized signal in one of our measured parameters that signal may reflect key processes in the system at large. In the autumn 2003, the absolute elevation of the station to relative to NGVD (National Geodetic Vertical Datum, sometimes referred to as 1929 Sea Level) was calibrated. Precision is uncertain at this time (but estimated to be within 0.1 m). Depth to base of the sonde (base of the sensor guard) at the Menauhant site is -0.68 m NGVD. The calibrated mean depth sensor height above the guard base for our YSI 6600 instruments is 0.26 m (SD<0.01m). Therefore depth readings (uncorrected for air pressure) at this station for this year should be interpreted as water surface heights above -0.42 m NGVD. A mean tidal range of 0.48m (SD = 0.19) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.99 m. A mean monthly salinity range of 3.9 ppt, from a mean monthly min of 28.5 ppt to a mean monthly max of 32.4 ppt, has been calculated for this site based on one year of observations (2002).

The Child's River station (CR) (41° 34.793' N 70° 31.854' W, 1.2 m deep), initiated in May 2002, is located on a dock piling at Edwards Boat Yard, a commercial marina near the upper tidal reaches of of Child's River—one of the two main surface fresh water sources to Waquoit Bay (see general description of Waquoit Bay watershed above). This location is very strongly stratified, characterized by a salt wedge with fresher river water overlying saline ocean water. Vertical salinity ranges can run from 0-10 ppm at the surface to more than 30 ppm just 1 m below. The sonde sensors are usually well within the salt wedge portion of the water column, nonetheless this location is also our freshest SWMP site, and is at the opposite end of Child's River from the seaward Menauhant station. Bottom sediments are fine organic rich muds. This location represents the most terrigenously and anthropogenically-impacted SWMP site. Monthly water quality, collected near this location for the past decade, shows very high chlorophyll concentrations during the warmer months and more recent dissolved nutrient records show very high nutrient-loads. Boat traffic at the marina likely leads to increased turbidity during the boating season as well. As this site is dockside at a private marina, general security is high along with easy access. The station is also serviceable year-round and usually not subject to seasonal shutdown due to ice over. In autumn 2003, the absolute elevation of the station to relative to NGVD (National Geodetic Vertical Datum, sometimes referred to as 1929 Sea Level) was calibrated. Precision is uncertain at this time (but estimated to be within 0.1 m). Depth to base of the sonde (base of the sensor guard) at the Child's River site is -0.86 m NGVD. The calibrated mean depth sensor height above the guard base for our YSI 6600 instruments is 0.26 m (SD<0.01m). Therefore depth readings (uncorrected for air pressure) at this station for this year should be interpreted as water surface heights above -0.58 m NGVD. A mean tidal range of 0.46 m (SD = 0.17) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.95 m. A mean monthly salinity range of 14.7 ppt, from a mean monthly min of 15.8 ppt to a mean monthly max of 30.5 ppt, has been calculated for this site based on one year of observations (2002).

The Sage Lot station (SL) (41° 33.254' N 70° 30.612' W, 1.2 m deep), initiated in May 2002, is located in a deeper portion of Sage Lot Pond – a small sub-estuary of Waquoit Bay (20 ha) surrounded by salt marsh and barrier beach. Its small watershed is the least developed of all of



Waquoit Bay's sub-watersheds and Sage Lot Pond is considered to be its least impacted and most pristine sub-estuary. Bottom sediments are organic rich muds. Sage Lot Pond possesses one of the few remaining eelgrass beds in the Waquoit Bay system. Indeed the Child's River and Sage Lot Pond sites are considered to represent opposite end-members of nutrient-loading and human-induced influence. Researchers often locate their experiments in these two locations to take advantage of this difference. However, Sage Lot Pond is hydrologically connected to an upstream brackish source -- Flat Pond -- via a series of tidal creeks, drainage ditches and culverts. Flat Pond borders a country club and golf course and some concern exists for its impact on the water quality of Sage Lot Pond. Currently, Sage Lot Pond is closed to shellfishing because of high fecal coliform concentrations, though these are thought to be of avian source. In autumn 2003, the absolute elevation of the station to relative to NGVD (National Geodetic Vertical Datum, sometimes referred to as 1929 Sea Level) was calibrated. Precision is uncertain at this time (but estimated to be within 0.2 m). Depth to base of the sonde (base of the sensor guard) at the Sage Lot site is about -0.6 m NGVD. The calibrated mean depth sensor height above the guard base for our YSI 6600 instruments is 0.26 m (SD<0.01m). Therefore depth readings (uncorrected for air pressure) at this station for this year should be interpreted as water surface heights above -0.3 m NGVD. A mean tidal range of 0.40m (SD = 0.14) is calculated based on one month of data (May 2003), with a minimum of 0.11 m and a maximum of 0.67 m. A mean monthly salinity range of 4.9 ppt, from a mean monthly min of 27.2 ppt to a mean monthly max of 32.1 ppt, has been calculated for this site based on one year of observations (2002).

#### 6) Data collection period:

SWMP water quality monitoring in Waquoit Bay was initiated in 1995. Several different pilot sites (i.e., North Basin and Central Basin) were occupied for varying durations before settling on our first permanent long term site at Metoxit Point in summer 1998. The Menauhant site was our second permanent station and began operation in March 2001. Sage Lot and Childs River sites began operation in May 2002. For 2004, data loggers were deployed at the Metoxit Point (MP), Menauhant Yacht Club (MH), and Childs River (CR) sites as of on the first day of the year. However, the Sage Lot site was not in operation as of the first of the year due to heavy sea ice conditions. The Metoxit site was abandoned for the winter on 1/9/2003 due to heavy sea ice. The Metoxit and Sage Lot sites were reoccupied and back in operation on March 31, 2004 and remained so for the rest of the year. The Menauhant and Childs River sites were in operation continuously throughout 2004. The Metoxit deployment dates and times for 2004 are indicated below:

BEGAN  
Metoxit Point Site

ENDED

12/31/2003, 09:00:00  
03/31/2004, 11:30:00  
04/14/2004, 15:00:00  
04/28/2004, 13:00:00

01/09/2004, 09:00:00  
04/14/2004, 14:30:00  
04/28/2004, 12:30:00  
05/20/2004, 08:00:00

05/20/2004, 08:30:00  
06/16/2004, 08:30:00  
07/07/2004, 19:30:00  
08/13/2004, 13:30:00  
09/10/2004, 16:30:00  
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11/04/2004, 11:00:00  
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12/21/2004, 14:30:00

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#### Menauhant Site

12/30/2003, 09:00:00  
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09/10/2004, 10:30:00  
10/08/2004, 16:30:00  
11/04/2004, 09:00:00  
11/30/2004, 11:00:00  
12/21/2004, 10:30:00  
01/20/2005, 12:00:00

#### Child's River Site

12/30/2003, 09:00:00  
01/13/2004, 10:30:00  
02/03/2004, 11:30:00  
02/19/2004, 14:00:00  
03/03/2004, 14:30:00  
03/18/2004, 14:30:00  
04/01/2004, 12:30:00  
04/14/2004, 13:30:00  
04/28/2004, 11:00:00  
05/20/2004, 12:00:00  
06/16/2004, 11:30:00

01/13/2004, 10:00:00  
02/03/2004, 11:00:00  
02/19/2004, 13:30:00  
03/03/2004, 14:00:00  
03/18/2004, 14:00:00  
04/01/2004, 12:00:00  
04/14/2004, 13:00:00  
04/28/2004, 10:00:00  
05/20/2004, 11:30:00  
06/16/2004, 11:00:00  
07/08/2004, 08:30:00

|                      |                      |
|----------------------|----------------------|
| 07/08/2004, 09:00:00 | 08/14/2004, 15:30:00 |
| 08/14/2004, 16:00:00 | 09/10/2004, 10:30:00 |
| 09/10/2004, 11:00:00 | 10/08/2004, 16:30:00 |
| 10/08/2004, 17:00:00 | 11/04/2004, 09:30:00 |
| 11/04/2004, 10:00:00 | 11/30/2004, 11:00:00 |
| 11/30/2004, 12:00:00 | 12/21/2004, 11:30:00 |
| 12/21/2004, 12:00:00 | 01/22/2005, 12:00:00 |

#### Sage Lot Site

|                      |                       |
|----------------------|-----------------------|
| 03/31/2004, 10:30:00 | 04/14/2004, 13:30:00  |
| 04/14/2004, 14:00:00 | 04/28/2004, 09:30:00* |
| 04/28/2004, 10:00:00 | 05/20/2004, 10:30:00  |
| 05/20/2004, 11:00:00 | 06/15/2004, 14:00:00  |
| 06/15/2004, 15:00:00 | 07/08/2004, 07:30:00  |
| 07/08/2004, 08:00:00 | 08/13/2004, 16:30:00  |
| 08/13/2004, 17:00:00 | 09/11/2004, 08:00:00  |
| 09/12/2004, 11:00:00 | 10/07/2004, 17:00:00  |
| 10/07/2004, 17:30:00 | 11/04/2004, 15:30:00  |
| 11/04/2004, 16:30:00 | 11/30/2004, 12:30:00  |
| 11/30/2004, 13:00:00 | 12/21/2004, 13:00:00  |
| 12/21/2004, 13:30:00 | 01/16/2005, 16:00:00  |

\* Battery failure towards end of deployment

#### 7) Distribution:

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program,

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from the NOAA/OCRM supported research that are produced for publication in open literature, including referred scientific journals will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. 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 of 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.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see section 1. Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under general information link on CDMO homepage) and online at the CDMO homepage <http://cdmo.baruch.sc.edu>. Data are available in text tab-delimited format, Microsoft Excel spreadsheet format and comma-delimited format.

8) Associated researchers and projects:

Our data is publicly available through our web site and we do not track its use.

## **II. Physical Structure Descriptors**

9) Sensor specifications:

YSI 6600/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

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

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: 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: Vented Level – Deep (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 656 ft (200 m)

Accuracy: +/- 1 ft (0.3 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

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

The reliability of the dissolved oxygen (DO) data 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. 200\*). Many reserves have upgraded to YSI 6600 EDS data sondes, which increase DO accuracy and longevity by reducing the environmental effects of fouling. The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period.

However, this potential drift is not always problematic for some uses of the data, ie. periodicity analysis. It should be noted that the amount of fouling is site specific and that not all data are affected. The Research Coordinator at the specific NERR site should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor. All data sondes used at DNERR sites in 2002 were non-EDS models.

The NERRS System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either depth or water level sensors. Both sensors measure water depth, but by convention, level sensors refer to atmospherically vented measurements and depth refers to non-vented measurements. Standard calibration protocols for the non-vented sensor use the atmosphere pressure at the time of calibration. Therefore, 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. This error is eliminated for level sensors because they are vented to the atmosphere throughout the deployment time interval. If proper atmospheric pressure data is available, non-vented sensor depth measurements can be corrected for deployments between calibrations. Readings for both vented and non-vented sensors are automatically compensated for water density changes due to variations in temperature and salinity. The Research Coordinator at the specific NERR site should be contacted in order to obtain information regarding atmospheric pressure data availability. All data sondes used at the DNERR sites in 2002 were non-vented models.

#### 10) Coded variable definitions:

All NERRS sites are required to use the following file naming convention.

File definitions: NERR Reserve/YSI deployment site/data type code/year

Our sites names are designated:

- a) Metoxit Point= **MP**
- b) Menauhant Site= **MH**
- c) Child's River = **CR**
- d) Sage Lot= **SL**

Example: wqbmpwq2004 (designates yearly data for the Metoxit Point site)

#### 11) Anomalous/Suspect Data:

**SMALL NEGATIVE TURBIDITY ANOMALIES:** Slight negative turbidity values sometimes occur as a result of small calibration offsets. Often these turbidity minimum values are between 0 and -2 NTU. All of these small negative turbidity values (the minimum for a given deployment) should be considered to be within 2 NTU of the true datum for correction purposes. Consequently, we have not deleted any of these small negative turbidity data.

**LARGER NEGATIVE TURBIDITY ANOMALIES:** Negative turbidity values greater than -2 NTU down to about -15 NTU do occur occasionally. We suspect this is a result of calibration error as these negative values act as the typical background value throughout a given run. We have also noted it occurring more frequently since converting our 6600s to EDS (since April 2004), though this may be coincidental with SWMP staff turn-over in the past year. In these cases, the minimum value of the turbidity data should generally be considered to approximate 0 NTU  $\pm$  2 NTU and the data can be adjusted accordingly by users. Consequently, we have not deleted any of these larger turbidity data.

**BIOLOGICAL-RELATED TURBIDITY ANOMALIES:** This type anomaly includes turbidity readings that are either outside of the normal range or spikes way above background and unrelated to increased sediment suspension or decreased water column clarity. We believe these records are real (and not sensor malfunction), though not reflective of actual water column turbidity. These extreme values are likely due to biological factors (such as small fish, crabs, or other marine organisms). Our criteria for flagging these data are single spikes (above rather constant background) over 50NTU that are more than 10 times surrounding values. These readings were deleted.

**SUSPENSION EVENT RELATED TURBIDITY ANOMALIES:** This type of anomaly includes turbidity readings that were either outside the normal range, or spikes way above background that are related to elevated turbidity levels indicative of wind wave related suspension events. We believe these are real (and not sensor malfunction), though not reflective of actual water column turbidity. These extreme values are likely due to large floating particles (i.e., seaweeds, detritus, etc.) suspended in the water column during storm events usually from strong southerly winds in the Waquoit Bay area. (see end of section 5 for more detail on these events at this site). Our criteria for flagging these data are values over 100NTU that are more than 5 times the magnitude of surrounding values, and linked to high winds. These readings were deleted.

## **January 2004**

Metoxit Point:

- a) Data were only collected from 01/01/2004 00:00:00 to 01/09/2004 09:00:00. Sonde was retrieved 01/09/04 at 09:00:00 and severe ice conditions prevented further deployment during January.

Menauhant:

- a) DO data appear a bit high (by about 10% and 1 mg/L) for the deployment period 12/29/2003 to 01/13/2004 9:30:00, and this offset was confirmed in post check. We assume this was a calibration error, and we have not deleted any of the data for this deployment period.
- b) DO and pH data show a several hour spike on 01/17/2004 from 10:00:00 to 13:30:00. Conditions were extremely cold (water temps ~ -2 C) and tide was very low – suspect very oxygenated water from wave turbulence in near surface layer. These DO and pH data have not been deleted.
- c) Negative depth data for period 01/20/2004 15:00-17:00 are associated with a low tide, but other parameters (S, DO, pH, Turbidity) indicate that sensors were still submerged. We assume offset due to air pressure change for slightly negative values and have not deleted these depth data.

Sage Lot:

No data was collected this month due to ice.

## February 2004

Metoxit Point:

No data were collected this month due to ice.

Menauhant:

a) DO data appear a bit high (by about 15% and 1.5 mg/L) for the deployment period 02/03/2004 11:30:00 to 02/19/2004 10:30:00, and this offset was confirmed in the initial post check, though a 2<sup>nd</sup> post check (103%) was close to 100% benchmark, and last (115%) / first (113%) readings from outgoing / incoming sondes indicate instrument was recording accurately. Very cold conditions and wave and current turbulence at site may allow for consistently high DO values. We have not deleted any of the DO data for this deployment period.

b) The following depth readings were slightly negative. But suspect slight calibration offset due to barometric pressure drift, as parameters appear to be consistent with submerged state of sensors. The data were not deleted.

|            |                     |
|------------|---------------------|
| 02/08/2004 | 17:00:00 – 19:30:00 |
| 02/11/2004 | 20:30:00 – 21:30:00 |
| 02/13/2004 | 10:30:00 – 11:00:00 |
| 02/14/2004 | 11:00:00 - 12:30:00 |
| 02/15/2004 | 12:00:00 – 12:30:00 |
| 02/18/2004 | 15:30:00            |

Child's River: No data anomalies this month.

Sage Lot:



No data was collected this month due to ice.

## **March 2004**

### **Metoxit Point:**

No data were collected until 03/31/2004 11:30 due to winter sea ice.

### **Menauhant:**

### **Child's River:**

- a) Small negative turbidity values related to calibration offsets were recorded this month for deployment period 03/03/2004 14:30 to 03/18/2004 14:00. See note at the beginning of this section for further explanation.

03/03/2004 14:30:00 to 19:30:00, 20:30:00, 21:00:00 to 23:30:00  
03/04/2004 00:00:00 to 02:30:00, 03:30:00 to 18:00:00, 19:00:00 to 23:30:00  
03/05/2004 00:30:00 to 01:30:00, 02:30:00 to 03:30:00, 04:30:00 to 23:30:00  
03/06/2004 00:00:00 to 04:00:00, 05:00:00 to 07:00:00, 08:00:00 to 16:00:00,  
17:00:00 to 23:30:00  
03/07/2004 00:00:00 to 05:00:00, 06:00:00 to 08:30:00, 09:30:00 to 20:30:00,  
22:00:00 to 23:30:00  
03/08/2004 00:00:00 to 04:30:00, 05:30:00 to 23:30:00  
03/09/2004 00:00:00 to 10:00:00, 11:00:00 to 12:00:00, 13:00:00 to 15:00:00,  
16:00:00 to 17:00:00, 18:00:00, 19:00:00, 20:00:00 to 22:00:00,  
23:30:30  
03/10/2004 00:00:00 to 11:30:00, 12:30:00 to 16:30:00, 17:30:00 to 19:30:00,  
20:30:00 to 22:00:00, 23:00:00 to 23:30:00  
03/11/2004 00:00:00 to 08:00:00, 09:30:00 to 10:00:00, 11:00:00 to 14:00:00  
15:00:00, 16:30:00 to 17:00:00, 20:00:00, 21:00:00 to 21:30:00  
22:30:00 to 23:30:00  
03/12/2004 00:30:00 to 07:30:00, 11:00:00 to 16:30:00, 17:30:00,  
18:30:00 to 20:00:00, 21:30:00, 22:30:00, 23:30:00  
03/13/2004 00:30:00, 04:30:00, 06:00:00, 09:30:00, 11:00:00 to 12:00:00,  
13:30:00, 21:30:00, 22:30:00, 23:00:00  
03/14/2004 02:00:00, 04:30:00 to 05:00:00, 06:00:00 to 06:30:00, 19:00:00  
03/15/2004 08:00:00, 14:30:00 to 15:00:00, 23:00:00  
03/16/2004 01:00:00, 03:30:00 to 04:30:00, 05:30:00 to 07:30:00,  
09:00:00 to 10:30:00, 12:30:00 to 20:00:00, 21:30:00, 22:30:00  
03/17/2004 01:00:00, 05:30:00 to 11:30:00, 12:30:00 to 15:00:00,  
16:30:00 to 17:30:00, 18:30:00 to 23:30:00  
03/18/2004 00:00:00 to 01:00:00, 02:00:00, 06:30:00 to 09:00:00, 10:00:00

### **Sage Lot:**

- a) Due to winter sea ice no data were collected until 3/31/2004 10:30 when Sage Lot was reoccupied and began operation for 2004.

## **April 2004**

### **Metoxit Point:**

a) DO values appear slightly high by about 10% and 1 mg/L at the end of the deployment period 04/14/2004 15:00:00 to 04/28/2004 12:30:00 and this was confirmed during post check. These data were not deleted because the shift is rather small and the probe showed no obvious malfunction during deployment

### **Menauhant:**

a) DO values appear slightly high (by about 5% and 0.5 mg/L) at the end of the deployment period 04/01/2004 12:00:00 to 04/14/2004 12:30:00 and ramping down near end of deployment period seems odd. Post check confirmed that sensor reading (94%) was low on retrieval, as did last (93%) / first (100%) readings from outgoing / incoming sondes. These data were not deleted because the shift is rather small and new probe showed no obvious malfunction during deployment.

b) The following depth readings were slightly negative. But suspect slight calibration offset due to barometric pressure drift, as parameters appear to be consistent with submerged state of sensors. The data were not deleted.

04/06/2004 05:00-05:30

04/06/2004 06:00

04/07/2004 06:00-06:30

04/08/2004 06:30-07:30

### **Sage Lot:**

a) Negative depth data for period 04/05/2004 06:30 are associated with a low tide, but other parameters (S, DO, pH, Turbidity) indicate that sensors were still submerged. We assume offset due to air pressure change for slightly negative values and have not deleted these depth data.

## **May 2004**

### **Metoxit Point:**

a) Turbidity values for deployment period from 05/20/2004 at 8:00:00 to 06/16/2004 at 8:00:00 appear to have a large negative offset of about -15 NTU. We suspect this is calibration error and have not deleted any turbidity data on this account. See comment at beginning of this section on large negative turbidity offsets.

05/20/2004 08:30:00 to 5/31/2004 23:30:00

## June 2004

### Metoxit Point:

- a) Turbidity values for deployment period from 05/20/2004 at 8:00:00 to 06/16/2004 at 8:00:00 appear to have a large negative offset of about -15 NTU. We suspect this is calibration error and have not deleted any turbidity data on this account (See comment above concerning larger negative turbidity anomalies).

06/01/2004 00:00:00 to 06/12/2004 23:30:00

06/13/2004 00:00:00 to 16:00:00, 17:30:00 to 20:00:00, 21:30:00

06/14/2004 01:00:00, 02:30:00 to 06:30:00, 08:00:00 to 08:30:00, 09:30:00,  
11:00:00 to 12:00:00, 13:30:00 to 14:30:00, 15:30:00,  
17:00:00 to 17:30:00, 19:30:00

06/15/2004 00:00:00, 01:00:00, 10:00:00 to 10:30:00, 12:30:00, 19:30:00

### Sage Lot:

- a) No data were collected for the following time due to deployment / retrieval gap in switching in and out sondes on 06/15/2004.  
06/15/2004 14:30

## July 2004

### Metoxit Point:

- a) Small negative turbidity values related to calibration offsets were recorded this month. See note at the beginning of this section for further explanation.

07/09/2004 16:00:00

07/16/2004 10:30:00, 12:00:00 to 13:00:00, 14:00:00, 15:00:00 to 23:30:00

07/17/2004 00:00:00, 01:30:00 to 04:00:00, 06:00:00, 07:30:00, 11:00:00,  
14:00:00 to 19:30:00, 20:30:00 to 21:00:00, 22:00:00 to 22:30:00,  
23:30:00

07/18/2004 00:00:00 to 00:30:00, 07:30:00

07/20/2004 12:30:00 to 13:30:00, 16:30:00, 19:00:00 to 19:30:00

07/30/2004 14:30:00, 16:30:00 to 17:00:00, 18:30:00, 19:30:00, 21:00:00

07/31/2004 00:00:00, 06:00:00

### Child's River:

- a) Anoxic events were frequent this month. Some DO readings were negative due to slight calibration offsets (and some drift perhaps) during deployment period from 07/08/2004 09:00:00 to 08/14/2004 15:30:00. These data were not deleted.

## **August 2004**

Child's River:

- a) Anoxic events (zero to near zero DO) were frequent this month.

## **September 2004**

Metoxit Point:

- a) Turbidity values for deployment period from 09/10/2004 at 16:30:00 to 09/30/2004 at 23:30:00 appear to have a large negative offset of about -15 NTU. We suspect this is calibration error and have not deleted any turbidity data on this account (See comment above concerning larger negative turbidity anomalies).

09/10/2004 16:30:00 to 09/30/2004 23:30:00

Sage Lot:

## **October 2004**

Metoxit Point:

- a) Negative turbidity values about -12 NTU too low related to calibration offsets were recorded this month. These data have not been deleted,

10/01/2004 00:00:00 to 23:30:00

10/02/2004 00:00:00 to 06:30:00, 08:00:00, 13:00:00 to 14:30:00,  
15:30:00 to 23:00:00

10/03/2004 01:30:00 to 03:00:00, 04:00:00 to 05:30:00, 06:30:00, 18:00:00,  
20:00:00 to 22:00:00

10/04/2004 02:00:00, 03:00:00, 04:30:00 to 05:00:00, 06:00:00 to 23:30:00

10/05/2004 00:00:00 to 23:30:00

10/06/2004 00:00:00 to 23:30:00

10/07/2004 00:00:00 to 23:30:00

10/08/2004 00:00:00 to 17:00:00

- b) Turbidity appears anomalously noisy and high from 10/2/2004 to 10/4/2004. The signal appears similar to a suspension event, though there is no corresponding meteorological

forcing for this period. Because we are uncertain of its cause and cannot rule out some type of suspension event, we have not deleted any data associated with this anomalous event.

Sage Lot:

## **November 2004**

Sage Lot:

- a) Turbidity values for deployment period from 11/04/2004 at 16:00:00 to 11/30/2004 at 12:30:00 appear to have a large negative offset of about -15 NTU. We suspect this is calibration error and have not deleted any turbidity data on this account. See comment at beginning of this section on large negative turbidity offsets.

11/04/2004 16:30:00 to 11/30/2004 12:30:00

## **December 2004**

Metoxit Point:

- a) Small negative turbidity values related to calibration offsets were recorded this month. See note at the beginning of this section for further explanation.

12/21/2004 19:00:00 to 12/23/2004 23:30:00

12/24/2004 00:00:00 to 12:00:00, 13:30:00 to 14:00:00, 15:30:00, 16:30:00,  
19:30:00, 21:00:00 to 21:30:00, 22:30:00 to 23:30:00

12/25/2004 00:00:00 to 01:30:00, 02:30:00 to 03:00:00, 04:00:00, 05:00:00  
06:00:00 to 08:30:00, 09:30:00 to 12:30:00, 14:00:00 to 18:00:00  
19:30:00 to 23:30:00

12/26/2004 00:00:00 to 01:00:00, 02:00:00, 04:30:00, 05:30:00 to 23:30:00

12/27/2004 00:00:00 to 01:30:00, 02:30:00 to 03:30:00

12/28/2004 03:30:00, 09:30:00, 20:00

12/29/2004 02:30:00,

12/30/2004 11:30:00, 13:00:00 to 15:00:00, 16:00:00 to 17:30:00, 20:00:00, 21:00:00,  
22:30:00

12/31/2004 02:30:00, 11:00:00, 16:00:00, 22:30:00 to 23:30:00

12) Deleted Data:

## **January 2004**

Menauhant:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

01/26/2004 10:30:00

b) The following anomalous turbidity data are likely related to a suspension event and were deleted. See note at the beginning of this section for further explanation

01/30/2004 18:00:00

Child's River:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

01/11/2004 21:00:00

## **February 2004**

Menauhant:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

02/08/2004 20:00:00

02/09/2004 23:00:00 - 23:30:00

## **March 2004**

Menauhant:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

03/05/2004 18:00:00-18:30:00

03/16/2004 06:00:00-06:30:00

03/30/2004 16:00:00

Child's River

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

03/14/2004 10:00

## **April 2004**

Metoxit Point:

a) The pH data collected for the period 04/14/2004 15:00:00 to 04/28/2004 12:30:00 are incorrect as no pH sensor was installed for this deployment. This was due to the fact that no pH probes were available at the time of deployment for sondes that had just had an EDS upgrade (All our sondes received a EDS upgrade in April 2004) – either the new flat glass probes or the modified (guard-removed) bulb type. All pH data were deleted for the period 04/14/2004 15:00:00 to 04/28/2004 12:30:00.

b) Turbidity data were deleted for the period 04/14/2004 15:00:00 to 04/28/2004 12:30:00 because of probe malfunction – likely a stuck wiper.

#### Menauhant:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |                               |
|------------|-------------------------------|
| 04/03/2004 | 13:00:00                      |
| 04/04/2004 | 11:00:00, 12:00:00 – 12:30:00 |
| 04/07/2004 | 17:30:00 – 18:00:00           |
| 04/08/2004 | 20:30:00                      |
| 04/11/2004 | 17:30:00                      |
| 04/12/2004 | 21:30:00                      |
| 04/15/2004 | 22:30:00                      |
| 04/16/2004 | 15:30:00, 23:30:00            |
| 04/22/2004 | 07:30:00                      |
| 04/23/2004 | 19:00:00                      |
| 04/25/2004 | 12:30:00                      |

#### Child's River:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |          |
|------------|----------|
| 04/29/2004 | 13:00:00 |
|------------|----------|

### **May 2004**

#### Metoxit Point:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |          |
|------------|----------|
| 05/24/2004 | 05:30:00 |
|------------|----------|

#### Menauhant

a) Dissolved oxygen readings from 05/09/2004 02:30:00 to end of deployment on 05/20/2004 11:00:00 are suspect, due to membrane failure, confirmed on retrieval and post check. These data were deleted.

b) The following anomalous turbidity data are likely related to some type of optic blockage of the sensor (seaweed?) during deployment and were deleted.

|            |                       |          |
|------------|-----------------------|----------|
| 05/26/2004 | 23:00:00 – 05/27/2004 | 03:30:00 |
| 05/27/2004 | 20:00:00 – 05/28/2004 | 03:30:00 |

c) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |          |
|------------|----------|
| 05/05/2004 | 14:30:00 |
| 05/07/2004 | 10:30:00 |
| 05/14/2004 | 14:00:00 |

Child's River:

a) pH probe noted broken (old un-guarded bulb type) upon retrieval. pH data look low and anomalous from 05/08/2004 19:00 to the end of the deployment on 5/20/2004 11:30 and these data were deleted.

b) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |       |
|------------|-------|
| 05/10/2004 | 19:00 |
|------------|-------|

c) The following anomalous turbidity data are likely related to a suspension event and were deleted. See note at the beginning of this section for further explanation

|            |       |
|------------|-------|
| 05/11/2004 | 23:30 |
|------------|-------|

d) Turbidity data look anomalous, though similar to a large and long duration turbidity event from about 05/13/2004 13:00 until the end of the deployment on 05/20/2004 11:30. Last (86 NTU) / first (3 NTU) comparison confirm a large offset. Turbidity data were deleted for the period 05/13/2004 13:30 until the end of the deployment on 05/20/2004 11:30.

Sage Lot:

a) The following anomalous turbidity data are likely related to a biological event or some type of optic blockage and were deleted. See note at the beginning of this section for further explanation

|            |                                                                 |
|------------|-----------------------------------------------------------------|
| 05/23/2004 | 15:00                                                           |
| 05/30/2004 | 09:00                                                           |
| 05/31/2004 | 10:00-11:30, 13:00-13:30, 16:00-18:30, 19:30-20:00, 21:00-23:30 |



## June 2004

### Metoxit Point:

a) The following anomalous turbidity data are likely related to a suspension event and were deleted. See note at the beginning of this section for further explanation

06/13/2004 21:00

06/14/2004 07:30, 9:00, 16:00, 18:30-19:00

06/15/2004 01:30, 14:00-14:30, 17:00

### Menauhant:

a) DO membrane was noted as punctured on retrieval of the deployment for the period from 05/20/2004 11:30:00 to 06/16/2004 at 11:00:00. Dissolved oxygen data appear reasonable until perhaps 06/14/2004 when drop-off in average daily value below 90% occurs. We assume this drop-off is associated with a membrane failure at about that time and have deleted all DO from 06/14/2004 00:00:00 to the end of the deployment on 06/16/2004 at 11:00:00.

b) A sharp negative spike of DO occurs on 06/27/2004 2:00:00 -3:00:00 – and then recovers to normal looking values. It is unclear what caused this anomaly, but it appears to be only temporary – the DO sensor checking out OK on post retrieval. The anomalous negative DO data have been deleted.

c) pH data from 06/06/2004 02:00:00 to end of deployment on 06/16/2004 11:00:00 appear anomalous and is likely due to a failure of the pH probe. This was one of the EDS - modified pH probes – which are guard-less and are very vulnerable to breakage. These pH data were deleted for this period.

d) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

06/27/2004 19:30:00

### Child's River:

a) Salinity data from about 06/08/2004 to end of deployment on 06/16/2004 11:00 show a rather monotonic decline by about 15 ppt over 1 week. Severe fouling (sea squirts) was noted and we suspect a compromise of the Salinity readings after 06/07 /2004. Last (11.6) / first (28.5) comparison confirms a ~- 16 ppt offset. We have deleted salinity data for period from 06/08/2004 00:00:00 to end of deployment on 06/16/2004 11:00.

b) pH data from 06/03/2004 19:00:00 to end of deployment on 06/16/2004 11:00:00 appear anomalous and is likely due to a failure of the pH probe, which was noted as broken on retrieval. This was one of the EDS - modified pH probes – which are guard-less and are very vulnerable to breakage. These pH data were deleted for this period.

c) pH data from 06/16/2004 17:30:00 to end of deployment on 07/08/2004 08:30:00 appear anomalous and is likely due to a failure of the pH probe, which was noted as broken on retrieval. This was one of the EDS - modified pH probes – which are guard-less and are very vulnerable to breakage. These pH data were deleted for this period.

d) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |          |
|------------|----------|
| 06/15/2004 | 01:00:00 |
| 06/19/2004 | 21:30    |
| 06/21/2004 | 08:00    |
| 06/23/2004 | 09:00    |

Sage Lot:

a) The following anomalous turbidity data are likely related to a biological event or some type of optic blockage and were deleted. See note at the beginning of this section for further explanation

|            |                                                           |
|------------|-----------------------------------------------------------|
| 06/01/2004 | 01:00-02:00, 04:00-06:30, 20:30, 21:30-22:00, 23:00-23:30 |
| 06/02/2004 | 00:00, 01:30-02:00, 03:00-08:00, 09:00-23:00              |
| 06/03/2004 | 00:30-02:00, 03:00                                        |
| 06/04/2004 | 07:00                                                     |
| 06/05/2004 | 04:30                                                     |
| 06/08/2004 | 12:00                                                     |
| 06/14/2004 | 00:00, 03:30                                              |

## July 2004

Menauhant:

a) Salinity data from 07/02/2004 to end of deployment on 07/08/2004 show a rather monotonic decline by about 2 ppt over a few days. Post deployment check shows a modest offset of -0.6 ppt, while last (30.0) / first (31.9) comparison indicates a ~- 2 ppt offset. Modest fouling was noted and we suspect a compromise of the Salinity readings after 7/2/2004. We have deleted salinity data for period from 07/03/2004 00:00:00 to end of deployment on 07/08/2004 08:00:00. We have not deleted DO , depth, or pH data for this same period because the effect of the slight drop in S on these measurements in this case is rather slight.

b) Salinity data from about 07/24/2004 to end of deployment on 08/14/2004 show a rather monotonic decline by about 9 ppt over 3 weeks. Severe fouling was noted and we suspect a compromise of the Salinity readings after 7/24/2004 through the end of the deployment. Last (21.8) / first (30.9) comparison confirms a ~- 9 ppt offset. We have deleted salinity data for period from 07/25/2004 00:00:00 to end of deployment on 08/14/2004 16:00:00.

c) pH data for period from 07/25/2004 00:00:00 to end of deployment on 08/14/2004 16:00:00 have also been deleted for reasons discussed above.

d) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |                    |
|------------|--------------------|
| 07/01/2004 | 08:30:00, 09:30:00 |
| 07/03/2004 | 14:00:00-14:30:00  |
| 07/07/2004 | 03:30:00           |

e) Turbidity data from about 07/31/2004 to end of deployment on 08/14/2004 show a rather sharp rise to maximum readings. Severe fouling was noted and we suspect a compromise of the Turbidity readings after 7/30/2004 through the end of the deployment. We have deleted turbidity data for period from 07/31/2004 00:00:00 to end of deployment on 08/14/2004 16:00:00.

Child's River:

a) pH data from 06/16/2004 17:30:00 to end of deployment on 07/08/2004 08:30:00 appear anomalous and is likely due to a failure of the pH probe, which was noted as broken on retrieval. This was one of the EDS - modified pH probes – which are guard-less and are very vulnerable to breakage. These pH data were deleted for this period.

b) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |                                 |
|------------|---------------------------------|
| 07/01/2004 | 20:00                           |
| 07/03/2004 | 12:00                           |
| 07/05/2004 | 08:00, 19:30-20:00, 22:30-23:00 |
| 07/06/2004 | 19:30                           |
| 07/08/2004 | 23:30                           |
| 07/09/2004 | 02:30                           |
| 07/10/2004 | 08:00                           |
| 07/12/2004 | 02:30-03:00, 20:30-21:00        |
| 07/13/2004 | 00:30-01:30, 02:30-03:00        |
| 07/15/2004 | 02:30                           |
| 07/17/2004 | 06:00, 08:30, 11:00             |
| 07/18/2004 | 13:30, 19:30, 20:30             |
| 07/19/2004 | 01:00, 20:30                    |
| 07/20/2004 | 19:00                           |
| 07/23/2004 | 22:00-22:30                     |
| 07/26/2004 | 03:00, 07:00                    |
| 07/29/2004 | 06:30, 19:00, 21:00             |
| 07/30/2004 | 01:00, 04:00                    |

#### Sage Lot:

- a) Salinity data from about 07/28/2004 (for deployment period 7/8 to 8/13) appear anomalous. This occurred near the end of an overly long deployment period due to staffing shortage (no SWMP techs among other personnel issues) that began in mid-June 2004. Heavy fouling of the sondes and sensors was noted on retrieval on 08/13/2004. For this reason, Salinity data were deleted for period from 07/28/2004 at 00:00:00 to end of deployment on 08/13/2004 at 16:30:00.
- b) DO data after 07/23/2004 (for deployment period 7/8 to 8/13) appear anomalous. This occurred near the end of an overly long deployment period due to staffing shortage (no SWMP techs among other personnel issues) that began in mid-June 2004. Heavy fouling of the sondes and sensors was noted on retrieval on 08/13/2004. For this reason, DO data were deleted for period from 07/24/2004 at 00:00:00 to end of deployment on 08/13/2004 at 16:30:00.
- c) Turbidity data show a sharp stair-step rise a few days after 08/01/2004 and reach max out values by 08/04/2004. . We suspect critical fouling of sensor. All turbidity data have been deleted for period from 08/01/2004 at 00:00:00 to end of deployment on 08/13/2004 at 16:30:00.

#### **August 2004**

##### Metoxit Point:

- a) Salinity data after 08/04/2004 (for deployment period 7/7 to 8/13) appear anomalous. This occurred near the end of an overly long deployment period due to staffing shortage (no SWMP techs among other personnel issues) that began in mid-June 2004. Heavy fouling on the sondes and sensors was noted on retrieval on 08/13/2004. For this reason, Salinity data were deleted for period from 08/05/2004 at 00:00:00 to end of deployment on 08/13/2004 at 13:00:00.
- b) DO data after 08/04/2004 (for deployment period 7/7 to 8/13) appear anomalous. This occurred near the end of an overly long deployment period due to staffing shortage (no SWMP techs among other personnel issues) that began in mid-June 2004. Heavy fouling on the sondes and sensors was noted on retrieval on 08/13/2004. For this reason, DO data were deleted for period from 08/05/2004 at 00:00:00 to end of deployment on 08/13/2004 at 13:00:00.
- c) pH data show a sharp 2 unit drop as of 08/03/2004 at 02:00:00. We suspect a broken pH probe – confirmed upon sonde retrieval. All pH data from 08/03/2004 at 02:00:00 to the end of deployment on 08/13/2004 at 13:00:00 have been deleted
- d) Turbidity data show a sharp stair-step rise (10 NTU) on 08/03/2004 at 04:30:00. We suspect critical fouling of sensor. All turbidity data have been deleted for period from 08/03/2004 at 04:30:00 to end of deployment on 08/13/2004 at 13:00:00 .

e) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

08/016/2004 09:30:00

Menauhant:

a) Salinity data from about 07/24/2004 to end of deployment on 08/14/2004 show a rather monotonic decline by about 9 ppt over 3 weeks. Severe fouling was noted and we suspect a compromise of the Salinity readings after 7/24/2004 through the end of the deployment. Last (21.8) / first (30.9) comparison confirms a ~- 9 ppt offset. We have deleted salinity data for period from 07/25/2004 00:00:00 to end of deployment on 08/14/2004 16:00:00.

b) pH data for period from 07/25/2004 00:00:00 to end of deployment on 08/14/2004 16:00:00 have also been deleted for reasons discussed above.

c) pH data were anomalously low from 08/15/2004 12:30 to end of deployment on 09/10/2004 10:30. pH probe (old un-guarded bulb type) was noted broken on retrieval. pH data were deleted for period 08/15/2004 12:30 to 09/10/2004 10:30.

d) DO data from about 08/04/2004 to end of deployment on 08/14/2004 show a rather monotonic decline of 60% over one week. Severe fouling was noted and we suspect a compromise of the DO readings after 08/04/2004 through the end of the deployment. Last (94%) / first (117%) comparison indicates at least ~-20% or -2 mg/L offset. We have deleted DO data for period from 08/05/2004 00:00:00 to end of deployment on 08/14/2004 16:00:00.

e) DO data from 8/27/2004 to end of deployment on 09/10/2004 10:30:00 look anomalously low (by about 10% or 1 mg/L). Badly fouled DO membrane with bryozoan growth was noted on retrieval. Last (84%) / first (99%) comparisons confirm this offset and post-check values were only 49%. Therefore, DO values from 8/27/2004 00:00:00 to end of deployment on 09/10/2004 10:30:00 were deleted.

f) Turbidity data from about 07/31/2004 to end of deployment on 08/14/2004 show a rather sharp rise to maximum readings. Severe fouling was noted and we suspect a compromise of the Turbidity readings after 7/30/2004 through the end of the deployment. We have deleted turbidity data for period from 07/31/2004 00:00:00 to end of deployment on 08/14/2004 16:00:00.

g) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

08/21/2004 14:00:00

Child's River

a) DO data from about 08/01/2004 00:00 to end of deployment on 08/14/2004 15:30:00 look anomalous – flat sections (not anoxic) and odd signal form, although this period also coincides with odd pH – also flat -- pattern. Extreme fouling was noted on retrieval and we suspect DO reading were compromised. DO values 08/01/2004 00:00 to end of deployment on 08/14/2004 15:30 were deleted.

b) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |                                                                                        |
|------------|----------------------------------------------------------------------------------------|
| 08/03/2004 | 02:30-03:00, 09:30                                                                     |
| 08/04/2004 | 08:30-09:00, 15:30, 23:30                                                              |
| 08/05/2004 | 01:00, 02:00, 07:30, 10:30, 20:00, 21:00-21:30                                         |
| 08/06/2004 | 00:00-00:30, 02:30, 06:30, 09:00, 10:30, 13:30, 19:00, 20:30, 23:30                    |
| 08/07/2004 | 03:30, 10:00, 11:00, 13:00-13:30                                                       |
| 08/08/2004 | 03:00, 09:30                                                                           |
| 08/09/2004 | 07:30, 10:00                                                                           |
| 08/11/2004 | 00:00, 02:30                                                                           |
| 08/12/2004 | 00:30-01:30, 03:30, 04:30-05:00, 06:00, 08:30, 10:00, 11:30, 16:00, 22:00, 23:00-23:30 |
| 08/13/2004 | 00:00-00:30, 01:30, 03:30, 06:30                                                       |
| 08/14/2004 | 20:00-20:30, 23:30                                                                     |
| 08/15/2004 | 01:30, 03:00, 15:30                                                                    |
| 08/16/2004 | 12:30                                                                                  |
| 08/17/2004 | 06:00-07:00                                                                            |
| 08/19/2004 | 20:30, 22:30                                                                           |
| 08/20/2004 | 19:00                                                                                  |
| 08/21/2004 | 18:30-19:00, 20:30-22:30                                                               |
| 08/22/2004 | 19:00                                                                                  |
| 08/24/2004 | 20:00-20:30, 23:00                                                                     |
| 08/30/2004 | 06:00                                                                                  |
| 08/31/2004 | 10:00                                                                                  |

Sage Lot:

a) During the deployment period 08/13/2004 17:00 to 09/11/2004 08:00 the sonde silo / tower experienced a failure (disassembly) in the field with the main sonde silo sliding downward and becoming detached from the main tower . This resulted in the silo and sonde ultimately laying horizontal on the bottom sediments for more than two weeks and compromising almost all of the data for the latter deployment period. It is unclear how this happened – perhaps a boat was tied to the system or it was run over by a vessel. Based on a comparison of depth records at other nearby SWMP sites, we have deleted all data, with the exception of temperature, from 08/21/2004 00:00 to the end of the deployment on 09/11/2004 08:00.

b) Salinity data from about 07/28/2004 (for deployment period 7/8 to 8/13) appear anomalous. This occurred near the end of an overly long deployment period due to staffing shortage (no SWMP techs among other personnel issues) that began in mid-June 2004. Heavy fouling of the

sondes and sensors was noted on retrieval on 08/13/2004. For this reason, Salinity data were deleted for period from 07/28/2004 at 00:00:00 to end of deployment on 08/13/2004 at 16:30:00.

c) DO data after 07/23/2004 (for deployment period 7/8 to 8/13) appear anomalous. This occurred near the end of an overly long deployment period due to staffing shortage (no SWMP techs among other personnel issues) that began in mid-June 2004. Heavy fouling of the sondes and sensors was noted on retrieval on 08/13/2004. For this reason, DO data were deleted for period from 07/24/2004 at 00:00:00 to end of deployment on 08/13/2004 at 16:30:00.

d) Turbidity data show a sharp stair-step rise a few days after 08/01/2004 and reach max out values by 08/04/2004. . We suspect critical fouling of sensor. All turbidity data have been deleted for period from 08/01/2004 at 00:00:00 to end of deployment on 08/13/2004 at 16:30:00.

## **September 2004**

### **Metoxit Point:**

a) Salinity data after 09/05/2004 (for deployment period 8/13 to 9/10) appear anomalously low, and this was confirmed by salinity check with YSI 650 and initial S value on new deployment at time of retrieval – low by about 2-3 ppt. We suspect fouling – which was rather heavy. Salinity data were deleted from 09/06/2004 at 00:00:00 until the end of the deployment on 09/10/2004 at 16:00:00.

b) Turbidity data after 09/06/2004 (for deployment period 8/13 to 9/10) appear anomalously high. It appears like a suspension event but there is no meteorological support for it. We suspect fouling – which was rather heavy. Turbidity data were deleted from 09/07/2004 at 00:00:00 until the end of the deployment on 09/10/2004 at 16:00:00.

c) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

09/06/2004 19:00:00

### **Menauhant:**

a) DO data from 8/27/2004 to end of deployment on 09/10/2004 10:30:00 look anomalously low (by about 10% or 1 mg/L). Badly fouled DO membrane with bryozoan growth was noted on retrieval. Last (84%) / first (99%) comparisons confirm this offset and post-check values were only 49%. Therefore, DO values from 8/27/2004 00:00:00 to end of deployment on 09/10/2004 10:30:00 were deleted.

b) pH data were anomalously low from 08/15/2004 12:30 to end of deployment on 09/10/2004 10:30. pH probe (old un-guarded bulb type) was noted broken on retrieval. pH data were deleted for period 08/15/2004 12:30 to 09/10/2004 10:30.

c) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |                          |
|------------|--------------------------|
| 09/02/2004 | 01:00, 10:00             |
| 09/06/2004 | 02:00                    |
| 09/11/2004 | 13:00                    |
| 09/12/2004 | 18:00                    |
| 09/13/2004 | 12:00, 23:30             |
| 09/14/2004 | 07:30, 18:30-19:00       |
| 09/15/2004 | 04:30-05:00, 10:30-11:30 |
| 09/18/2004 | 04:30                    |
| 09/22/2004 | 06:00                    |
| 09/23/2004 | 21:00                    |

d) The following anomalous turbidity data are likely related to a suspension event and were deleted. See note at the beginning of this section for further explanation

|            |              |
|------------|--------------|
| 09/15/2004 | 19:00, 20:30 |
| 09/16/2004 | 07:00, 08:00 |
| 09/25/2004 | 03:30, 05:00 |
| 09/29/2004 | 05:00        |

Child's River:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation.

|            |              |
|------------|--------------|
| 09/03/2004 | 00:30        |
| 09/06/2004 | 01:00-01:30  |
| 09/07/2004 | 00:30        |
| 09/11/2004 | 12:30        |
| 09/12/2004 | 13:00        |
| 09/14/2004 | 10:00        |
| 09/15/2004 | 12:30        |
| 09/16/2004 | 13:00        |
| 09/20/2004 | 05:00        |
| 09/22/2004 | 08:00        |
| 09/24/2004 | 08:30        |
| 09/27/2004 | 08:30, 10:30 |
| 09/28/2004 | 05:00        |
| 09/30/2004 | 08:00        |

Sage Lot:

a) During the deployment period 08/13/2004 17:00 to 09/11/2004 08:00 the sonde silo / tower experienced a failure (disassembly) in the field with the main sonde silo sliding downward and



becoming detached from the main tower . This resulted in the silo and sonde ultimately laying horizontal on the bottom sediments for more than two weeks and compromising almost all of the data for the latter deployment period. It is unclear how this happened – perhaps a boat was tied to the system or it was run over by a vessel. Based on a comparison of depth records at other nearby SWMP sites, we have deleted all data, with the exception of temperature, from 08/21/2004 00:00 to the end of the deployment on 09/11/2004 08:00.

## October 2004

Menauhant:

a) DO data look anomalous ramping upward and high for most of deployment period 10/08/2004 17:00 – 11/04/2004 09:00. Last (149%) / first (106%) comparison and post-check (113%) all indicate offset or malfunction (membrane failure). All DO data for period 10/08/2004 17:00 – 11/04/2004 09:00 were deleted.

b) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

|            |              |
|------------|--------------|
| 10/06/2004 | 05:00, 16:30 |
| 10/07/2004 | 05:00        |

c) The following anomalous turbidity data are likely related to a suspension event and were deleted. See note at the beginning of this section for further explanation

|            |               |
|------------|---------------|
| 10/06/2004 | 23:30         |
| 10/09/2004 | 10:00         |
| 10/15/2004 | 20:00         |
| 10/20/2004 | 18:00         |
| 10/21/2004 | 09:30         |
| 10/22/2004 | 10:30 – 11:00 |
| 10/23/2004 | 07:30         |
| 10/28/2004 | 08:30, 10:30  |
| 10/29/2004 | 11:30, 14:30  |
| 10/30/2004 | 12:00, 22:00  |

Child's River:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation.

|            |                            |
|------------|----------------------------|
| 10/02/2004 | 13:00                      |
| 10/04/2004 | 13:00                      |
| 10/06/2004 | 09:30                      |
| 10/07/2004 | 08:30                      |
| 10/08/2004 | 07:30, 09:30, 10:30, 11:30 |

## **November 2004**

### **Metoxit Point:**

a) Turbidity data for the period from 11/04/2004 11:00:00 to 11/30/2004 14:00:00 appear anomalous and strange to say the least. We suspect sensor malfunction. Turbidity data for the entire deployment have been deleted.

### **Menauhant:**

a) DO data look anomalous, -downward spike and ramping recovery -- from 11/25/2004 15:30 until end of deployment on 11/30/2004 11:30. Suspect DO membrane failure. All DO data for period 11/25/2004 15:30 – 11/30/2004 11:30 were deleted.

### **Child's River:**

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation.

|            |             |
|------------|-------------|
| 11/05/2004 | 16:00       |
| 11/09/2004 | 10:30       |
| 11/12/2004 | 11:00       |
| 11/15/2004 | 11:00       |
| 11/18/2004 | 14:30       |
| 11/28/2004 | 08:00-08:30 |

### **Sage Lot:**

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation.

11/07/2004 22:00:00

## **December 2004**

### **Menauhant:**

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation

12/22/2004 021:30

b) The following anomalous turbidity data are likely related to a suspension event and were deleted. See note at the beginning of this section for further explanation

12/23/2004 20:30

Child's River:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation.

12/08/2004 08:30

Sage Lot:

a) The following anomalous turbidity data are likely related to a biological event and were deleted. See note at the beginning of this section for further explanation.

12/05/2004 22:00:00

13) Missing data:

Missing data are denoted by a period in the data set. Data are missing due to equipment failure where no probes deployed, maintenance/calibration of equipment, elimination of obvious outliers, or elimination of data due to calibration (both pre and post) problems. For more details on deleted data, see section 11, Data Anomalies. The Waquoit Bay NERR Research Coordinator can also be contacted about other issues concerning missing or anomalous data.

Sage Lot:

a) Sonde batteries experienced rapid power drain during a rather short 2-week deployment period from 04/14/2004 14:00 to 04/28/2004 9:30 resulting in what we interpret to be intermittent and then final power loss, and consequent data loss, in the last few days of the deployment from 04/26/2004 to 04/28/2004. Initial battery power (10.5 volts) was modest, but well above normal threshold (10.0) for changing batteries prior to deployment, especially for a short deployment with ambient temperatures in the 10 C range, which suggests sonde malfunction of some kind. All data (T, Conductivity, S, DO, Depth, pH, Turbidity) are missing for the following times.

04/26/2004 18:00, 20:00, 21:00, 22:00, 23:00

04/27/2004 00:00, 01:00, 02:00-15:00, 16:00, 19:30, 20:30, 21:30, 22:30-23:30

04/28/2004 00:00-09:30

b) Due to the tower and sonde silo failure on or about 08/21/2004, no sonde was redeployed on retrieval on 09/11/2004 until the following day after the sonde silo and tower were repaired and reset at the site. Consequently no data were collected from 09/11/2004 08:30 to 09/12/2004 10:30.

Child's River:

a) No pH data were collected during deployment from 08/14/2004 16:00 to 09/10/2004 10:30. Due to high loss of pH probes during previous deployment period, we had no extra pH probes on hand at the time of redeployment.

14) Post deployment information:

End of Deployment Post-calibration Readings in Standard Solutions:

| Site | Date     | Salinity (ppt)<br>(std-31.70ppt) | DO%<br>(std-air) | pH<br>(std-7.0) | Turbidity<br>(std-0 NTU) |
|------|----------|----------------------------------|------------------|-----------------|--------------------------|
| MP   | 12/29/03 | 31.82                            | 100.3            | 6.94            | 5.7                      |
|      | 03/30/04 | 31.79                            | 105.8            | 6.89            | -0.4                     |
|      | 04/13/04 | 31.74                            | 109.6            | 7.0             | 6.4                      |
|      | 04/26/04 | 32.03                            | 99.9             | 7.03            | -0.1                     |
|      | 05/19/04 | 31.16                            | 95.3             | 7.01            | -14.4                    |
|      | 06/14/04 |                                  | 96.7             |                 |                          |
|      | 07/07/04 | 31.0                             | 97.3             | broken          | 3.2                      |
|      | 08/12/04 | 30.4                             | 99.0             | 6.98            | 1.5                      |
|      | 09/10/04 | 31.64                            | 98.2             | 7.06            | -11.2                    |
|      | 10/08/04 | 31.44                            | 100.2            | 7.0             | 0.8                      |
|      | 11/03/04 | 31.55                            | 102.2            | 6.92            | 0.2                      |
|      | 11/29/04 | 31.47                            | 98.6             | 7.02            | 0.0                      |
|      | 12/20/04 | 31.7                             | 105.1            | 7.09            | -1.5                     |

| Site | Date     | Salinity (ppt)<br>(std-31.70ppt) | DO%<br>(std-air) | pH<br>(std-7.0) | Turbidity<br>(std-0 NTU) |
|------|----------|----------------------------------|------------------|-----------------|--------------------------|
| MH   | 12/29/03 | 31.41                            | 111.9            | 7.00            | 0.2                      |
|      | 01/12/04 | 31.98                            | 88.9             | 7.07            | -0.1                     |
|      | 02/02/04 | 31.51                            | 103.0            | 7.10            | 0.0                      |
|      | 02/17/04 | 31.73                            | 102.2            | 7.01            | 0.0                      |
|      | 03/02/04 | 31.38                            | 97.8             | 6.97            | 0.0                      |
|      | 03/17/04 | 31.38                            | 100.5            | 6.96            | 0.1                      |
|      | 03/30/04 | 30.93                            | 93.8             | 6.99            | 0.0                      |
|      | 04/13/04 | 31.27                            | 101.5            | 6.93            | 0.2                      |
|      | 04/26/04 | 31.65                            | 112.5            | 7.09            | -0.2                     |
|      | 05/19/04 | 31.17                            | 127.5            | 5.80            | 0.1                      |
|      | 06/15/04 | 31.1                             | 128.0            | 7.00            | 0.0                      |
|      | 07/07/04 | 30.27                            | 100.2            | 7.10            | 1.4                      |
|      | 08/14/04 | 31.5                             | 48.5             | 7.05            | 1.1                      |
|      | 09/10/04 | 31.25                            | 97.3             | 7.04            | 0.1                      |
|      | 10/08/04 | 31.1                             | 113.0            | 7.0             | 0.5                      |
|      | 11/03/04 | 31.1                             | 113.8            | 6.93            | 0.2                      |
|      | 11/29/04 | 30.95                            | 104.5            | 6.97            | 0.2                      |

|      |          |                                 |                  |                 |                          |
|------|----------|---------------------------------|------------------|-----------------|--------------------------|
|      | 12/20/04 | 31.08                           | 104.8            | 7.06            | 0.2                      |
| Site | Date     | Salinity (ppt)<br>(std-31.7ppt) | DO%<br>(std-air) | pH<br>(std-7.0) | Turbidity<br>(std-0 NTU) |
| CR   | 12/29/03 | 31.27                           | 92.0             | 7.08            | -0.4                     |
|      | 01/12/04 | 32.15                           | 98.2             | 7.0             | 0.0                      |
|      | 02/02/04 | 31.4                            | 91.5             | 7.01            | 5.7                      |
|      | 02/17/04 | 31.72                           | 100.5            | 7.02            | -0.1                     |
|      | 03/02/04 | 31.62                           | 89.5             | 6.97            | -4.8                     |
|      | 03/17/04 | 31.73                           | 97.7             | 6.98            | 0.2                      |
|      | 03/30/04 | 31.29                           | 108.9            | 6.89            | 0.2                      |
|      | 04/13/04 | 31.55                           | 119.4            | 6.97            | -0.6                     |
|      | 04/26/04 | 31.34                           | 111.8            | broken          | 0.2                      |
|      | 05/19/04 | 31.3                            | 107.8            | broken          | 2.9                      |
|      | 06/15/04 | 31.3                            | 97.4             | broken          | 0.0                      |
|      | 07/07/04 | 26.0                            | 35.3             | 6.96            | 1.7                      |
|      | 08/14/04 | 28.4                            | 110.0            |                 | 0.1                      |
|      | 09/10/04 | 30.10                           | 57.9             | 7.05            | 0.8                      |
|      | 10/08/04 | 31.63                           | 99.2             | 7.0             | 0.7                      |
|      | 11/03/04 | 30.9                            | 97.5             | 7.03            | 0.3                      |
|      | 11/29/04 | 31.2                            | 100.5            | 6.85            | -0.7                     |
|      | 12/20/04 | 31.69                           | 103.3            | 6.91            | -0.1                     |
| Site | Date     | Salinity (ppt)<br>(std-31.7ppt) | DO%<br>(std-air) | pH<br>(std-7.0) | Turbidity<br>(std-0 NTU) |
| SL   | 03/30/04 | 31.78                           | 105.2            | 7.02            | -0.6                     |
|      | 04/13/04 | 31.57                           | 102.0            | 7.06            | 0.0                      |
|      | 04/26/04 | 31.67                           | 105.5            | 6.97            | 0.2                      |
|      | 05/19/04 | 31.9                            | 98.8             | 7.02            | 0.0                      |
|      | 06/14/04 | 31.2                            | 89.5             | 7.01            | 0.1                      |
|      | 07/07/04 | 31.0                            | 91.0             | 7.02            | 1.3                      |
|      | 08/13/04 | 30.7                            | 6.5              | broken          | 1.5                      |
|      | 09/10/04 |                                 |                  |                 |                          |
|      | 10/07/04 | 31.4                            | 94.4             | 7.04            | 0.2                      |
|      | 11/04/04 | 31.69                           | 101.4            | 7.02            | -16.2                    |
|      | 11/29/04 | 31.39                           | 101.0            | 6.97            | -0.2                     |
|      | 12/20/04 | 31.71                           | 101.0            | 7.02            | -0.2                     |

15) Other remarks/notes:

Deployment/Retrieval (or last / first) comparisons for each site are shown below in Tables 1-4. They represent another form of post-check on retrieved sonde data as it is assumed that the recently calibrated deployed sonde is highly accurate on its initial measurement. If the assumption holds true we should expect last / first readings to be quite similar within the usual 30 minute time difference between readings if the retrieved instrument was still reading accurately. Large differences indicate potential problems. However there are some caveats to this comparison approach. If time differences between retrieval / deployment are much greater than 30 min, then parameter differences should be also greater, and certainly lose any usefulness beyond a few hours. Also, at certain times some parameters are changing quite rapidly and a 30 min interval could allow for real and rather large differences. One example is DO during late morning and early afternoon, when DO is often ramping up rapidly -- or salinity can change rapidly in areas where the gradients (both vertical and horizontal) are large (i.e., Child's River).

Table 1: MP:

| MP       | Date<br>M/D/Y | Time<br>hh:mm:ss | Temp<br>C | SpCond<br>mS/cm | Salinity<br>ppt | DO %<br>% | DO Conc<br>mg/L | Depth<br>m | pH   | Turbidity+<br>NTU |
|----------|---------------|------------------|-----------|-----------------|-----------------|-----------|-----------------|------------|------|-------------------|
| Deploy   | 12/31/2003    | 9:00:40          | 4.29      | 46.711          | 29.64           | 104.4     | 11.13           | 1.085      | 8.06 | 9.4               |
| Retrieve | 1/9/2004      | 9:00:40          | -0.95     | 47.692          | 29.36           | 100.3     | 12.24           | 1.264      | 8.03 | 21.6              |
| Deploy   | 3/31/2004     | 11:30:40         | 6.39      | 46.307          | 29.6            | 108.9     | 11.05           | 1.009      | 7.71 | 1.4               |
| Retrieve | 4/14/2004     | 14:30:40         | 10.05     | 47.44           | 30.7            | 104.8     | 9.71            | 0.645      | 7.72 | 1.8               |
| Deploy   | 4/14/2004     | 15:00:40         | 10.06     | 47.077          | 30.44           | 104.7     | 9.72            | 0.793      | 0    | 52.6              |
| Retrieve | 4/28/2004     | 12:30:40         | 11.87     | 45.69           | 29.54           | 118.2     | 10.61           | 0.897      | 1.38 | 5                 |
| Deploy   | 4/28/2004     | 13:00:40         | 12.02     | 45.951          | 29.73           | 104.9     | 9.37            | 0.912      | 7.88 | 2.3               |
| Retrieve | 5/20/2004     | 8:00:40          | 17.11     | 48.207          | 31.49           | 65.7      | 5.24            | 0.954      | 7.76 | 2.3               |
| Deploy   | 5/20/2004     | 8:00:40          | 17.9      | 46.488          | 30.25           | 103       | 8.15            | 0.762      | 7.78 | 15.6              |
| Retrieve | 6/16/2004     | 8:00:40          | 20        | 46.538          | 30.28           | 91.6      | 6.96            | 0.987      | 7.98 | 47.6              |
| Deploy   | 6/16/2004     | 8:30:49          | 20.14     | 47.217          | 30.77           | 98.9      | 7.48            | 1.013      | 7.91 | 1.5               |
| Retrieve | 7/7/2004      | 19:00:50         | 25.54     | 47.742          | 31.07           | 164.8     | 11.31           | 1.398      | 8.17 | 1.7               |
| Deploy   | 7/7/2004      | 19:30:47         | 25.64     | 47.399          | 30.82           | 139.3     | 9.56            | 1.027      | 8.11 | 0.3               |
| Retrieve | 8/13/2004     | 13:00:48         | 24.97     | 41.303          | 26.45           | 181.3     | 12.9            | 0.428      | 6.33 | 13.3              |
| Deploy   | 8/13/2004     | 13:30:48         | 25        | 47.423          | 30.85           | 118.3     | 8.2             | 1.031      | 8.05 | 1.5               |
| Retrieve | 9/10/2004     | 16:00:44         | 24.05     | 43.385          | 27.95           | 132.6     | 9.5             | 0.904      | 8.01 | 11                |
| Deploy   | 9/10/2004     | 16:30:48         | 24.02     | 46.786          | 30.41           | 144.2     | 10.2            | 0.966      | 8.06 | -11.6             |
| Retrieve | 10/8/2004     | 17:00:49         | 18.04     | 45.9            | 29.82           | 157.5     | 12.46           | 1.218      | 8.42 | -10.7             |
| Deploy   | 10/8/2004     | 17:30:45         | 18.03     | 45.841          | 29.78           | 155.1     | 12.28           | 1.148      | 8.3  | 0.8               |
| Retrieve | 11/4/2004     | 10:30:51         | 11.25     | 47.879          | 31.08           | 76.2      | 6.87            | 0.995      | 7.83 | 2.9               |
| Deploy   | 11/4/2004     | 11:00:49         | 11.6      | 47.377          | 30.74           | 84.8      | 7.6             | 1.141      | 7.83 | 2.7               |
| Retrieve | 11/30/2004    | 14:00:52         | 8.57      | 47.484          | 30.63           | 129.9     | 12.44           | 1.453      | 8.22 | 3                 |
| Deploy   | 11/30/2004    | 14:30:50         | 8.58      | 47.113          | 30.37           | 123.1     | 11.81           | 1.387      | 8.07 | 1.1               |
| Retrieve | 12/21/2004    | 14:00:53         | 0.65      | 47.973          | 29.91           | 102.3     | 11.93           | 0.71       | 8.22 | 1.5               |
| Deploy   | 12/21/2004    | 14:30:54         | 0.63      | 48.05           | 29.96           | 105.1     | 12.26           | 0.911      | 8.17 | 44.3              |
| Retrieve | 1/16/2005     | 16:00:49         | 3.35      | 46.123          | 29.1            | 108.4     | 11.87           | 1.485      | 8.2  | 6.3               |

Table 2: MH:

| MH       | Date<br>M/D/Y | Time<br>hh:mm:ss | Temp<br>C | SpCond<br>mS/cm | Salinity<br>ppt | DO %<br>% | DO Conc<br>mg/L | Depth<br>m | pH   | Turbidity+<br>NTU |
|----------|---------------|------------------|-----------|-----------------|-----------------|-----------|-----------------|------------|------|-------------------|
| Deploy   | 12/30/2003    | 9:00:40          | 4.61      | 48.839          | 31.18           | 111.7     | 11.7            | 0.63       | 8.05 | 1.5               |
| Retrieve | 1/13/2004     | 9:30:40          | -0.22     | 50.351          | 31.34           | 111.9     | 13.22           | 0.47       | 7.99 | 1.3               |
| Deploy   | 1/13/2004     | 10:00:40         | -0.13     | 50.688          | 31.59           | 111.4     | 13.1            | 0.583      | 8.03 | 1                 |
| Retrieve | 2/3/2004      | 11:00:40         | -1.18     | 51.964          | 32.2            | 101.6     | 12.24           | 0.914      | 8.12 | 0.6               |
| Deploy   | 2/3/2004      | 11:30:40         | -1.24     | 51.934          | 32.16           | 124.2     | 14.98           | 0.691      | 8.06 | 0.9               |
| Retrieve | 2/19/2004     | 10:30:40         | -0.6      | 50.767          | 31.53           | 115.2     | 13.72           | 0.927      | 8.01 | 1.9               |
| Deploy   | 2/19/2004     | 11:00:40         | -0.45     | 50.973          | 31.71           | 113.9     | 13.5            | 0.893      | 7.87 | 1.6               |
| Retrieve | 3/3/2004      | 13:30:40         | 4.56      | 48.991          | 31.28           | 115.4     | 12.08           | 0.158      | 7.91 | 1                 |
| Deploy   | 3/3/2004      | 14:00:40         | 4.93      | 48.686          | 31.11           | 122.4     | 12.72           | 0.335      | 7.84 | 1.6               |
| Retrieve | 3/18/2004     | 13:30:40         | 2.89      | 48.998          | 31.03           | 115.1     | 12.58           | 0.593      | 7.81 | 3.1               |
| Deploy   | 3/18/2004     | 14:00:40         | 4.65      | 46.384          | 29.46           | 105.7     | 11.19           | 0.533      | 7.74 | 15.1              |
| Retrieve | 4/1/2004      | 11:30:40         | 5.61      | 48.821          | 31.29           | 105.9     | 10.81           | 0.662      | 7.87 | 1.8               |
| Deploy   | 4/1/2004      | 12:00:40         | 5.69      | 48.544          | 31.11           | 106.7     | 10.89           | 0.488      | 7.88 | 2.1               |
| Retrieve | 4/14/2004     | 12:30:40         | 9.52      | 47.291          | 30.56           | 92.6      | 8.69            | 0.12       | 7.87 | 3.6               |
| Deploy   | 4/14/2004     | 13:00:40         | 9.67      | 46.83           | 30.24           | 100.4     | 9.41            | 0.182      | 7.64 | 3.2               |
| Retrieve | 4/28/2004     | 10:00:40         | 10.29     | 46.063          | 29.73           | 94.7      | 8.78            | 0.447      | 7.75 | 1.6               |
| Deploy   | 4/28/2004     | 10:30:40         | 10.64     | 46.847          | 30.31           | 98.6      | 9.05            | 0.442      | 7.77 | 1.1               |
| Retrieve | 5/20/2004     | 11:00:40         | 17.53     | 48.223          | 31.5            | 43        | 3.4             | 0.627      | 7.97 | 1.9               |
| Deploy   | 5/20/2004     | 11:30:40         | 17.65     | 48.093          | 31.41           | 112.1     | 8.85            | 0.591      | 7.79 | 2.7               |
| Retrieve | 6/16/2004     | 11:00:40         | 19.58     | 47.226          | 30.78           | 87.3      | 6.67            | 0.605      | 6.17 | 3.9               |
| Deploy   | 6/16/2004     | 11:30:40         | 19.79     | 48.815          | 31.94           | 121.9     | 9.22            | 0.683      | 7.97 | 1.8               |
| Retrieve | 7/8/2004      | 8:00:40          | 22.52     | 46.171          | 29.99           | 88.6      | 6.45            | 0.593      | 7.87 | 2.7               |
| Deploy   | 7/8/2004      | 8:30:40          | 22.7      | 48.829          | 31.92           | 95.3      | 6.84            | 0.521      | 7.85 | 1.5               |
| Retrieve | 8/14/2004     | 16:00:40         | 25.55     | 34.721          | 21.81           | 93.5      | 6.76            | 0.548      | 7.72 | 2423              |
| Deploy   | 8/14/2004     | 16:30:40         | 25.44     | 47.541          | 30.93           | 117.2     | 8.06            | 0.487      | 8    | 3.9               |
| Retrieve | 9/10/2004     | 10:30:40         | 23.18     | 45.385          | 29.41           | 83.8      | 6.05            | 0.511      | 6.82 | 2.7               |
| Deploy   | 9/10/2004     | 11:00:40         | 23.25     | 47.137          | 30.68           | 98.6      | 7.06            | 0.586      | 7.86 | 2.3               |
| Retrieve | 10/8/2004     | 16:30:40         | 18.45     | 47.744          | 31.16           | 116       | 9.03            | 0.79       | 8.16 | 5.5               |
| Deploy   | 10/8/2004     | 17:00:40         | 18.29     | 47.399          | 30.91           | 114.9     | 8.99            | 0.682      | 8.08 | 0.9               |
| Retrieve | 11/4/2004     | 9:00:40          | 10.96     | 47.595          | 30.86           | 149.4     | 13.56           | 0.546      | 8.17 | 5.7               |
| Deploy   | 11/4/2004     | 9:30:40          | 10.89     | 47.635          | 30.89           | 106.3     | 9.66            | 0.744      | 8.02 | 1                 |
| Retrieve | 11/30/2004    | 11:00:40         | 8.08      | 48.112          | 31.04           | 108.6     | 10.49           | 0.964      | 8.15 | 0.7               |
| Deploy   | 11/30/2004    | 11:30:40         | 8.19      | 48.059          | 31.01           | 113.1     | 10.9            | 0.89       | 8.07 | 1                 |
| Retrieve | 12/21/2004    | 10:30:40         | 2.15      | 48.608          | 30.63           | 115.7     | 12.92           | 0.655      | 8.22 | 1.4               |
| Deploy   | 12/21/2004    | 11:00:40         | 2.09      | 48.771          | 30.74           | 113.1     | 12.64           | 0.755      | 8.18 | 0.9               |
| Retrieve | 1/20/2005     | 12:00:40         | 0.6       | 48.565          | 30.3            | 114.5     | 13.33           | 0.59       | 8.36 | 2.1               |

Table 3: CR:

| CR | Date | Time | cTime | Temp | SpCond | Salinity | DO % | DO Conc | Depth | pH | Turbidity+ |
|----|------|------|-------|------|--------|----------|------|---------|-------|----|------------|
|----|------|------|-------|------|--------|----------|------|---------|-------|----|------------|

|          |            |          |          |      |        |       |       |       |       |      |       |
|----------|------------|----------|----------|------|--------|-------|-------|-------|-------|------|-------|
| Deploy   | 12/30/2003 | 9:00:52  | 9:00:00  | 5.28 | 44.631 | 28.31 | 118.6 | 12.46 | 0.874 | 8.22 | 1     |
| Retrieve | 1/13/2004  | 10:00:52 | 10:00:00 | 0.36 | 45.743 | 28.33 | 92    | 10.93 | 0.613 | 7.93 | 1.5   |
| Deploy   | 1/13/2004  | 10:30:52 | 10:30    | 00.4 | 046.03 | 28.5  | 109.9 | 13.0  | 0.75  | 08.0 | 0003  |
| Retrieve | 2/3/2004   | 11:00:52 | 11:00    | 00.4 | 045.56 | 28.2  | 113.3 | 13.5  | 1.10  | 08.1 | 0003  |
| Deploy   | 2/3/2004   | 11:30:52 | 11:30    | 00.1 | 046.71 | 28.9  | 110.8 | 13.2  | 0.85  | 07.9 | 0863  |
| Retrieve | 2/19/2004  | 13:30:52 | 13:30    | 00.7 | 047.06 | 29.3  | 099.0 | 11.6  | 0.76  | 08.1 | 0001  |
| Deploy   | 2/19/2004  | 14:00:51 | 14:00    | 01.0 | 047.42 | 29.6  | 119.7 | 13.9  | 0.63  | 08.0 | 0003  |
| Retrieve | 3/3/2004   | 14:00:51 | 14:00    | 06.8 | 045.16 | 28.8  | 146.2 | 14.8  | 0.29  | 08.3 | 0003  |
| Deploy   | 3/3/2004   | 14:30:52 | 14:30    | 06.9 | 045.42 | 29.0  | 148.8 | 15.0  | 0.52  | 08.1 | -0003 |
| Retrieve | 3/18/2004  | 14:00:52 | 14:00    | 03.5 | 046.84 | 29.6  | 122.4 | 13.3  | 0.81  | 08.2 | 0003  |
| Deploy   | 3/18/2004  | 14:30:52 | 14:30    | 03.7 | 046.67 | 29.5  | 146.4 | 15.8  | 0.71  | 08.2 | 0008  |
| Retrieve | 4/1/2004   | 12:00:52 | 12:00    | 06.5 | 046.53 | 29.8  | 099.6 | 10.1  | 0.81  | 07.9 | 0003  |
| Deploy   | 4/1/2004   | 12:30:52 | 12:30    | 06.4 | 046.73 | 29.9  | 104.2 | 10.5  | 0.64  | 07.7 | 0004  |
| Retrieve | 4/14/2004  | 13:00:52 | 13:00    | 10.3 | 042.90 | 27.5  | 087.7 | 08.3  | 0.33  | 07.6 | 0006  |
| Deploy   | 4/14/2004  | 13:30:50 | 13:30    | 10.5 | 043.09 | 27.6  | 085.2 | 08.0  | 0.37  | 07.8 | 0005  |
| Retrieve | 4/28/2004  | 10:00:52 | 10:00    | 12.2 | 044.91 | 29.0  | 084.9 | 07.6  | 0.62  | 07.7 | 0001  |
| Deploy   | 4/28/2004  | 11:01:00 | 11:00    | 12.3 | 044.40 | 28.6  | 084.6 | 07.6  | 0.57  | 07.6 | 0002  |
| Retrieve | 5/20/2004  | 11:31:00 | 11:30    | 19.3 | 043.25 | 27.9  | 079.7 | 06.2  | 0.77  | 06.0 | 0086  |
| Deploy   | 5/20/2004  | 12:00:50 | 12:00    | 19.4 | 043.94 | 28.4  | 081.0 | 06.3  | 0.76  | 07.6 | 0003  |
| Retrieve | 6/16/2004  | 11:00:49 | 11:00    | 21.7 | 019.46 | 11.6  | 095.8 | 07.9  | 0.72  | 06.1 | 0001  |
| Deploy   | 6/16/2004  | 11:31:00 | 11:30    | 21.6 | 044.13 | 28.5  | 092.6 | 06.9  | 0.80  | 07.8 | 0001  |
| Retrieve | 7/8/2004   | 08:31:06 | 08:30    | 25.4 | 038.19 | 24.2  | 043.7 | 03.1  | 0.76  | 06.2 | 0013  |
| Deploy   | 7/8/2004   | 09:00:48 | 09:00    | 25.4 | 042.80 | 27.5  | 050.2 | 03.5  | 0.70  | 07.3 | 0007  |
| Retrieve | 8/14/2004  | 15:30:49 | 15:30    | 26.0 | 032.77 | 20.5  | 058.5 | 04.2  | 0.73  | 07.6 | 0007  |
| Deploy   | 8/14/2004  | 16:01:00 | 16:00    | 26.0 | 034.67 | 21.8  | 117.5 | 08.4  | 0.64  |      | 0008  |
| Retrieve | 9/10/2004  | 10:31:00 | 10:30    | 24.1 | 036.50 | 23.1  | 038.3 | 02.8  | 0.67  |      | 0007  |
| Deploy   | 9/10/2004  | 11:00:49 | 11:00    | 24.2 | 038.77 | 24.7  | 055.9 | 04.1  | 0.73  | 07.5 | 0014  |
| Retrieve | 10/8/2004  | 16:30:49 | 16:30    | 18.9 | 037.22 | 23.6  | 142.3 | 11.5  | 0.92  | 08.2 | 0005  |
| Deploy   | 10/8/2004  | 17:01:00 | 17:00    | 18.8 | 040.16 | 25.7  | 139.7 | 11.2  | 0.80  | 08.1 | 0003  |
| Retrieve | 11/4/2004  | 09:31:00 | 09:30    | 12.5 | 045.41 | 29.4  | 083.5 | 07.4  | 0.70  | 07.9 | 0003  |
| Deploy   | 11/4/2004  | 10:00:50 | 10:00    | 12.6 | 043.86 | 28.3  | 086.4 | 07.7  | 0.86  | 07.9 | 0003  |
| Retrieve | 11/30/2004 | 11:00:50 | 11:00    | 08.7 | 044.66 | 28.6  | 102.0 | 09.9  | 1.09  | 08.2 | 0002  |
| Deploy   | 11/30/2004 | 12:01:00 | 12:00    | 08.7 | 044.89 | 28.8  | 107.3 | 10.4  | 1.04  | 08.1 | 0001  |
| Retrieve | 12/21/2004 | 11:31:00 | 11:30    | 03.5 | 043.67 | 27.4  | 098.2 | 10.8  | 0.72  | 08.4 | 0001  |
| Deploy   | 12/21/2004 | 12:00:52 | 12:00    | 03.7 | 043.93 | 27.6  | 102.0 | 11.2  | 0.86  | 08.1 | 0002  |
| Retrieve | 1/22/2005  | 12:00:52 | 12:00:00 | 0.03 | 46.03  | 28.46 | 112.8 | 13.51 | 1.169 | 8.33 | 4     |

Table 4: SL:

| SL       | Date<br>M/D/Y | Time<br>hh:mm:ss | Temp<br>C | SpCond<br>mS/cm | Salinity<br>ppt | DO %<br>% | DO Conc<br>mg/L | Depth<br>m | pH   | Turbidity+<br>NTU |
|----------|---------------|------------------|-----------|-----------------|-----------------|-----------|-----------------|------------|------|-------------------|
| Deploy   | 3/31/2004     | 10:30:40         | 6.22      | 46.812          | 29.94           | 102.6     | 10.42           | 0.512      | 7.88 | 0.9               |
| Retrieve | 4/14/2004     | 13:30:40         | 10.33     | 44.935          | 28.93           | 100       | 9.32            | 0.125      | 7.8  | 0.7               |
| Deploy   | 4/14/2004     | 14:00:00         | 10.36     | 44.407          | 28.55           | 95.1      | 8.88            | 0.202      | 7.7  | 2.5               |
| Retrieve | 4/27/2004     | 22:00:40         | 11.88     | 44.826          | 28.92           | 108.4     | 9.77            | 0.444      | 7.94 | 1.4               |



|          |            |          |       |        |       |       |       |        |      |        |
|----------|------------|----------|-------|--------|-------|-------|-------|--------|------|--------|
| Deploy   | 4/28/2004  | 10:00:40 | 10.43 | 43.698 | 28.05 | 97.8  | 9.14  | 0.436  | 7.82 | 1.5    |
| Retrieve | 5/20/2004  | 10:30:40 | 19.07 | 46.126 | 29.98 | 112.5 | 8.72  | 0.44   | 7.97 | 2.6    |
| Deploy   | 5/20/2004  | 11:00:40 | 19.3  | 45.634 | 29.63 | 110.9 | 8.58  | 0.397  | 7.91 | 2.2    |
| Retrieve | 6/15/2004  | 14:00:40 | 20.79 | 46.161 | 30    | 140.2 | 10.52 | 0.512  | 8.03 | 1.7    |
| Deploy   | 6/15/2004  | 15:00:40 | 21.21 | 46.563 | 30.29 | 125.9 | 9.36  | 0.49   | 8.01 | 1.6    |
| Retrieve | 7/8/2004   | 7:30:40  | 24.27 | 47.364 | 30.83 | 74.8  | 5.26  | 0.687  | 7.77 | 4.2    |
| Deploy   | 7/8/2004   | 8:00:40  | 24.18 | 47.83  | 31.17 | 80.4  | 5.65  | 0.684  | 7.79 | 0.9    |
| Retrieve | 8/13/2004  | 16:30:40 | 25.48 | 41.089 | 26.29 | 52.1  | 3.68  | 0.556  | 7.73 | 2112.1 |
| Deploy   | 8/13/2004  | 17:00:40 | 25.53 | 48.291 | 31.47 | 121.8 | 8.34  | 0.538  | 7.9  | 1.3    |
| Retrieve | 9/11/2004  | 8:00:40  | 21.42 | 41.106 | 26.36 | 40.1  | 3.04  | 1.215  | 6.12 | 2.9    |
| Deploy   | 9/12/2004  | 11:01:00 | 21.48 | 46.955 | 30.57 | 104.5 | 7.72  | 0.557  | 7.94 | 1.8    |
| Retrieve | 10/7/2004  | 17:01:00 | 18    | 43.658 | 28.2  | 141.2 | 11.29 | 0.641  | 8.49 | 1.6    |
| Deploy   | 10/7/2004  | 17:31:00 | 18.33 | 45.189 | 29.31 | 134.9 | 10.65 | 0.558  | 8.17 | 1.4    |
| Retrieve | 11/4/2004  | 16:01:00 | 9.59  | 44.225 | 28.38 | 101.1 | 9.61  | -0.115 | 7.95 | 2.1    |
| Deploy   | 11/4/2004  | 16:00:40 | 10.25 | 45.761 | 29.51 | 119.9 | 11.14 | 0.7    | 8.05 | -14.7  |
| Retrieve | 11/30/2004 | 12:30:40 | 7.47  | 45.286 | 28.98 | 134.4 | 13.34 | 0.722  | 8.2  | -14.8  |
| Deploy   | 11/30/2004 | 13:01:00 | 7.25  | 44.501 | 28.41 | 111.7 | 11.19 | 0.673  | 7.95 | 1.4    |
| Retrieve | 12/21/2004 | 13:01:00 | -0.92 | 46.603 | 28.63 | 106.5 | 13.06 | 0.293  | 7.92 | 1.5    |
| Deploy   | 12/21/2004 | 13:30:40 | -0.84 | 46.795 | 28.78 | 105.4 | 12.88 | 0.471  | 8.04 | 0.7    |
| Retrieve | 1/16/2005  | 16:00:40 | 3.19  | 44.694 | 28.09 | 124.5 | 13.78 | 0.774  | 8.12 | 1.5    |

## Precipitation Totals:

### January 2004

|               |      |
|---------------|------|
| 15            | 0.5  |
| 18            | 14.5 |
| 28            | 3.6  |
| Monthly Total | 18.6 |

### February 2004

|               |      |
|---------------|------|
| 3             | 11.9 |
| 6             | 37.6 |
| 7             | 5.6  |
| 18            | 13   |
| 21            | 3.3  |
| Monthly Total | 71.4 |

### March 2004

|    |      |
|----|------|
| 5  | 1    |
| 6  | 0.5  |
| 7  | 13.7 |
| 9  | 4.1  |
| 12 | 12.7 |
| 17 | 12.2 |

|               |      |
|---------------|------|
| 18            | 3    |
| 19            | 1.3  |
| 20            | 7.1  |
| 21            | 3.3  |
| 22            | 12.2 |
| 26            | 1.8  |
| 27            | 0.3  |
| 28            | 6.6  |
| 29            | 0.3  |
| Monthly Total | 80.1 |

**April 2004**

|               |       |
|---------------|-------|
| 1             | 5.6   |
| 2             | 41.4  |
| 4             | 0.5   |
| 5             | 22.6  |
| 6             | 4.3   |
| 12            | 0.5   |
| 13            | 2.8   |
| 14            | 17.5  |
| 15            | 16    |
| 16            | 0.3   |
| 24            | 2     |
| 25            | 10.4  |
| 27            | 16    |
| 28            | 5.1   |
| 29            | 10.2  |
| Monthly Total | 155.2 |

**May 2004**

|               |      |
|---------------|------|
| 3             | 1    |
| 4             | 9.7  |
| 5             | 9.1  |
| 6             | 0.3  |
| 10            | 2.3  |
| 20            | 0.5  |
| 23            | 0.3  |
| 24            | 0.5  |
| 25            | 18.5 |
| 27            | 3.6  |
| 28            | 4.1  |
| 29            | 26.4 |
| Monthly Total | 76.3 |

**June 2004**

|   |      |
|---|------|
| 2 | 19.3 |
| 4 | 2.8  |
| 7 | 14   |
| 8 | 0.3  |

|    |     |
|----|-----|
| 15 | 9.1 |
| 18 | 0.5 |
| 19 | 1.8 |
| 20 | 1.8 |
| 23 | 2.5 |
| 30 | 3   |

Monthly Total 55.1

## **July 2004**

|    |      |
|----|------|
| 3  | 8.6  |
| 6  | 12.4 |
| 12 | 0.8  |
| 14 | 6.9  |
| 15 | 1.5  |
| 29 | 21.3 |
| 30 | 0.5  |

Monthly Total 52.0

## **August 2004**

|    |      |
|----|------|
| 2  | 0.5  |
| 6  | 7.6  |
| 14 | 14.2 |
| 16 | 53.8 |
| 17 | 10.7 |
| 19 | 0.8  |
| 22 | 5.6  |
| 28 | 0.3  |
| 31 | 0.3  |

Monthly Total 93.8

## **September 2004**

|    |      |
|----|------|
| 1  | 53.6 |
| 8  | 0.5  |
| 10 | 0.5  |
| 15 | 0.3  |
| 16 | 6.4  |
| 17 | 10.9 |
| 19 | 40.1 |
| 29 | 36.8 |
| 30 | 83.6 |

Monthly Total 232.7

## **October 2004**

|    |     |
|----|-----|
| 1  | 0.5 |
| 2  | 0.3 |
| 3  | 2   |
| 11 | 0.5 |

|    |      |
|----|------|
| 13 | 0.3  |
| 15 | 0.8  |
| 16 | 11.2 |
| 17 | 9.7  |
| 18 | 0.3  |
| 20 | 23.4 |
| 21 | 0.3  |
| 23 | 0.3  |
| 24 | 0.3  |
| 25 | 0.8  |
| 26 | 0.5  |
| 27 | 0.3  |

Monthly Total 51.5

**November 2004**

|    |      |
|----|------|
| 1  | 0.3  |
| 4  | 0.8  |
| 5  | 19.6 |
| 6  | 7.9  |
| 13 | 18.3 |
| 14 | 30.2 |
| 21 | 2.8  |
| 22 | 4.1  |
| 25 | 3.6  |
| 26 | 16   |
| 29 | 14   |

Monthly Total 117.6

**December 2004**

|    |      |
|----|------|
| 2  | 22.4 |
| 4  | 3.3  |
| 8  | 29.5 |
| 9  | 0.8  |
| 10 | 2.5  |
| 11 | 24.4 |
| 12 | 0.3  |
| 13 | 0.5  |
| 14 | 3.8  |
| 19 | 2.5  |
| 20 | 0.5  |
| 21 | 0.8  |
| 24 | 17.3 |
| 25 | 1.5  |
| 27 | 18.8 |
| 28 | 6.4  |
| 29 | 3    |
| 30 | 0.3  |

Monthly Total 138.6

**On 07/01/2021 this dataset was updated to include embedded QAQC flags for anomalous/suspect data.** System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2006, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

#### Menauhant

DO data appear a bit high (by about 10-15% and 1-1.5 mg/L) for the deployment period 02/19/2004 11:00:00 to 03/03/2004 13:30:00., and also contain an odd ramping up trend. However, this apparent offset was not confirmed in post check (98%), although last (115%) / first (106%) readings from outgoing / incoming sondes do indicate a possible instrument offset. Very cold conditions and wave and current turbulence at site may allow for consistently high DO values. We have not deleted any of the DO data for this deployment period.

DO data appear a bit high (by about 10% and 1 mg/L) for the deployment period 03/18/2004 14:00:00 to 04/01/2004 11:30:00. However, this apparent offset was not confirmed in post check (101%), nor in last (106%) / first (107%) readings from outgoing / incoming sondes indicating instrument was recording accurately and high DO values are real. Very cold conditions and wave and current turbulence at site may allow for consistently high DO values. We have not deleted any of the DO data for this deployment period.

#### Child's River

Very high turbidity spikes were noted around the low tides during this month. It is unclear if these truly represent the water column values or are some biological event associated with low tides—especially night-time low tides. We have not deleted these data if they were associated with a low tide and had 3 or more very high turbidity values closely associated in time.

#### Sage Lot

A major rain event on 09/28/2004 and 09/29/2004 coincides with a large 3 ppt drop in salinity in Sage Lot Pond lasting about 10 days from 09/28/2004 to 10/08/2004.